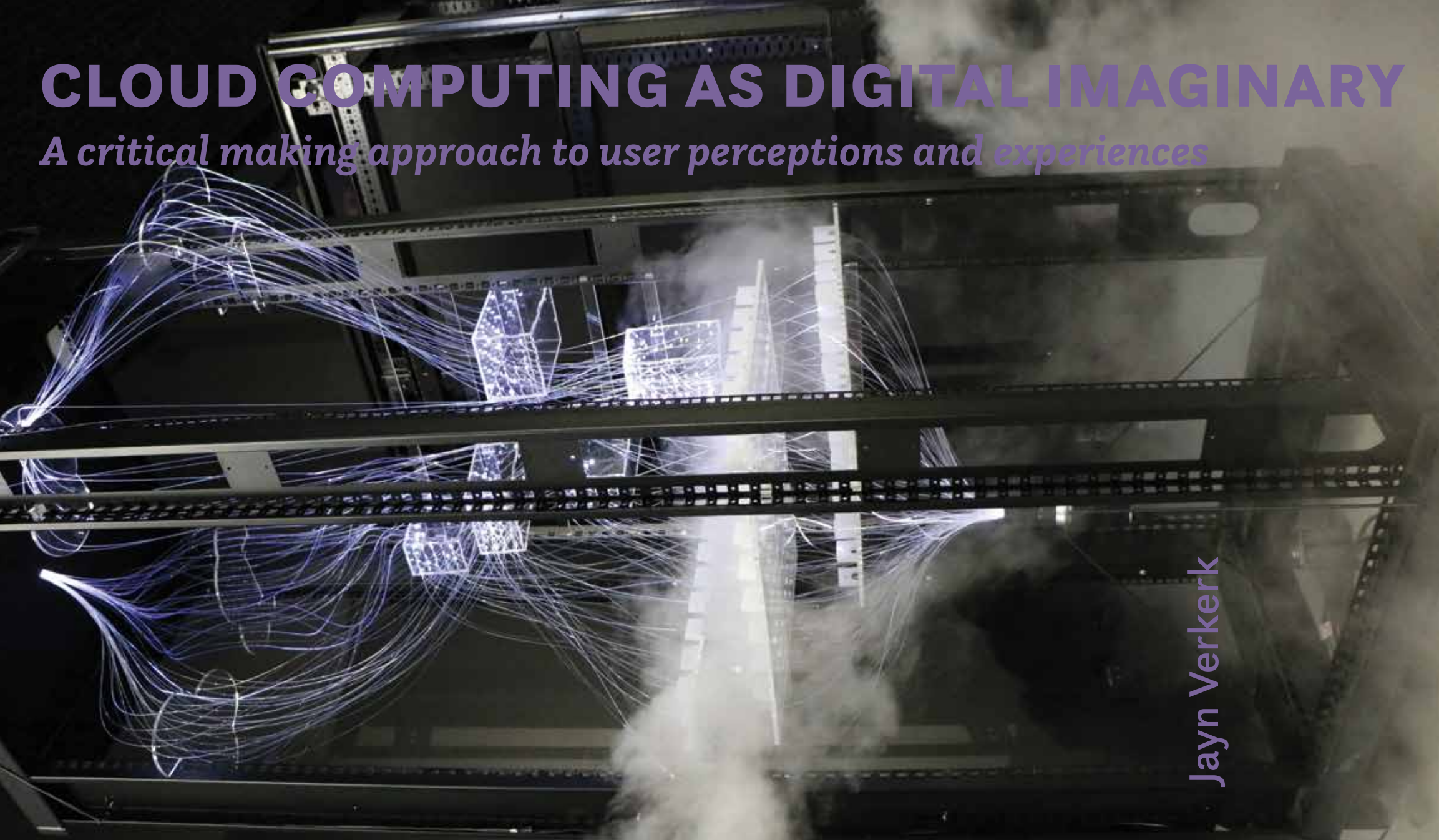
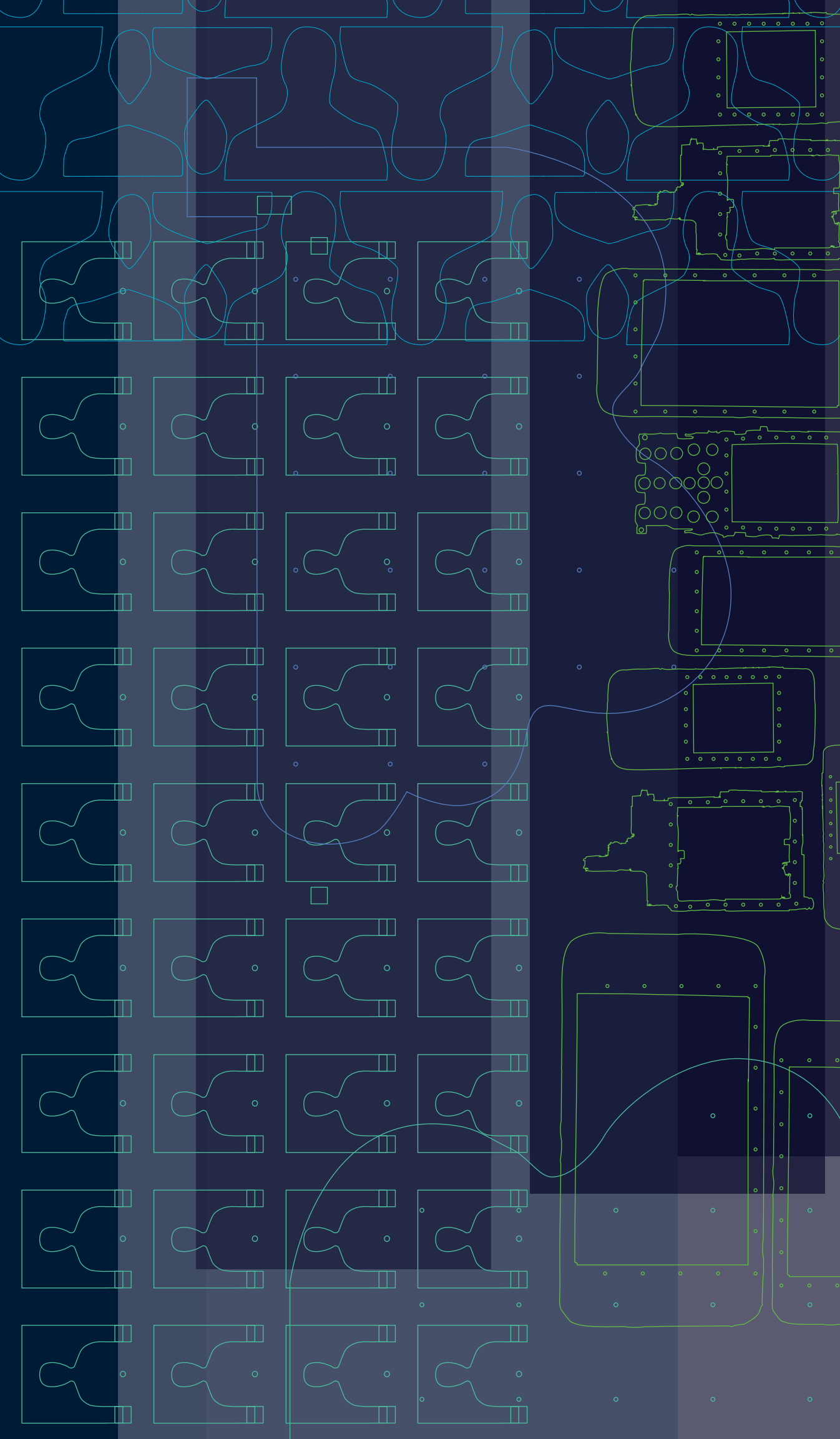
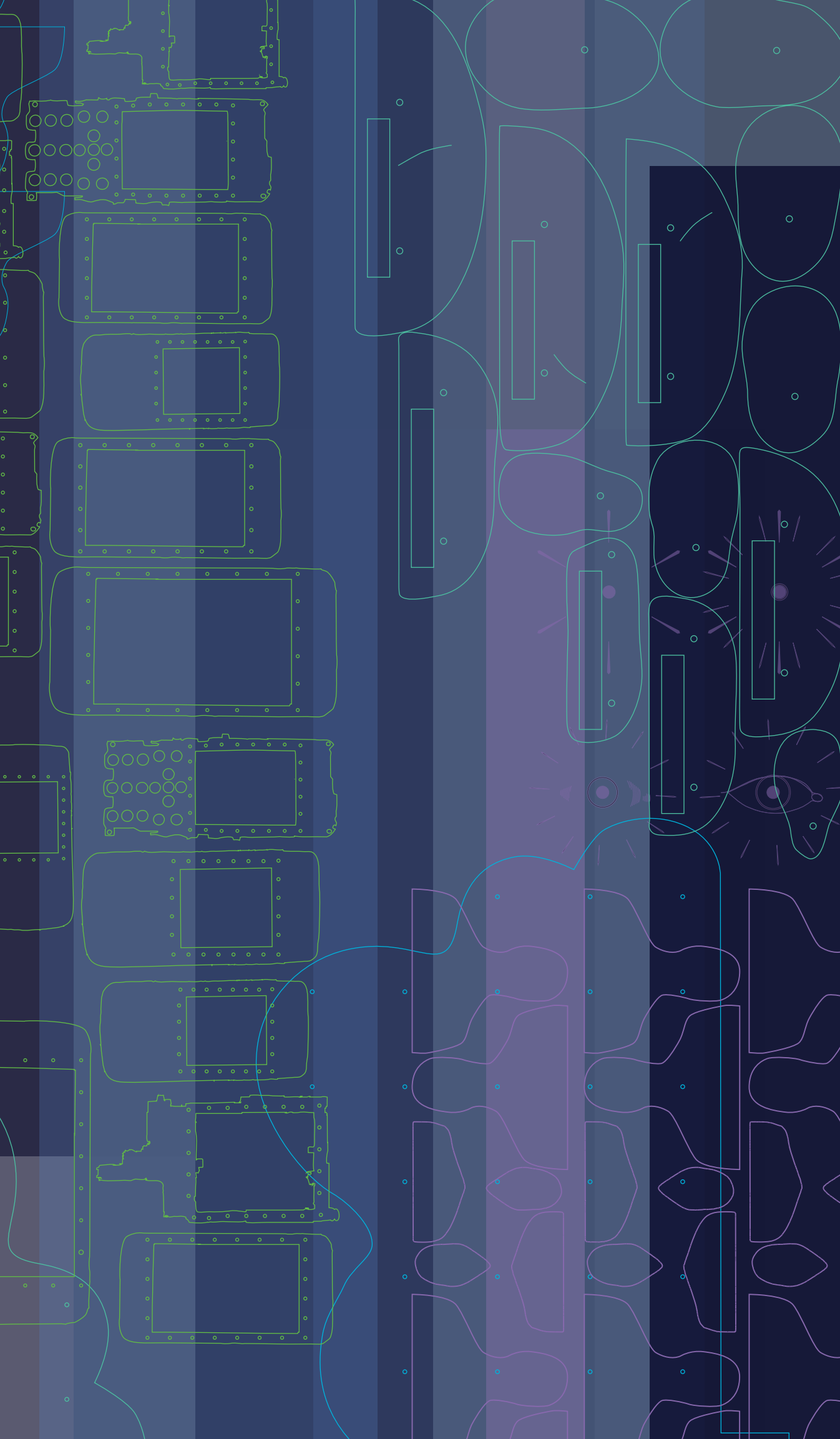
CLOUD COMPUTING AS DIGITAL IMAGINARY

A critical making approach to user perceptions and experiences



Jayn Verkerk





CLOUD COMPUTING AS DIGITAL IMAGINARY

A critical making approach to user perceptions and experiences

Jayn Verkerk

A thesis submitted to the Wellington Faculty of Architecture and Design Innovation at Te Herenga Waka Victoria University of Wellington, in partial fulfilment of the requirements for the degree of Doctor in Philosophy in the School of Design Innovation.

April 2021

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Colophon

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Abstract

Cloud computing provides ready access to data, anywhere, anytime through a one-click connection to centralised data storage. For the user the physicality of cloud computing is reduced to a browser icon. While highly convenient, users have concerns regarding privacy, security, and data surveillance, and don't understand the technology. This suggests an imaginary of the cloud as benign, poetic and immaterial.

How does the metaphor of the cloud shape how users imagine cloud computing? This research investigates how users understand, perceive and imagine the hidden technology of cloud computing. Participatory design methodology was employed with groups of cloud computing users. Data was gathered using visual narrative methodology through a Cloud Drawing exercise and Follow-up interview. Stimulus Images of clouds in the arts and cloud computing industry further revealed how participants imagine the cloud. Findings informed a critical making methodology that addressed the immaterial nature of cloud computing through physical artefacts inspired by participant responses.

An exhibition of the artefacts provided a phenomenological encounter with diverse cloud narratives for new participants' responses. An enclosed server cabinet exploring the first theme of Surveillance uses video, Pepper's Ghost magic illusion, and smoke. Viewers observe an imaginary of mobile connection to the cloud that incorporates a panoptical vision from an all-seeing eye above. The second themed artefact, Factory, portrays a system-wide imaginary of cloud computing infrastructure through a network of fibre optic strands, and transparent user figurines. A third artefact, Noosphere, presents an imaginary of cloud computing as a technology that enables knowledge sharing and social connection. A networked bust containing an interactive element empowers the viewer to distribute light and knowledge horizontally. The artefacts have a dual purpose – a manifestation of the critical making process, and a means to gather further participant feedback.

Through critical making I intentionally used physical means to explore the digital technology of centralised cloud computing. Photographs and drawings provide documentation of the creative process, moving the research into a digital format. The digital capture of the work is recorded, while the physical experience through light, smoke and interactive elements is no longer possible. A final record of the artefacts and accompanying research will reside in digital form in the finite, digital shadow of the cloud, and in a physical book.

This research highlights the imbalance between users' imaginaries of the cloud, the physical reality of the industry, and the metaphor it uses to advertise itself. While the growing cloud computing industry, with a market total of US$214 billion in 2019 alone, is driven by users' streaming of video and music, it also enables data surveillance, and impacts on the environment (Gartner, n.d.). For cloud computing companies, including Google, Facebook and Amazon, the aim is delivery of a working product rather than a trusted one. My research seeks to address this imbalance through investigating users' experience of the cloud. Through cloud artefacts that function as models of the cloud, this research provides a record of the human experience of the invisible digital cloud.

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Contents

Video documentation

Project documentation is viewable at https://jaynverkerk.com/

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Glossary

The cloud – The singular metaphor of the cloud, used predominantly by individual users and non-users of cloud computing to broadly describe collective data storage spaces.

Cloud computing – I define cloud computing following the definition by NIST (National Institute of Standards and Technology, U.S. Department of Commerce):

> 'A model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.'
>
> – Mell, P., Grance, T. (2011). NIST Special Publication 800-145. The NIST Definition of Cloud Computing. Gaithersburg, MD: U.S. Department of Commerce.

Ethereal – celestial or spiritual, immaterial.

Immaterial – Not formed or consisting of matter; incorporeal; intangible; not material; non-physical; metaphysical; ethereal.

Intangible – Incapable of being touched; not cognisable by the sense of touch.

Material – Of or relating to matter; formed or consisting of matter. A physical object; an object having a real physical existence.

Metaphor – A figure of speech in which a name or phrase is transferred to an object or action different from, but in some way similar to, that to which it is literally applicable.

Myth – A usually traditional story of ostensibly historical events that embodies and provides an explanation, or justifies something such as the early history of a society, a religious belief, a natural phenomenon, or a man-made technology.

Virtual machine – Emulation of a computer system through the partitioning of a single physical computer into several virtual devices. Through hardware, computer or resource that is not physically present but made by software to appear to be present from the user perspective, virtual machines can provide the functionality of a physical computer.

1 Introduction

Cloud computing provides ready access to data, anywhere, anytime through a one-click connection to centralised data storage. While highly convenient, users have concerns regarding privacy, security, and data surveillance, and don't understand the technology. For the user the physicality of cloud computing is invisible as the interface is reduced to a browser icon and public images of cloud computing are uncommon. This contributes to a vague understanding of the technology and an imaginary of the cloud as benign, poetic and immaterial.

The efficient delivery of cloud storage is made possible by a cloud computing industry built on 'surveillance capitalism' (Zuboff, 2019). Through this practice user data is shared with third parties, used to predict user behaviour and to inform machine learning. Although the cloud is presented as benign, magical and ephemeral, it has a market total of US$214 billion in 2019 alone, considerable physical infrastructure, and a substantial environmental impact (Gartner, 2019). While the entire IT sector consumes 7% of the world's electricity, in 2016 a three-fold increase in Internet growth was predicted to occur before 2020 (Greenpeace, 2016). While shared networks originated in the sixties, it was not until the early 2000s that cloud computing was established into users' everyday experience online.

Mosco suggests that when technologies are fully adopted into culture, affecting culture and society, it is important to discuss their impact (Mosco, 2014, p.4-5). Currently, as cloud computing is becoming more ubiquitous than ever, it appears to be such a time. With increasing use of invisible digital technologies, such as cloud computing and the personalised nature of connecting online through mobile devices, there is much room for deception. Gaps are evident between users' experiences of cloud computing and cloud computing industry practices. For cloud computing companies, including Google, Facebook and Amazon, the aim is delivery of a functioning product rather than a product that users trust. Initial research into users' experience of cloud computing showed a gap between the industry advertising image of the cloud and the physical reality of cloud computing. My research seeks to address these gaps through investigating users' experience of cloud computing, the reality of the industry, and the effects of the metaphor it uses to advertise itself. How do users perceive, experience and imagine the cloud?

1.1 Motivations

Coming from a design practice background my approach to computer technology has predominantly been production or communication driven – computers as efficient tools to achieve a specific task, or communication tools that facilitate social connection and access to information. These cover some of the primary purposes for computers in our daily lives. In recent years, through the increase in social media, in the quantity of user data, access to data through the cloud and the ubiquity of smart devices, computers have for many people become more integrated into their daily lives.

The ways that people engage with computer technologies are shaped by social processes (Streeter, 2016, p.8). Therefore, in order to understand the significance of cloud computing, it is important to investigate people's relationship with it, and how users think and feel about the cloud (Nissenbaum, 2013, p.6).

My own first memory of cloud was in a postgraduate design class where someone suggested 'put it in the cloud'. I understood at that moment that the cloud was a conceptual term for a digital storage space. So the metaphor was effective. But why use the poetic term cloud for computer data storage? At this time the fantastical term cyberspace, taken from William Gibson's science fiction novel, was outmoded and replaced by the Internet, so the use of cloud to describe an information technology concept seemed archaic and unnecessary. Were the early spiritual narratives of the Internet that viewed cyberspace as an electronic heaven again, or still, pertinent? (Davis, 2015; Wertheim, 1999, p.18). Being a non-digital native, I wondered what exactly the cloud was and how it had come about. As a New Zealander I had not encountered cloud computing data centres because they tend to be located in remote locations that are mostly offshore. I was curious about how the description of virtual server technology as a cloud might affect how it is used. What was the intention of the delivery of virtual server storage through a minimal user interface depicting a small white cartoon cloud in the corner of a browser? A purposeful, diversionary, obscuring of a process through a minimal interface, or a considered, informed attempt to create a seamless experience? And what role could design play in this?

Gjoko Muratovski states that contemporary designers in today's complex world need to understand human needs and behaviour, and create systems for living (Muratovski, 2016, p.378). So how does cloud computing function as a designed system for living? Existing literature shows that users are confused about cloud computing (Crothers et al, 2016, p.2). Cloud computing is widely used but not well understood, and users appear to be complicit in the data economy. Most everyday free use of cloud computing services are not overtly marketed to personal users. They are instead seamlessly integrated into services, social media and other apps. As a result cloud computing is invisible and appears unavoidable.

How do users experience the cloud computing economy in which they receive free data storage in exchange for the industry's use of that data for artificial intelligence applications, prediction and machine learning? While Zuboff, Mosco, Hu and others write on the industry and the role of users, and some research into users' perception and use of cloud computing exists, the personal imaginary of the user is deprioritised by industry and unexplored in existing literature. The hidden infrastructure, drawn-out T&Cs and unannounced background operations may affect how users perceive or think about cloud computing. In response I sought to investigate users' imaginaries and experiences of cloud computing, with attention to the role of the cloud metaphor. I was intrigued to investigate what lay behind the cloud and probe ways to critically interrogate this space.

1.2 Research approach

In an industry owned by a small number of tech giants the human experience of cloud computing gets little consideration. For these private companies, including Google, Facebook and Amazon, the aim is delivery of a working product that stores user data and collects behavioural surplus rather than a trusted product (Zuboff, 2019, p.102). For designers, identifying a product or service that does not work optimally conventionally leads to an analysis, and results in an improved redesigned solution. Examples of this are I&IC, and Saitta and Redecentralise, who develop alternative options to the cloud (I&IC, *Decentralization, Design, and the Cloud: Metahaven in Conversation with*

Eleanor Saitta, 2012). However, redesigning the cloud is not in scope for this project. My focus lies in a critical making investigation into users' experiences, perceptions and understandings of cloud computing.

My overall approach was designed to reveal knowledge that was not discoverable through other means. Approaching the cloud from the users' perspective was the antithesis of the digital cloud's analysis of users' behavioural data. At the outset of the project I intuitively chose to apply my design skills into my study, which I did through translating user feedback into design outputs. As a visual learner I also knew that sketching, putting ideas onto paper and materialising something into a visual and physical form helps to develop my own thinking. I saw the lack of temporal objects related to cloud computing as a core problem in users' understanding of the immaterial cloud, and my own, so making artefacts seemed a logical step to work through the challenges of the cloud. Although I was drawn to make physical outputs I did not know at the outset what form artefacts might take or how these would be integrated with the written component. As my thinking developed, the project focus became the distinctly human experience of cloud computing.

How do individual users make meaning of cloud computing? How do users envision the cloud? How do cloud computing industry imaginaries impact on users' experience of the technology? In response to my questions regarding users' perspectives of cloud computing, I first interviewed participants about their understanding and use of cloud computing. I then sought to reveal users' individual imaginaries of the cloud from a personal user perspective. To what extent does the invisibility of the cloud computing infrastructure influence and define users' imaginaries? How might users think and respond differently to a physical representation of cloud computing?

I address these questions through the visual methodology of cognitive mapping, open-ended interviews, and phenomenological engagement with physical artefacts, as I discuss in detail in Chapter 4. Distinguishing qualities of cloud computing are its digital nature, the hidden, invisible seeming infrastructure, and the use of a cloud metaphor. This research seeks to disentangle these factors and to uncover how each factor impacts on users' perspective, understanding and experience of cloud computing.

1.3 Research objectives

My objectives are:

1. to uncover how the cloud metaphor and industry imaginaries developed
2. to uncover users' imaginaries through visual, conceptual mapping, including participants' perceived relationship to cloud computing
3. to investigate participants' perception and understanding of cloud computing, including knowledge of data surveillance, environmental impact and physical infrastructure
4. to uncover how existing cultural and cloud computing industry imaginaries influence users' perception, experience, and imaginaries of cloud computing
5. to reveal how the immaterial quality of cloud computing informs users' imaginaries, perception, and experience of cloud computing
6. to demonstrate participatory, critical making methodologies as appropriate for investigating intangible, digital technologies like cloud computing.

1.4 Research significance

The point of distinction of this project lies in my participant-led approach through critical making to the complex digital technology of cloud computing. The black-boxed cloud hides data surveillance practices, environmental effects and complex physical infrastructure. Data surveillance impacts on elections, political views and privacy. Running the substantial industry infrastructure impacts the environment, while cloud computing corporations appear to have a disproportionate influence on society as they are subject to few industry regulations. In contrast to this, the cloud projects an image of a cloud computing industry that is poetic, distant and immaterial, making it easy for users to disassociate from the materiality of the technology.

In my understanding of cloud computing I observed the disempowerment and lack of involvement and understanding of the user in the delivery of cloud services. This inspired my decision to enact a continuous, democratic approach with participants, involving users in participatory activities, using abductive reasoning in 'what if' leaps of meaning, unravelling users' encounters with the cloud. My process allowed users to interpret their own impressions in the form of drawings and to give feedback to previous participant input. This contrasts with other approaches that may involve gathering participant data, and removing that data from the participant space to build design alternatives in the design environment, and providing infrastructure or hypothetical solutions. My qualitative, human-centred research, uses open-ended questions, and digs deeper into users' thoughts and feelings, revealing new knowledge.

The resulting understanding of users' experiences is important as it untangles users' interactions in the digital cloud. This offers insights into users' perceptions of the mechanisms of cloud-based products that are engineered to deliver engaging and addictive experiences to users. This knowledge can ultimately inform human-centred computing systems. Observing the effects of participants' interactions to cloud artefacts raised the consciousness of participants, while providing insights into the effects that consciousness raising about the cloud could have for a wider public. Further discussion of my participant-led approach and how my methodologies evolved is discussed in Chapter 4.

What follows is background about cloud computing, including information about the industry and how it functions, related technologies that preceded cloud computing, and the significance of the technology for the user.

2 Background

2.1 Pre-cloud history

Internet technology was first developed in the United States as part of a defence department initiative to share information in government and academia. Sending data through packet switching became possible through ARPANET (Advanced Research Projects Agency Network, n.d.) from 1969 onwards. From the 1990s the World Wide Web facilitated the widespread sharing of content over the Internet by those outside of academia and government. Since then, communication by email over Internet networks has become the norm, as increased network speeds and wider network distribution enable increasingly efficient online communication. With the advent of the first Internet-enabled smartphone in 1996, and the growth of high-speed Internet networks, mobile computing has become ubiquitous. As the IT industry prepared to move to remote storage, computing companies gradually built smaller and less powerful computer hard drives, prioritising mobility in computing. Consequently, accessing data and connecting online is available to many. This has led to the development of cloud comptuing to facilitate fast, accessible, mobile connection and information exchange. The IT industry started using the term cloud computing to describe the integration of file access, software and computer power over the Internet from 2006 (Mosco, 2014, p.16). Although the technology of cloud computing evolved from Internet technologies, the origin of centralised data storage predates the Internet in 50s and 60s theories of shared resources.

2.2 Sharing

Shared goods and services within communities can lead to cost-saving through the efficient use of resources. From an environmental perspective, sharing makes sense as it can lessen environmental impact. Resources such as electricity, water and transport networks demonstrate the efficiencies of networked resources. Tung-Hui Hu describes forerunners of cloud computing in the form of time-sharing of computing services in the late 50s and early 60s (Hu, 2015, p.38). Direct comparisons with utilities such as the electricity industry, water, sanitation and railroads inspired Douglas Parkhill's concept of distributed computing services (Parkhill, 1966). Parkhill's considered discussion of shared computing is relevant to current uses of cloud computing.

Parkhill defined his computer utility as a time-sharing system 'in which many remotely located users are connected via communication links to a central computing facility' (Parkhill, 1966). Characteristics include the avoidance of the physical transport of data and programmes, multiprogramming on one central computer, shared pay-as-you-go cost for users, and cost efficiencies for the user. Parkhill further suggests that it is essential that a computer utility should be a public system run for the public interest and therefore actively dominated by governments. He warns of the

dangers of an Orwellian scenario if any group were to 'tap into an individual's private files without that individual's permission' (Parkhill, 1966, p.168) Parkhill's tapping resembles what Shoshanna Zuboff describes as the use of data exhaust by Google, where users' data is appropriated for machine learning in exchange for data storage on services such as Gmail (Zuboff, 2019, p.68). This tapping into user data for purposes other than storage distinguishes shared cloud data storage from utilities such as roads, electricity and water, where commonly the exchange of services is more clearly delineated.

2.3 Cloud visions

How did cloud computing develop into what it is today? An early vision for mobile access that referenced clouds was conceived by Silicon Valley company General Magic to describe their AT&T personal assistant in 1993 (Hoffman, 2013). In the recent *General Magic* documentary, engineers are seen drawing cloud forms on whiteboards in explanation of the 1993 promotion of the AT&T personal assistant (Kerruish & Maude, 2019). Hu and others contend that cloud forms were used widely in computer engineering circles in representations of networks (Hu, 2015). The first mention of cloud computing was in 1996, at a meeting at Compaq's offices in the U.S., at which it was adopted as the marketing term for centralised storage (Relagado, 2011). A vision was conceived for application software that was not a feature of the hardware – but of the Internet. The naming of cloud computing echoes the same magical visionary thinking that was behind the naming of the company General Magic and their concept for a 'pocket crystal' communication device that led to the iPhone. Whether the naming of the cloud originates from General Magic or earlier, the poetic term references a wealth of image making and literature in Western culture.

Cloud computing is made possible through virtualisation. The information technology term virtualisation allows the partitioning of a single physical computer into several virtual devices. Through virtualisation users can access data in the cloud using a web browser via smartphone, laptop or PC, regardless of location. Virtualisation offers flexibility for users as it is available on a pay as you go system, on-demand, using shared resources. For private users and businesses, cloud computing removes the cost of private data centres and provides scalable storage capacity. In the context of computer drives, sharing computer power by moving software and data into the cloud negates the need for the ownership of memory-hungry software on individual personal hard drives. Cloud computing is also beneficial for mobile computing because data is accessible anywhere through the cloud and storage capacity is scalable. However, substantial physical infrastructure is needed to operate cloud computing services.

The economies of shared storage as conceived by Parkhill are presented as an immaterial cloud solution for the physical burden of individual data storage, when in fact cloud computing presents a substantial physical burden. Material manifestations of cloud computing include data centres that contain mass data servers, undersea and underground networks of cables connecting servers to computers, cooling systems and full back-up power systems to cope with power outages. The first data server centres were built by Google as simple constructions, in which Google stored hard drives in containers in 2005 (Cubitt et al, 2011, p.7). Because mass data storage generates heat and requires cooling, the current trend is to locate data storage centres in remote cold climates, as they provide natural cooling for the thousands of servers running 24 hours a day. I discuss the physical infrastructure of cloud computing further in chapter 7. Further components are the software, virtual machines,

applications and analytics that generate the informational capital of big data. The costs of cloud computing raise the possibility of comparing cloud computing to previous analog-based media. Though this is difficult to assess, as these systems are different and the changes brought about by the new technologies are irreversible (Cubitt et al, 2011, p.154).

Reading documents online instead of printing documents suggests lower paper use, leading to an ideal of the paperless office, however dematerialising information has failed to lead to less use of paper (The Climate Group, 2008, p.29). Although viewing media online negates the production of DVDs and CDs and their respective players, online streaming of music and video increases the demand for data centre capacity, increasing electricity consumption (Cook, 2015, p.5). For the individual, the cost of data storage appears to be more economical, just as shared public utilities such as an electricity network or shared roads. However, cloud computing is a privately-owned utility run by corporations such as Amazon Web Services and Google and are therefore run for profit, while public utilities are often publicly owned and non-profit. The IT industry has changed to accommodate cloud computing, for example in Mobile computing leads to higher levels of online data consumption and growth of the cloud computing industry (Cook, 2015). Exact figures on the size of the industry provide some perspective.

2.4 Industry size and growth

The cloud computing industry has grown exponentially in recent years. Technology news company Cisco estimated in 2018 that the number of Internet users globally will grow from 3.9 billion in 2018 to 5.3 billion, or 66% of the world's population, by 2023. Regarding individual cloud usage, Cisco forecast that global consumer cloud storage traffic per user would grow from the 513 mb per month in 2015 to 1.7 gigabytes per month in 2020, while overall data centre storage capacity was expected to grow nearly five-fold, from 382 exabytes to 1.8 zettabytes (Cisco Annual Internet Report, 2020). Industry growth is reflected in growing profits for cloud computing companies. In April 2019, research company Gartner predicted a 17.5% increase in cloud computing revenue for 2019 to a market total for the industry of US$214 billion. Revenue for SaaS (Software as a Service) alone was predicted at US$94 billion in 2019 (Costello, n.d.). Cloud computing is growing in tandem with related technologies that together incrementally affect how people connect online.

Internet and Wi-Fi speeds are constantly increasing, as are the number of hyperscale data centres. The increasing emergence of cheap smartphones facilitates the rising consumer demand for video streaming, which is made possible through extensive cloud computing networks (Cook, 2017, p.7). Smart devices increase consumer demand for high bandwidth video and audio streaming, which is by far the biggest driver of explosive data growth (Cisco, 2020). The growth in demand for data has resulted in substantial electricity consumption in the maintenance of cloud companies. Cook states that the cloud industry is the sixth largest consumer of electricity, larger than Germany, but smaller than Russia (Cook, 2014, p.11). The impact of cloud computing on the environment is cause for concern, as these companies tend to be secretive about energy use and the physical location of their data centres.

Recent years have seen some response from a growing number of major cloud computing companies who have been challenged on the sustainability of their practices, with some committing to being 100% renewably powered, and others promising to phase out the use of coal. These companies include big operators such as Apple, Facebook and Google. Within the IT sector cloud computing is responsible for 2% of

global greenhouse gases emissions in 2008 (The Climate Group, p.10, 2008). Of that amount, cloud data centres account for almost half of emissions (Cook & Van Horn, 2011). Recent data regarding data centre use states that data centres and data networks each accounted for around 1% of global electricity use in 2018 (Kamiya, 2019; Masanet et al, 2020, p.984). In recent research, Malmodin and Lundén's study shows that a number of factors have led to lower than previously estimated environmental footprint for Internet use and cloud storage. Malmodin and Lundén's research measures both the carbon footprint as the 'full life cycle carbon equivalent emissions and effects related to the global ICT (Information and Communications Technology) and the E&M (Entertainment and Media) sectors', and the energy footprint, as the 'use stage electricity consumption' (Malmodin & Lundén, 2018, p.3). Their findings show that both footprints peaked around 2010 and started to level off, despite a four-fold growth in the world's data traffic between 2010-2015. Though there was a steady increase in users over that time, 2020 estimates suggest that although user numbers will continue to increase, they predict that carbon and energy footprints will likely stay at a similar level. The authors offer a number of factors as contributors for this. These include the increase in use of energy efficient smartphones and decreased sales in new televisions and PCs; the use of apps on smartphones replacing consumer electronics; improved energy efficiency of display technologies; and the growth of small energy efficient devices, including the Internet of Things (IoT) (Malmodin & Lundén, 2018). Kamiya claims that the lower than expected impact on energy use in recent years is due to the rise in hyperscale data centres. Because hyperscale data centres are more efficient, the rise in numbers of them being built results in lower electricity use (Kamiya, 2019). Although steadying levels of electricity use in data centres is positive, a number of factors are not considered in many industry analyses of the overall environmental impact cloud computing.

Cubitt notes that the accepted measure for industry efficiencies do not quantify the efficiency of the manufacture of IT devices themselves (Cubitt, 2017, p.19). As Malmodin and Lundén note, the manufacturing stage for IT devices makes a considerable contribution to the total carbon footprint. The impact of the manufacture of IT is estimated at 2% of global carbon emissions and the continuing development of new technologies leads to more manufacture of compatible devices and therefore more emissions (Boccaletti et al, 2008). Other contributors that are not calculated into environmental assessments of the IT industry are the effects on the environment of the mining of metals that go into ICT devices, and the disposal of the resulting mountains of e-waste. Development of efficiencies of ICT encourages obsolescence because the useful lifespan of devices is reduced because of incompatibilities. Sources that praise the efficiencies of the current industry fail to consider these factors or to prioritise solutions that lower energy use below current levels, rather than focusing on increasing the functionality of a system that is good enough.

An overview of these hidden aspects of the cloud computing industry, the data surveillance economy, and the environmental impact of cloud computing, led to me to wonder how users thought about the cloud. How much do users know about the cloud and how do they imagine this technology?

2.5 Users

Users' behaviour patterns when using cloud computing are ambiguous. The use of cloud computing shows a curious ambivalence – convenient, free and frequently used – yet not understood, trusted or private. The 2015 New Zealand World Internet Project study showed that people lack trust in cloud computing, have concerns about

privacy and usefulness, and feel confused about how it works and where it is (Crothers, Smith, Urale & Bell, 2016). Part of a larger five-year international project originating at the UCLA Center for Communication Policy, this study worked with academic partners in 20 different countries. In the 2017 study concerns had grown from the previous 2015 results, as just under half of respondents reported the most prevalent reasons that would increase Internet use overall as 'better security and ways of protecting my identity' (Díaz Andrade, Hedges, Karimikia & Techatassanasoontorn, 2017, p.7). The New Zealand World Internet Project study from 2015 reported privacy as a concern for users (44%), along with security (29%), and lack of usefulness (29%). Privacy concerns determined one in four respondents' decision to not use cloud computing at all (Crothers, C. et al, 2015). Completed before the 2018 Facebook-Cambridge Analytica scandal, in which it was revealed that Cambridge Analytica harvested and sold the personal data of millions of Facebook users without consent, concerns about privacy are likely to have risen since that time. Similar results were evident in the cloud computing research project Inhabiting and Interfacing the Cloud(s) (I&IC, n.d.). In this 2014-2017 study, most participants expressed unease about surveillance, though typically respondents were not prepared to stop using cloud computing. A 2012 study commissioned by U.S. multinational software and cloud computing company Citrix, with a sample size of over 1,000 participants, also found that most users were confused about what cloud computing is (Citrix, 2012, p.1). Additionally, participants who claimed they never used the cloud in fact did, for example when banking, shopping or networking. Most believed the cloud was related to weather and one in five respondents admitted to pretending to know what the cloud was. Specific concerns regarding privacy have arisen in other research.

2.6 Privacy

Contradiction is evident in users' management of privacy online. In 2009 research around 80% of respondents said they did not want tailored advertising and 69% believed there should be a law requiring advertisers to delete information about users' Internet activity (Turow, King, Hoofnagle, Bleakley & Hennessy, 2009). Contradictory patterns when managing privacy online are described by Barnes as the privacy paradox (Barnes, 2006). Privacy paradox behaviour is evident in Acquisti et al, in which respondents expressed concerns regarding privacy online, while simultaneously sharing personal information widely online on a daily basis (Acquisti, Brandimarte & Loewenstein, 2015). In Taddicken's 2008-2009 study of users' experience of privacy, surveillance and levels of self-disclosure online, respondents reported privacy concerns alongside a conscious decision to accept the loss of privacy as a worthwhile payoff (Taddicken, 2012). Interestingly, Acquisti et al found that the user's environment affected the level of self-disclosure (Acquisti et al, 2015). Safe, private, physical surroundings resulted in more disclosure. The influence of the physical environment on the level of users' self-disclosure highlights the personal, subjective experience of being online on mobile devices. A strange interaction occurs here between experiential online space and users' physical environment. Although users were aware that the Internet is not a private place, the ambience of their immediate environment determined their behaviour online.

As cloud computing has developed, connection online has become more intimate – personal mobile devices are pervasive, physical drives have become smaller, social media and search engines have become more personalised. Connecting online is more individualised and more diverse than ever before, as content is customised to each user's online behaviour, search history, interests, politics and points of view.

These complexities point to a need to interrogate this personal, experiential space to reveal more about how users experience cloud computing.

How do users imagine cloud computing? How might critical making interrogate individual users' experience of cloud computing? How does the vague metaphor of the cloud shape the users' lack of understanding and perception of cloud computing? Before addressing these questions I first discuss definitions, a review of literature and my theoretical framework.

3 Definitions, literature review, theoretical framework

I first discuss definitions for terms that recur throughout the research. I then go on to discuss an overview of selected relevant literature on the topic of cloud computing. Literature covers media studies, political aspects of the industry, privacy and identity in relation to cloud computing, related media histories, spiritual associations with clouds, metaphor, and the context of the rich cultural associations with clouds in Western culture.

3.1 Definitions

Defining the cloud

Users are uncertain when they are using cloud computing and when they are not, as personal and behavioural data is seamlessly absorbed into the cloud (IICloud(s) n.d.). This uncertainty is exacerbated by divergent definitions for cloud computing.

Cook & Van Horn state that news media use the term cloud computing to define Internet-based platforms, that store and deliver data to Internet capable devices. IT experts define cloud computing as pay-per-use services in real time, over the Internet (Cook & Van Horn, 2011). A formal definition from 2011 by U.S.-based NIST (National Institute of Standards and Technology, n.d.) states that:

> Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.
>
> Mell & Grance, Retrieved from: https://csrc.nist.gov/publications/detail/sp/800-145/final

A more limited definition is given in the 2015 World Internet Project International New Zealand study as applications run on a third-party server, e.g. Google Cloud, Dropbox and GitHub (Crothers, Smith, Urale & Bell, 2016). In answer to a question about the use of cloud computing, 49% of respondents in this study said they used cloud computing. In the same research, 85% of respondents said they visited social networking sites such as Facebook, 76% watched television online, and 51% watched feature films online. This inaccurately defines cloud computing as excluding social media, video and music streaming. The much higher rate of people using social media compared to cloud storage such as Google Cloud shows that including social media in the definition for cloud computing substantially changes the research results. In contrast to Crothers et al, Cook & Van Horn define the cloud as inclusive of video delivered through YouTube, while Mosco includes Facebook as a cloud computing

company (Cook & Van Horn, 2011, Mosco, 2014, p.7). I define cloud as more than storage on Google Drive or Dropbox – cloud computing also plays an integral part in the use of cloud software, social media services, advertising and search engines. The ability to access content on-demand outside of user's own stored data on apps such as Spotify, social media and Netflix is what drives the growth of the industry. This is confirmed by Cook who states that one of the key drivers for growth in global Internet traffic is the consumption of music and video files (Cook, 2017, p.7). The substantial impact of music and video streaming was forecast in a 2016 report by Cisco which stated that by 2020 video streaming would account for 80% of data demand, a three-fold increase from 2015 (Cook, 2017, p.7). High levels of data consumption are made possible by an increase of 'power hungry data centres that serve as factories of the digital economy' (Cook, 2017, p.17). I therefore argue that video and music streaming services and social media are integral components of cloud computing.

My position is focused on the user perspective with consideration for the reality of the cloud computing industry. As such I use both the term cloud computing and the cloud. Cloud computing refers predominantly to industry, including both purchased services and free storage, video and music streaming, and social media data. The vernacular broader term cloud describes the users' experience of online data stored outside of their own personal digital device.

In IT terminology the subject for this research is SaaS as experienced by individuals in their everyday interactions online. Most people's use of cloud computing can be classified as SaaS (Software as a Service) including email, Netflix, Facebook, Spotify, Google, Instagram, Pinterest, Microsoft and Apple software. Forms of cloud computing outside the subject of this research are IaaS (Infrastructure as a Service) and PaaS (Platform as a Service). Cloud is used in relation to metaphorical aspects of cloud computing.

Metaphor theory

Central to the subject of cloud computing is the use of the cloud metaphor. I define metaphor following Lakoff & Johnson's conceptual theory of metaphor (CTM). Simplification of concepts is central to the use of metaphor, because metaphors conflate two words and two meanings – some qualities of one word are retained and combined with some qualities of the target metaphor (Lakoff and Johnson, 1980). Subsequently, when applying Lakoff and Johnson's CTM, qualities of the source domain of a familiar practice (clouds) are conceptually transferred onto a target domain, making the target (cloud computing) understood through the known qualities of the source (cloud). In this case some of the qualities of meteorological clouds are applied to cloud computing. In the CTM process non-used aspects of the source are downplayed.

The metaphor of cloud computing helps to convey the complex concept of remote data storage. Because cloud computing is technologically multifaceted, it is challenging to explain to a non-expert audience, hence the simplified term of cloud computing. This exercises a universal human process of translating complex new or unknown information into simplified stories in the form of myths and metaphors. When we experience uncharted skies, imaginative narratives help understanding, for example through seeing patterns in the stars in the form of constellations, and when confronted with new technologies the imagination similarly makes sense of things. Since 2000 the use of a cloud narrative has been perpetuated by industry through the marketing of the imaginaries of clouds in advertising and technical press. These cloud narratives borrow from a lengthy, cultural history of image making related to clouds. Visions of stored data borrow from culturally ingrained narratives of clouds in literature, religion, art and poetry to sell the concept of a floating omnipresent storage capacity with no consequences. However, the cloud metaphor not only simplifies,

it also tells the story of a benign, powerful mystery above us – amorphous, uncontrollable and ungraspable. How do narratives of clouds contribute to the personal perception we have of cloud computing? Clouds are light, fluffy and weightless, yet the complex technological infrastructure of cloud computing is not weightless, as it obscures remotely located server farms that are inaccessible and invisible to the user.

Users

At the beginning of this project I located the elements of my research as cloud computing or the cloud, and cloud computing users. After unpacking the metaphor of the cloud and taking a critical perspective on the technology, the industry, the user's perception and understanding, and the imaginaries that embody the cloud, I considered a reformulating of the term user. User is an information technology term that was constructed to describe a computer user and the function of a person in relation to a computer. I felt some resistance to naming people who use computers as users, as it objectifies people. Research exists about the early development of functional interface icons for Apple, Hewlett Packard and General Magic. The first of these functional icons included trash cans, folders and documents. User icons – figures representing computer users – developed after this. This aligns with Chun's argument that software produces users (Chun, 2006, p.21). On reflection I retained the term user as it is descriptive for the purposes of this study. However, my thinking on the role of the user led me to consider the wider human experience of cloud computing rather than that of a computer user as simply a client and user of IT services. To counter retaining the term user I adopted the framework of Helen Nissenbaum's values in design philosophy, which I discuss at 4.3.

Style

All artefacts are named with an uppercase letter to signify a reference to the relevant artefact and not the related theory or a common noun. For example, Surveillance, Factory and Noosphere. As noted in 1.3 all research participant comments are marked as follows: '*away the problem*' [X].

3.2 Literature review

In this section I discuss key texts that are relevant to various aspects of this study of cloud computing. Numerous additional literature sources are referenced in the discourse within the coming chapters.

Cloud computing

In *To the Cloud* Vincent Mosco covers the origins of cloud computing, the infrastructure, marketing of the cloud, environmental issues, and the labour behind the cloud, contextualising his argument through comprehensive referencing of industry statistics. *To the Cloud* ties the industry in with the cloud metaphor, viewing the technology and aspects of the industry in relation to historical texts, such as Aristophanes' *The Clouds*. Mosco also compares the 'big data numbers don't lie' approach to building knowledge to the more nuanced humanities approach of qualified data collection (Mosco, 2014, p.190). An area Mosco is less comfortable with is the closing chapter titled *Big data and cloud culture*. Although several cultural references to writings on clouds are discussed, discussion of visual expressions of cloud culture in the closing few pages is minimal and only superficially relates to cloud computing. This suggested a gap for me, and inspired me to look at more diverse historical artworks that reference clouds, and to art that is thematically – rather than literally – related to themes

of clouds and the technology of cloud computing. Though the cloud metaphor is analysed, Mosco is less engaged and seduced by the metaphor, unlike others including Hu, Bratton and Cubitt, who actively respond to the poetic cloud metaphor. A more in-depth investigation of the cloud from the point of view of the political, labour and infrastructural aspects is Tung-Hui Hu's *The Prehistory of the Cloud*.

Hu discusses the politics, labour practices and history of cloud computing, exploring the physical presence of cloud computing and the existing military and network infrastructures upon which the cloud is built. Hu describes big data as a militarisation of information, along with social media, because similar neoliberal principles are deployed (Hu, 2015, p.115). Like Chun, Cubitt, Zuboff and others, Hu argues that users' personalised experience of the cloud in social media and search engines equates to free labour, as behavioural surplus is exchanged for data storage, social media, search engines and other services. In my observation the current exchange is representative of the cloud metaphor – vague, unclear boundaries and transactions. A repeating theme through this research is the trickiness of the cloud metaphor – as Driscoll notes in his review of Hu – because the cloud lacks clear boundaries, the role of the user is difficult to contain or qualify (Driscoll, n.d.). This vagueness of the cloud and the relationship of the user to it, raised a question for me about the level of awareness of users. I was inspired to uncover how and why individual users participate, and how they rationalise, imagine and understand their participation with the cloud. I perceived a gap in the literature, because Hu does not reference research on user behaviour and perspective on cloud computing. As a designer I questioned how a participatory approach to the users' experience of cloud computing might provide more information on how the cloud is perceived. Earlier literature on past media forms provides context for people's responses to recent communications technologies.

Media history

Literature on historical technologies such as the telephone show how imaginaries and narratives about communications media reflect anxieties about new technologies. Carolyn Marvin investigates late nineteenth century technologies, primarily the telephone and electricity, and their representation in society. The source for much of Marvin's history are texts from technologists in early electrical profession trade journals and advertisers of these technologies (Marvin, 1990, p.11). Mosco has a comparable approach in *To the Cloud*, though he references advertising and technical press. Marvin points to concerns that rose in the last quarter of the nineteenth century as relevant to later issues about instant communication. Several technologies central to the twentieth century were invented at this time, including the telephone, electric light and cinema. Marvin documents the adjustments in behaviour of people at that time as they integrated these new technologies into their lives. Changing boundaries between home, power, anonymity, class and gender are discussed – issues that are also relevant to the use of the Internet and cloud computing. Jeffrey Sconce's text covers the same period as Marvin, through to the end of the twentieth century, though Sconce focuses on electronic presence, including also spiritual presence (Sconce, 2000). For Sconce, anxieties about new technologies play out specifically in perceptions of psychological or spiritual presence. Outlining five cultural events in media history, Sconce draws a connection between the rise in spiritualism as a response to communicating through radio and telegraphy. He closes with discussion of spirituality in virtual reality and cyberspace. Both Marvin (1990) and Sconce (2000) discuss the sociological significance of media, and anxieties of new technologies, referencing popular culture, documenting the effects of communications technologies. A perspective related to Marvin and Sconce is provided by Streeter, who writes on the development of the Internet.

In Thomas Streeter's *The Net Effect* he describes the Internet as the outcome of culture of a given time, rather than purely the driver of modern culture. Streeter's romantic perspective explores how computers and the Internet were imagined at different times: as a military tool, as a tool for efficiency, and a metaphor of an open, free, frontier. The Internet is viewed as entangled in imagination and human longing, as the Internet has formed and represented different characteristics due to people's making sense of it (Streeter, 2011, p.168). This approach gives space to the human cultural influences rather than considering the development of the Internet as purely technological, in which people are passively subject to new technologies. Streeter's perspective points to the aims of my investigation on how people imagine and understand cloud computing technology – not just as a way to think about how the cloud might work better, but to understand how the Internet evolves. Streeter's argument that culture influences the development of the Internet led me to wonder about the influence of imaginaries in the development of cloud computing, present and future. Patrice Flichy's study of the Internet imaginary focuses on academic, computer sciences and journalistic sources (Flichy, 2007, p.12). My approach differs from this in that the area for my study is users' imaginaries of cloud computing and how these relate to the public image of cloud computing presented by the industry, and existing cultural narratives of clouds. I wondered how the cloud imaginary influenced users' interaction with cloud computing.

Cloud metaphor

Hamblyn's comprehensive study of the history of the invention of clouds states:

> The sky throughout history has been variously filled by the promptings of the imagination, whether with gods and prophecies and the rhythms of the zodiac, or with the first faint stirrings of scientific thought.
>
> Hamblyn, 2001, p.21

Hamblyn's writing on the broader subject of clouds and cloud symbolism led me to question how people might associate historical cloud images with cloud computing technology. Do historical associations with clouds inherently inform associations we presently have of cloud computing?

In earlier discussion of the Internet in 1997, the term cyberspace was used. Tung-Hui Hu reflects on the cloud metaphor, comparing the fluctuating forms of physical clouds to cloud computing's masking of a system that creates freelancers for the state security system (Davis, 2015; Hu, 2015). Mosco similarly considers the cloud metaphor in relation to cloud computing technology (Mosco, 2014).

The analytical approach taken in Marianne van den Boomen's study of metaphors' influence on the development and use of digital technologies is useful to apply to cloud computing (van den Boomen, 2014, p.96). Arguing that metaphors clearly frame the way we think, specific metaphors including the cloud are methodically unpacked, noting where they point and what the implications might be for users and other digital metaphors (van den Boomen, 2014, p.97). Applying Lakoff and Johnson's conceptual theory of metaphor (CTM), van den Boomen maps how current digital metaphors, from clouds to social media and everything in between, function. In doing so van den Boomen contends that CTM does not cover all aspects of some digital metaphors, some aspects end up de-presented, allocated to hidden black boxes. Applying CTM with a focus on the user and in this study's context, the source domain of cloud carries qualities of intangibility that imply security, poetics and associations with nature that evoke familiarity and naturalness. Qualities of the target domain of cloud computing that are downplayed are the environmental impact, integration of surveillance technologies, and technological complexity.

While van den Boomen considers users' perspectives, she does not include users in her research. My research follows van den Boomen's thinking as I investigate the cloud metaphor's impact. However, I apply a participatory approach that includes the input of participants as users of cloud computing. Relevant to the metaphor of cloud computing is Lakoff & Johnson's outline of three kinds of metaphorical concepts as orientational metaphors. For example, 'More Is Up', 'Control Is Up', 'Good Is Up', 'Rational Is Up' (Lakoff & Johnson, p.196). I discuss orientational metaphors in relation to verticality and horizontality further in 3.3 and 6.3. These orientational metaphors impact on participants' and users' perception, understanding and imaginaries of cloud computing. Spatial aspects of cloud computing are addressed also in theories of cloud computing as a system in chapter 7.

Cloud layers and systems

Both Tung-Hui Hu and Benjamin Bratton conceptualise cloud computing through the idea of layers. While Hu untangles the physicality of the cloud infrastructure built on railway networks and a cloud that obscures a political layer of unethical labouring practices, Bratton envisions planetary scale computation in his model of *The Stack* (2016). Bratton's complex theory of a seven-tiered stack is comprised of software, hardware, network, and cloud stacks, as well as non-technological stacks in the physical and geographical environment (Bratton, 2016). The cloud is outlined as the sovereignty of global technology services including Google, while the user layer, below the cloud stack, is inhabited by humans and non-human agents. Hu illuminates the cloud from a perspective of security and control through surveillance of individual users and citizens, while Bratton is primarily concerned with an analytical, planetary-wide, systemic overview.

In contrast to Bratton and Hu, Shoshanna Zuboff frames cloud computing as a system for data storage, and an integrated use of stored user data for profit through data surveillance. In Zuboff's *The Age of Surveillance Capitalism* she describes a capitalist, economic system, in which personal data is exchanged for the use of social platforms, data storage and web services by large corporations, like Google and Facebook. Unpacking technological developments leading to the collection and storage of user data, Zuboff focuses on Google in particular (Zuboff, 2019). Yet another perspective is taken by Sean Cubitt in his view of the environmental impact of wider digital industries encompassing cloud computing. In Cubitt's *Finite Media*, he argues for policy and regulation changes, and changes in user behaviour in response to the environmental consequences of the industries of digital technologies (Cubitt, 2017). Cubitt describes the use of material resources to support media industries as advancing from extraction, to recombining, through to waste. Exposing the power structures involved in the capitalist exchange of behavioural surplus for privacy, Zuboff argues that a solution lies in a revision of that system through legislative and political means. While Zuboff champions the fate of citizens, individual users are not the focus for Cubitt who looks to the wider system instead. He does however broadly suggest a solution for the users of these systems through more considered archiving of personal data and opting out of the energy grid. I wondered to what extent people were aware of these systems, how users experienced and understood cloud computing, and how they reconciled or rationalised their use of cloud computing.

Users' experience

Zuboff observes that individual users are essentially subject to the data surveillance systems created by tech giants. These systems are run by private companies and unlegislated by governments, leaving users powerless. A counter to this vision is Wendy Chun's argument that the Internet has always been a public place. This aligns

with a framing of the Internet as a politically embodied space comparable to the public meeting space of the Greek agora (Damiris & Wild, 1997). Chun further states that the prevalent image of the user as a subject and victim of surveillance is false, because social media and the Internet in fact empower individuals to surveil one another. Chun contends that through observing others, users are more likely to be comfortable with being the subject of surveillance (Chun, 2016, p.113). Thus, Chun frames the user as an active participant rather than a passive subject, proposing that a solution lies in active user participation. While neither Chun nor Zuboff utilise or solicit input from users, the design research project IICloud(s) – *Inhabiting and Interfacing the Cloud(s)* investigates users' habits and imaginings about the cloud through ethnographic research. Throughout a lengthy investigation involving multidisciplinary teams and workshops, the IICloud(s) research group worked to produce alternative solutions to centralised cloud computing services. Research included gestural responses to working with the cloud, ethnographic investigation into user habits, and the problems and observations of a group of heavy users of cloud computing. There is some commonality in my research approach – IICloud(s) also used participant input on the use of cloud computing, investigation into users' perception of the technology, and a brief exercise in which drawings were made by individual participants. The outcome of the IICloud(s) drawing exercise is documented briefly only, primarily as evidence that 'no one really knew how the cloud works' (Cloud of Cards, IICloud(s) – *Inhabiting and Interfacing the Cloud(s)*, 2018). My own use of a drawing exercise consisted of a more in-depth investigation into users, as I explain in Methodology, chapter 4. IICloud(s) research aims are summarised as the production of alternative solutions to centralised cloud computing, while my aims are to explore and define the human experience of cloud computing. Nevertheless, it is relevant to reference the IICloud(s) informative report of the ethnographic elements of the overall IICloud(s) project findings (IICloud(s) – *Inhabiting and Interfacing the Cloud(s)*, 2018). These are summarised in five lessons:

- Lesson 1 – The cloud, a blurry concept
- Lesson 2 – Cloud providers, cloud users, the gap between the discourse of the service providers and the actual user experience
- Lesson 3 – Is the cloud a set of folders?
- Lesson 4 – An opaque process, the difficulty for users to understand the opaque processes behind the cloud
- Lesson 5 – Surveillance? Users showed concern about surveillance but saw surveillance as 'the (ugly) price to pay for the ease of use/access'.

Nova, 2018, p.93-94

Some of the above findings overlap with findings with my research, while others do not. One common theme is the continued engagement in cloud computing despite apparent awareness of the 'ugly price of surveillance' (Nova, 2018, p.94). This raised a question for me about the role of the cloud metaphor in this process. The vagueness inherent in the cloud metaphor inspired Natalie Kane and Tobias Revell in their *Haunted Machines* research project about the narratives people construct around technology (Revell & Kane, n.d.). Themes of spiritual presence are addressed in other sources also.

Spirituality

Erik Davis (2015) sees similarities between knowledge seeking through communications technology and the metaphysical or spiritual search for higher knowledge, because they both engage with abstract immateriality. The desire for connection to

immaterial online space through Internet connection is compared to early Christian gnostic belief through salvation in heaven. In the dualist framework earthly material reality is rejected for a spiritual connection to higher, heavenly immateriality. Margaret Wertheim (1999) similarly draws a connection between religion and Internet connection, defining cyberspace as a utopian online space. Wertheim compares this to the metaphysical spaces of heaven and hell in *Dante's Hell*, because both are imaginary worlds that provide escape from the limitations of material existence. While Wertheim looks specifically at the Catholic belief system through Dante's *Comedia* and Renaissance painting, Davis differs in approach as he views the Internet and the age of information in relation to broader mystical and metaphysical quests for knowledge. Both Davis and Wertheim hypothesise that the Internet fills a gap left by the absence of religion and that spiritual beliefs are present in Internet culture. Jeffrey Sconce writes on spiritual presence within twentieth century communications technologies, in the mediums of television and radio. A link to spiritual and magical-seeming transcendence of time and space returns also in the work and naming of visionary 1990s Silicon Valley company General Magic. This is visualised in the General Magic logo of a rabbit being conjured from a hat. General Magic's early pocket crystal concept for a smartphone type device also has magical associations, as does the AT&T vision of a cloud communication technology that closely resembles cloud computing as it functions today (Kerruish & Maude, 2019; Hoffman, 2013).

The discourse on mystical and metaphysical belief systems in relation to the Internet is representative of the early period of the Internet in the late nineties. Since that time the Internet has become embedded in many people's lives through fibre optics, vast efficient networks, mobile computing, and cloud computing, yet discussion of the spiritual aspects of online connection is missing from much literature. With the advent of mass centralised data server storage as the cloud, spiritual associations again appear to recall Western cultural history of clouds as spiritual places. To what extent does the cloud inspire or recall spiritual associations for users, and industry? And how does the cloud metaphor impact on users' perception and use of computing cloud?

Environment

Existing research on the environmental impact of cloud computing exposes the gap between a metaphorical reading of cloud computing and the reality of the physical infrastructure and its impact. Technologists claim that cloud computing can provide unlimited storage and computing power, and that cloud computing's potential is almost limitless (Ma, 2012). When the Internet became publicly available large technology companies such as Google presented and sold cloud computing, encouraging users to share everything forever in the limitless cloud. However, Cubitt et al point to the environmental costs and the politics of running data centres, and the deceptive perception of a weightless cloud computing solution, arguing that the environmental impact of sharing forever is not feasible (Cubitt, Hassan & Volkmer, 2011). Cubitt suggests that more realistic expectations for archiving data become the norm, as a means to mitigate the environmental impact of cloud computing. As with other resources – the oceans, business markets, oil – storage supply is neither infinite nor without environmental consequences (Cubitt, 2017, p.14). A philosophical view of media is taken in John Durham Peter's *The marvelous clouds: toward a philosophy of elemental media,* in which media are described as elements that make up the world. Peters argues that current media such as the Internet make us both freer and more dependent (Peters, 2015, p.226). Similar to Hu, the subject of the physical manifestation of the cloud is considered, as Peters also points out the dependence of media practices on mines, electrical grids, human labour and global inequalities. While Cubitt raises resource

issues from a legal and ecological stance to an academic audience, Peters' approach is more expansive and philosophical. Peters responds to the trend in media theory to emphasise materiality through instead focusing on media ensembles of elemental nature and artifice (Peters, 2015, p11). Acknowledging the growing importance of immateriality in the form of bits, he draws in the immaterial human metaphoric language tied up with the use of media, including clouds. Peters' discussion of media in relation to the cultural history and significance of elements relates to my investigation of clouds and how users reconcile the technology of data server technology with the immateriality of the cloud.

Summary

How do users perceive, experience and understand the cloud? What affect does the hidden infrastructure have on that experience? The above literature explores the territory of this study, while also exposing knowledge gaps relating to cloud computing.

As digital technologies are increasingly ubiquitous, personalised and impactful, it is important to question how products serve people, and how the needs of the user integrate or conflict with these products. As an integrated part of connecting online, cloud computing is one of these products. Through cloud computing users have increasing access to seamless, personalised, mobile data. Free cloud storage is stealthily exchanged for personal data, creating a data economy that many users experience as convenient, magical and confusing. The cloud is conveyed through an evocative metaphor that hides black-boxed infrastructure, substantial impact on the environment, and an immense surveillance economy that defines the tech giants that own cloud computing systems as the largest and most profitable companies in the world today.

While much is written on political aspects of cloud computing and the risks to privacy of engaging with a remote data server system (Hu, 2015; Mosco, 2014; Zuboff, 2019), comprehensive qualitative research on the experience of individual users is missing. Research on cloud computing that does involve users documents distrust and lack of understanding (Díaz, Hedges, Karimikia & Techatassanasoontorn, 2018; *IICloud(s) – Inhabiting and Interfacing the Cloud(s)*, 2018). In-depth investigations into users' level of understanding of cloud computing, and users' perception and experience of the technology is lacking. Literature on histories of media technologies investigate social imaginaries of technologies, including associations with spirituality, and paranoid, fearful visions (Marvin, 1988; Sconce, 2000; Flichy, 2007). My intention in this project is to similarly explore users' imaginaries and gaps in knowledge regarding users' experience of cloud computing. Particular to my approach to the topic is the use of visual methodology to document users' individual digital imaginaries of cloud computing. Originality of my research is demonstrated in my critical making approach to the characteristic immateriality of cloud computing. The resulting phenomenological installation of the physical cloud artefacts is designed to draw out participant responses about a technology that is seldom represented visually, especially in the form of a physical artefact. The artefacts provide opportunities for participants to think beyond the metaphor – about the imaginaries that the cloud computing industry uses to advertise itself, the physical realities of the infrastructure and data surveillance. Ultimately my aim is to provoke participants to consciously determine their own informed imaginary and perspective of their cloud. The research outcome contributes to knowledge regarding users' perspectives on cloud computing as a black-boxed seamless technology. My intention is that research outcomes will inform responsible, ethical delivery and use of similar black-boxed digital technologies.

3.3 Theoretical framework

The imaginary

In psychoanalysis the term imaginary originates in the work of psychoanalyst and psychiatrist Jacques Lacan. Along with the real and the symbolic, the imaginary forms a central part of Lacan's theories. The real is described as a pre-language developmental stage of need, while the symbolic is associated with desire and as a state in which language and narrative is known. The imaginary is linked to a child's mirror stage, the six to 18-month stage of development when the child first imagines and identifies herself with her mirror image. Lacan describes a loss at seeing the other whole mirror image that creates a narcissistic demand to search in other people and objects for a mirror to identify with. Within sociology Charles Taylor defines the social imaginary as:

> The ways in which people imagine their social existence, how they fit together with others, how things go on between them and their fellows, the expectations which are normally met, and the deeper normative notions and images which underlie these expectations.
>
> Taylor, 2004, p.171

Taylor describes social imaginaries as common understandings and common practices, shared by large groups of people, 'the way ordinary people imagine their social environment, carried in images, stories and legends' (Taylor, 2004, p.171). Though imaginaries are illusory and unstable, they have real effects on individuals and collectives as they are expressive of cultural perspectives and anxieties, and can inform behaviours (Johnston, n.d.). Within the communications technology field Robin Mansell discusses how digital imaginaries relate to information society.

Digital imaginary

Digital imaginaries can be both empowering and disempowering (Mansell, 2012). Empowering when they deliver 'near-mystical qualities associated with the seductive siren of computational sophistication', and disempowering when technologies configure their users leading to ambiguous, unpredictable outcomes (Mansell, 2017, p.40). Mansell's perspective aligns with my own aims to explore both user and industry imaginaries, and the ways that industry imaginaries influence users' behaviour.

Several functional and aesthetic features of digital technologies are discussed in literature about the digital imaginary. Geoffrey Bowker examines literary and archival aspects of the digital imaginary. He characterises the imaginary of digital technologies in terms of mass archival databases that recall Borges' *Library of Babel*, and non-linear qualities of storytelling (Bowker, 2019, p.98). Particular to the cloud is the registration of fleeting thoughts that might otherwise be repressed or forgotten, and tinkering of memories (Bowker, 2019, p.98). Writing from an art historical perspective, Leon Marvell specifies the Digital Age as distinct from the Atomic Age (Marvell, 2003, p.45). Marvell designates invisibility as an essential quality of the functioning computer as the defining object of the Digital Age, along with the reduction of everything into transcendent binary integers (Marvell, 2003, p.46). Marvell states that the material object of the computer is envisioned as a virtual simulacrum, a likeness of a computer, that exists between the physical and the intellectual. I dispute this and define personal computers as fundamentally material objects that compute or perform tasks, and believe that portraying computers as immaterial denies their significance and impact. While the personal computer is a physical object, when connected to on-demand network resources virtuality comes into play in the form of cloud computing. A more

precise likeness or visual simulacrum is the metaphor of the cloud that through virtualisation stands in for infrastructural storage drives in data centres.

Another quality of the digital aesthetic is the replication of nature, with the ultimate aim of creating something that cannot be distinguished from the real (Marvell, 2003, p.46). Links between technology and nature are directly applicable to the metaphor used in cloud computing industry's imaginary of the cloud, as I discuss further in 7.2, 7.4, and 7.6.

In 3.2 I discussed social imaginaries related to past technologies of electric light and telephones (Marvin, 1990), television (Sconce, 2000), and the Internet (Flichy, 2007). The imaginary of the digital sublime is covered in section 5.5, including Mosco's 2004 *Digital Sublime* (Mosco, 2004). The differentiating quality of meteorological clouds in their relative position overhead is one that I wanted to interrogate in imaginaries about cloud computing.

Vertical, horizontal

Both social and digital imaginaries reference vertical and horizontal structures. Taylor broadly defines the non-secular pre-modern society ruled by ancient laws or sovereignty as based on a higher morality, and therefore vertical. Counter to this, modern society is essentially free and horizontal, incorporating collective agency rather than a hierarchical system (Taylor, 2004, p.163). Speaking on information society imaginaries, Mansell details three basic models:

1. the market-led technology diffusion model
2. the state and market-led diffusion model
3. digital mediation in collaborative commons.

Of these, the horizontal, peer-to-peer, creative commons model is most preferred in critical media studies, though this model is not automatically without power asymmetries (Mansell, 2017, p.41). Zuboff states that the opposition to governments' regulation of the tech industry continues to be framed as a threat to individual freedom. This perceived threat has been a defining feature of the tech industry (Zuboff, 2020, p.1). This shows the powerful impact of early imaginaries of a free, egalitarian Internet, built by young students and enthusiasts in Silicon Valley. The importance of verticality and horizontal structures is an aspect I examine further in the description of the critical making of my artefacts in 6.3.

Differences between horizontal and vertical perspectives were evident in participants' responses to cloud computing, and in particular in their encounters with the cloud artefacts. As discussed in 3.1 Metaphor theory, theorists Lakoff & Johnson define vertical metaphor of 'up' as positive, rational, more in control. Cloud Drawings tended to emphasise the vertical, while in comparison horizontal perspectives were seldom represented. Distinct associations of the vertical to religion, surveillance and positivity inspired me to adopt different orientations when subsequently making the artefacts. This resulted in participant responses to both vertical and horizontal orientations, as I discuss in my analysis in chapters 6, 7 and 8. An understanding of literature on horizons, horizontal and vertical perspectives provides context for this.

Hito Steyerl argues that perspective and spatial orientation is changing from horizontal to a secular verticality (Steyerl, 2011, p.169). Historically, perspectives were based on the horizon because horizons provide orientation and context. For example, early navigators oriented their location based on the position of the horizon, and linear perspective is structured around horizon (Steyerl, 2011, p.171). Steyerl affirms that views afforded through linear perspective are based on scientific, mathematical space that flattens into a singular, objective perspective, aligning with colonial

dominance (Steyerl, 2011, p.4). Steyerl and Sheikh agree that horizons are predictable both temporally and spatially, as a base from which to calculate location. This is evident in the experience of measurable space receding into the distance over time (Sheikh, 2011, p.158; Steyerl, 2011, p.175). The early concept of cyberspace was modelled as a horizontal, flexible, egalitarian cyberspace (Mosco, 2004, p.89). Similarly, Sheikh contends that the horizontal is a prime metaphor for rhizome-like communities (Sheikh, 2011, p.160). Yet Steyerl argues the failure of the horizontal perspective in the blurry horizons of Turners' colonial depiction of slavery in *The Slave Ship*. In contrast to the horizon, the vertical perspective from above presents a disembodied, militaristic, machine view.

Verticality, or a God's eye view is facilitated by drones, Google Maps, 3D cinema, military surveillance and satellite images (Steyerl, 2011). For personal users in Western countries vertical surveillance cameras, smartphones with inbuilt cameras, multiple browser windows and video are common. The view from above afforded by these technologies has socio-political implications, epitomised by a 'one-way gaze of superiors onto inferiors, a looking down from high to low' (Steyerl, 2011, p.8). These effects of disempowerment for those below are long-standing, as evidenced by René Descartes, who, in 1637 was inspired to demystify clouds through empirical enquiry. Clouds were: 'so high that even poets and painters see them as the throne of God and pretend that He uses his own hands to open and close the doors to the winds' (as cited in Hamblyn, 2001, p.41). In response to the deficiencies of one common perspective, Steyerl contends that digital technologies offer an alternative, 'new representational freedom' in the form of multi-directional network perspectives (Steyerl, 2011, p.9).

Multiple, subjective perspectives became available in the twentieth century, in cinema, photography and abstraction in the arts, for example in cubism and montage. The proliferation of new media technologies produces more viewpoints in the form of widely accessible consumer still cameras, television, computer interfaces with multiple overlapping windows, mobile smartphones, and VR and 3D animation (Steyerl, 2011). Adajania and Hoskote describe the progression from singular perspective in their description of an 'Nth field', in which post-Cold War collaboration across geographic boundaries, online networks, and the mobility of people suggest multiple perspectives (Adajania & Hoskote, 2011). Multiple perspectives appear to promise the best of the vertical and the horizontal, yet in the context of this project verticality is problematic. While the vertical provides an objective overview, it relates to hierarchical structures while also simplifying and analysing, whereas the horizontal is highly singular and colonial, and limited in its view. In the context of users' experience of cloud computing, I argue that multiple perspectives are not as free and open as Steyerl suggests. The ideal freedom of multiple perspectives online is possible visually, yet through the private ownership model of cloud computing it remains problematic because content is framed and politicised online, and the verticality of surveillance is consistent across online data surveillance in the cloud. Returning to the context of the user and their experience of cloud computing, I examine participants' experience of the vertical and horizontal further within the artefact chapters, 6, 7 and 8. The tension between the vertical and horizontal is paralleled in the pairing of the material and the immaterial.

Immaterial/Material

The polarity of the materiality and immateriality are central to users' experience of cloud computing. The cloud experience recalls Plato's *Allegory of the Cave*, in which prisoners in a cave observe shadows cast on the wall made by the fire behind them, which they perceive as reality. Only when freed can prisoners comprehend the original objects that cast the shadows. The cave wall is the equivalent of a screen onto

which images are projected. Mosco argues that while cloud technologies are most obviously material in the physical infrastructure, materiality exists in the labour that operates the cloud, in advertising campaigns that promote the cloud aesthetic, and in discourse about the cloud (Mosco, 2014, p.77). While these aspects of cloud computing have a material presence, users' experience of the cloud is limited. Applying Plato's Cave allegory, my observation is that users experience the cloud in immaterial aspects of the digital cloud icon, and the cloud metaphor that conjures up an infinite resource in the sky. Standing in for the original material objects casting the (digital) shadows are the physical infrastructure of cloud computing, the data surveillance economy, and the environmental impact of the cloud computing industry. Plato's challenge is to seek to leave the cave and understand a higher truth without shadows or interfaces. Bolter and Gromola compare the challenge of Plato's cave to a virtual reality art installation where viewers are persuaded into thinking of the shadow play as real (Bolter and Gromola, 2003, p.136). The tension between the immaterial and physical parts of the cloud is a repeating theme in literature about digital technologies and the cloud. As Hu argues, the cloud is both a material object and the intangible ideas that lie behind it (Hu, 2015, p.IX).

Observing a failure of cloud computing technology in the lack of trust reported by users of cloud computing, my motive was to apply a critical making and user-focused approach to investigating imaginaries of cloud computing. The initial framework I apply is the theory of the imaginary, with distinct attention to the digital imaginary and gaps between cloud computing industry imaginaries and user imaginaries expressed by research participants. Responses from participants signified the importance of vertical and horizontal orientation in representations of cloud computing. My approach incorporates materiality and immateriality, and touches on the polarities of the imaginary and the temporal. These themes are discussed in the following chapters. As the outcome of my critical making process, the significance of artefacts and models are analysed also. I now proceed with discussion of my methodology for the project.

4 Methodology

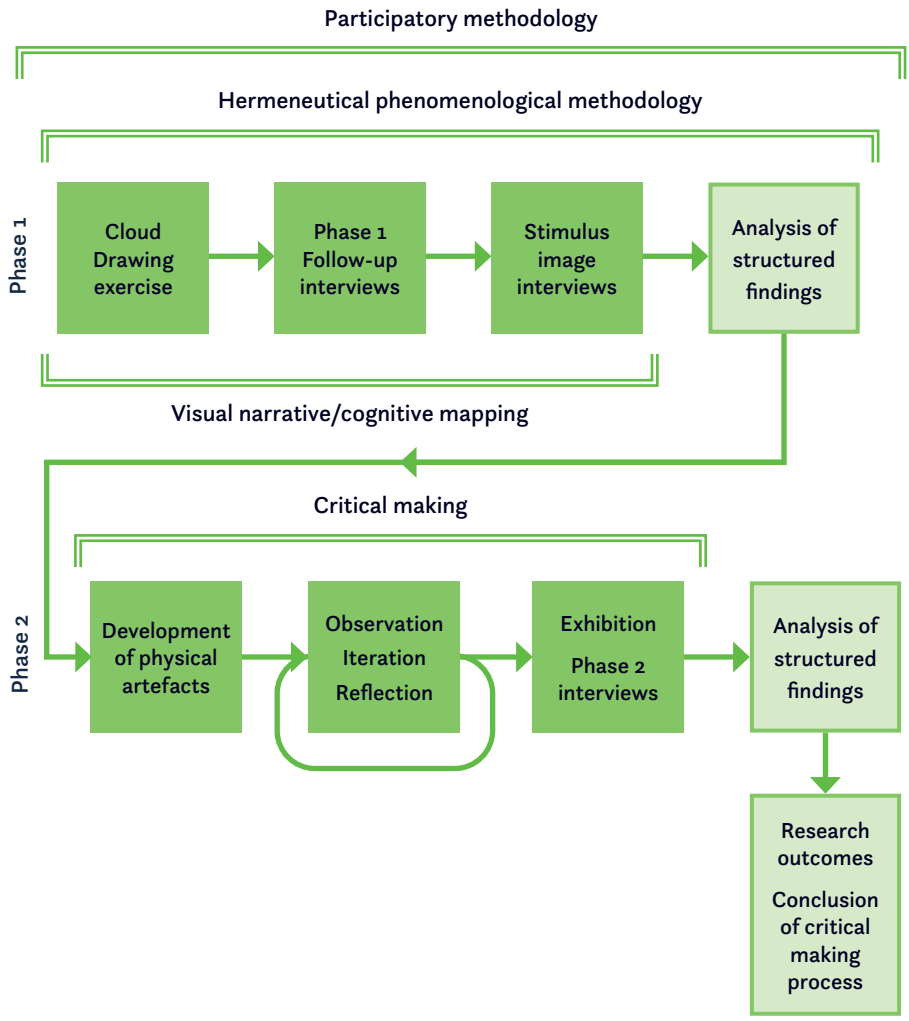
My intention in this project was to gather in-depth data about the subjective experiences and perceptions of cloud computing users. I therefore chose qualitative methodologies. Qualitative research is appropriate for complex topics and recording how people see and experience the world (Muratovski, 2016, p.37). Table 1 shows the translation of the research objectives at 1.3 into my methodology.

Table 1: Research objectives and chosen methodologies

Research objectives	Methodologies
1. To uncover how the cloud metaphor and industry imaginaries developed	Literature review
2. To uncover users' imaginaries through visual, conceptual mapping, including participants' perceived relationship to cloud computing	Cloud Drawing exercise Follow-up interviews Phase 2 interviews
3. To investigate participants' perception and understanding of cloud computing, including knowledge of data surveillance, environmental impact and physical infrastructure	Follow-up interviews Stimulus Image interviews
4. To uncover how existing cultural and cloud computing industry imaginaries influence users' perception, experience, and imaginaries of cloud computing	Follow-up interviews Stimulus Images interviews Phase 2 interviews
5. To reveal how the immaterial quality of cloud computing informs users' imaginaries, perception, and experience of cloud computing	Critical making of artefacts Phase 2 interviews
6. To demonstrate participatory, critical making methodologies as appropriate for investigating intangible, digital technologies like cloud computing	Cloud Drawing exercise All interviews Critical making of artefacts Analysis of findings

The methodologies used are visualised in Table 2. Participatory methodology is the overarching framework for the project.

Table 2: Project methodology



4.1 Overview

Participatory design methodology

Also called co-design, participatory design methodology is the umbrella methodology that applies to all phases of this research. Participatory design methodology includes end-users in the development of products, as this values human agency and experience. Because there is a documented lack of understanding and confusion for users about cloud computing, participatory design is an appropriate methodology for this project (Crothers, Smith, Urale & Bell, 2016). Originating in Sweden in the 1970s, participatory design methodology was developed when the Norwegian Iron and Metal Workers Union began working with people to design computer applications that empower users (Bødker, 1996, p.218). Following this methodology, user input is employed throughout all phases of this research, starting with Phase 1.

To gather in-depth knowledge about participants' experience of cloud computing I applied hermeneutical phenomenological methodology as I discuss in section 4.2. Visual narrative – or cognitive mapping methodology – was employed in Phase 1, in which participants drew a picture of their cloud in the Cloud Drawing exercise. After this further data was gathered in the Follow-up interview. To discern participants' associations with the cultural and cloud computing industry imaginaries of clouds, Stimulus Images were shared to elicit participant feedback, giving them the opportunity to elaborate on their earlier reflections on their drawings.

After analysing the results from Phase 1, I used the interview feedback and the Cloud Drawings to inspire my critical making response. Phase 2 combined a cycle of

iteration, observation and reflection to arrive at three designed artefacts. These artefacts address the core immateriality of users' experience of cloud computing through manifesting the cloud in material form. The critical making artefacts were shared in an exhibition, during which a new set of participants were interviewed about their experience of the physical cloud artefacts. Because earlier participants had seen Stimulus Images of cloud computing industry infrastructure, I felt there was a risk that participation in Phase 1 would influence participation in Phase 2. I therefore selected new, unbiased participants who had not taken part in Phase 1. Differences in responses between Phase 1 and Phase 2 revealed information particular to the materiality of the cloud. Emerging data was analysed, resulting in research outcomes.

This project is an in-depth investigation focusing on users' experience of cloud computing from a design perspective. Unlike some design-based studies, this project does not seek to provide a alternative designed solution to the cloud, as I discuss in further detail in 4.2. Although solutions to the problem of cloud computing are not in scope for this project, qualitative data from this study could in the future inform a brief for end products that provide other solutions to the current forms of cloud computing.

Ethics

Ethics approval was arranged for the Cloud Drawing exercise, and all interviews in Phase 1 and 2. Participants were sought both within the university and externally. Participant involvement was confidential, participants' identities are anonymised throughout. Age range, gender and belief system of the participants was noted in documentation.

Partiality

I am approaching users' experience of cloud computing from the perspective of a practising designer with extensive experience in communication and graphic design. My design practice experience allows me to understand, analyse, reference, and research data and transcode participant data into artefacts that challenge existing representations of cloud computing. However, it is important to note my own subjective partiality in this research as a digital non-native with a critical perspective. Despite striving to impartiality, I am inevitably partial, for example in my choice of images in the Stimulus Image interviews, and in my choice of the Cloud Drawings that formed the inspiration for Phase 2 of the research. This aligns with the hermeneutical phenomenology approach as I discuss in section 4.2.

User sampling

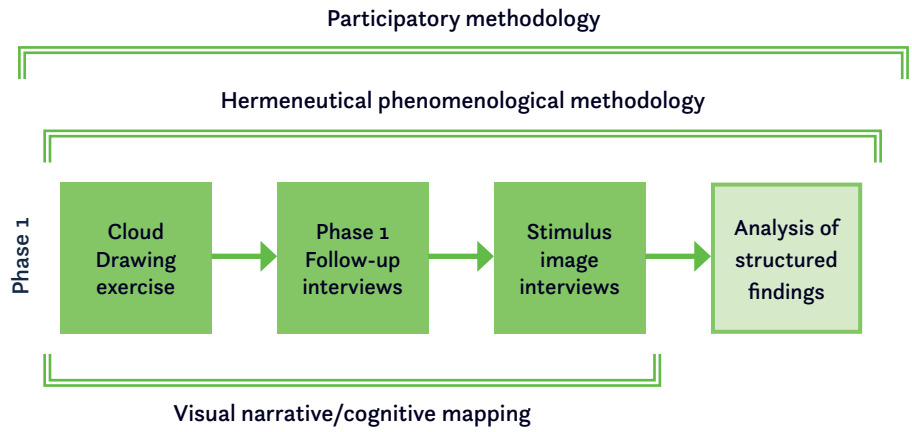
In both Phase 1 and Phase 2, I gathered a wide range of participants, representing diversity in age (from 12 to 60), range in gender (14 females and ten males in Phase 1, and five females and 12 males in Phase 2), and a range of cultural backgrounds. Participants were a mix of digital natives and digital non-natives, as this could expose differences between these types of users. Accordingly, participants were asked to name their belief system, so that potential correspondences between participants' belief systems and their imaginaries of the cloud could be observed. I initially planned to investigate the varying data across the categories, however, I found that numbers were too small to clearly identify trends. My focus went instead to the rich information gathered in the data from participant interviews.

Twenty-four participants took part in Phase 1, an adequate number for phenomenological research. The total one to two hour length of the Cloud Drawing exercise, the Follow-up interviews, and the Stimulus Image interviews provided much in-depth data. Seventeen participants took part in the Phase 2 artefacts exhibition stage.

4.2 Phase 1

The following is a discussion of the methodology and components of the first phase of the project.

Table 2a: Phase 1 methodology



Hermeneutical phenomenology methodology

The introduction of new communications technologies has historically captured the imagination, particularly those technologies where the infrastructure is not visible to the user. This makes cloud computing fertile ground for projecting rich narratives. As Marina Warner argues, the process of projecting form and meaning onto something is human nature:

> As Nature abhors a vacuum, so does the mind resist meaninglessness, invent stories to explain haphazard incidents, provide reasons and origins; the amorphous, the inchoate, the formless, have beckoned irresistibly to the shaping powers of thought and imagination.
>
> Warner, 1999, p.106

Because cloud computing infrastructure is largely invisible, users have little material form to help make sense of the technology. Instead, a subjective imaginary of the cloud is formed through individual experience. It is therefore relevant to the aims of this research to use phenomenological methodology, because it values subjective perception. Phenomenology broadly seeks to define phenomena as it appears through consciousness and lived experience (Laverty, 2003). Originating in German philosophy, the father of phenomenology Edmund Husserl describes phenomenology as a science of pure phenomena that allows a reconciliation of objective and subjective aspects of perception (Husserl, 1999, p.35). Phenomenologist Merleau-Ponty describes Husserl's mission as a drive 'to discover a way between logicism and psychologism' (Merleau-Ponty, 1974, p.232). Muratovski states the relevance of a phenomenological approach when researching products today. He writes that the experience and narrative of a product can be more important than the product itself (Muratovski, 2016). Appropriate to phenomenological methodology, my research includes personal reflections from outside the research topic, and involves participants with lived experience of the topic, as this can lead to rich, imaginative and distinct responses (Polkinghorne, 1989). My specific application of phenomenology blends most features of hermeneutical phenomenology.

Hermeneutical phenomenology methodology encompasses researchers' pre-understanding – or historicality – as an unavoidable part of being in the world,

accepting researchers' individual perspectives. Following the structure of phenomenological research, my project includes extensive, open interviews with small samples of participants. Both Heidegger and Husserl recommend bracketing when interviewing, to avoid individual biases of the researcher (Laverty, 2003). Bracketing involves suspending reactions to the participant's response, while playing a passive part through active listening (Leedy & Ormrod, 2013). In contrast to this, I reject bracketing in my research, because bracketing is not realistic or possible (Laverty, 2003). Moreover, hermeneutical phenomenology is suited to creative arts research, as situating subjective perspectives within a broader theoretical context can be a basis for knowledge claims (Barrett, 2014, p.60). It is therefore fitting to consider individual perspectives, including my own, both in the writing and the critical interpretation of participant data into artefacts (Nelson, 2013). Within hermeneutical phenomenology, the researcher's biased position is addressed through self-reflection, and explicit, overt explanation of their position in relation to the topic of research (Laverty, 2003). Another way of countering the subjectivity of the researcher's interpretation is achieved through a hermeneutical circle that moves from parts of the experience to the whole, and back and forth, to increase the level of engagement (Laverty, 2003). The vehicle for the hermeneutical phenomenological approach in Phase 1 is the visual methodology of cognitive mapping which I apply in the Cloud Drawing exercise.

Cloud Drawing exercise

The non-linguistic process of drawing is useful for designers, in therapeutic contexts, and as visual research methodology. Drawing is a useful tool for designers to develop ideas, and as a tool to explain things to others (Crilly, Clackwell & Clarkson, 2006). In art therapy drawing is valuable as a means to show subconscious impressions and underlying emotions. The visual methodology of drawing, or cognitive, or mental mapping is effective for eliciting non-linguistic participant feedback. Cosgrove suggests that maps and sketches have the capacity to both communicate knowledge, and creatively convey ideas, hopes and fears (Cosgrove, 2001, p.3). Cognitive drawing was used in the 1970s by geographers, and more recently by cognitive scientists in migration studies (Jung, 2014). Bagnoli declares that including participant drawings as a research component values non-linguistic knowledge, allows people to think creatively, and helps to open discussion (Bagnoli, 2009). After drawing thoughts and ideas, participants can reflect on the resulting image, compare their ideas to the world in the drawing, and elaborate through verbal reports (Törrönen, 2002, Kearney & Hyle, 2004, p.367). This brings me to my research question:

How do users perceive, understand and imagine the cloud?

Although there is a substantial physical component to cloud computing, the physicality is hidden or black-boxed. Cloud computing companies are known for minimal disclosure on environmental and privacy issues, and physical locations of the industry infrastructure, hence images of data centre infrastructures are not widely visible to the public. Because of this I envisaged there might be scope for imaginative responses to the topic of cloud computing. To that end, I invited participants to draw a picture of their own cloud, including themselves, as a representation of their cloud computing imaginary. My aim was to reveal the nature of participants' imaginaries of cloud computing. Would qualities of meteorological clouds, such as immateriality, ephemerality and weightlessness be present in users' visual narratives? Would participant drawings align with cloud computing industry narratives, meteorological clouds, or clouds in popular culture?

Mapping precedent

One precedent that relates to my Cloud Drawing exercise is Kevin Kelly's 2009 *Mapping the Internet*. In this project *Wired* founding editor Kelly asked people to draw the Internet as they imagined it, indicating their 'home'. Academic Mara Vanina Osés completed a brief analysis of 50 of the *Mapping the Internet* maps (*Taxonomy of Internet Maps*, n.d.). Osés' analysis documented network topologies: the placement of physical (real) and virtual elements, and connections between the nodes. The morphology of the maps was studied, and the relative positioning of the artist of the map in relation to the Internet. While Kelly's 'folk cartography' study (*The Internet Mapping Project*, n.d.) served as a reference point for my own Cloud Drawing exercise, my intention was different as the Cloud Drawing exercise was specifically conceived to reveal users' perceptions, experiences and imaginaries of cloud computing.

After introducing participants to the Cloud Drawing exercise, I actively encouraged focused attention to the drawing process by leaving the participant for 20-30 minutes to complete the task. The resulting drawings were a vehicle for the collection of data and a visual anchor for the next stage. Subsequent to the Cloud Drawing exercise participants were questioned about their understanding, perceptions and behaviours in relation to cloud computing in the Follow-up interview.

Follow-up interviews

After completing the Cloud Drawing, participants were asked to take part in a Follow-up interview. Questions addressed how the participant engaged with the cloud, the level of trust of the system, whether the user felt in control of the cloud computing process, how well participants understood the technology, how they thought about and imagined the cloud, and any problems they experienced (see Appendix 2). In keeping with the hermeneutical phenomenology approach, the Follow-up interviews were in-depth, with open-ended questions. Participants reflected on their drawings where relevant. This allowed me to gather subjective data that values diverse personal responses. After this I applied visual narrative methodology through sharing images in the Stimulus Image interviews.

Stimulus Image interviews

The concluding part of Phase 1 was devised to uncover how existing media, cultural, poetic and spiritual associations with clouds informed participants' cloud imaginaries. For this last part of Phase 1, I collected a variety of cloud-themed images, from cloud computing industry, advertising, art historical images, technological and scientific images. Participants were presented with two to five images from a set of 15, based on themes that arose in each participant's drawing and Follow-up interview. These images encouraged participants to think about clouds from many angles, as a way to construct a rich, meaningful impression of a complex topic (Leedy & Omrod, 2003, p.148). The intention of this process was to identify whether users were familiar with, and therefore might be influenced by, various cloud computing, art historical and spiritual imaginaries of clouds. Showing particular images of cloud computing infrastructure and advertisements also clarified participants' level of knowledge of cloud computing. The images were viewed apart from their original context, without identification or accompanying text, to ensure a neutral response. In the analysis of participant responses to the Stimulus Images, the origin, history and intended audience for each image was considered (Rose, 2016). On presenting each image I asked the participant to comment whether the image shown was in any way representative of their experience of cloud computing. This approach demonstrates the hermeneutical phenomenology approach of open-ended questions to elicit optimal responses.

Accordingly, participants elaborated on their thinking in the Cloud Drawing exercise, and the Follow-up interview, and made associations between the Stimulus Images and their own drawings, which often clarified their thinking. Occasionally, entirely new associations were made, at other times participants chose specific details to expand on, such as an impression or thought related to their ideas about cloud computing.

I applied aspects of Törrönen's proposed strategies for the use of images, or stimulus texts, in my research (Törrönen, 2002, p.345). Törrönen categorises three separate strategies for selecting images for interview data. These are described as 'clues', in which the texts or images, together with the interview, stand as representative of the whole (metonymy). 'Clues' are comprised of 'microcosms', where participants compare their worlds with that of the texts or images, identifying with aspects of the texts; and 'provokers' that, along with questions, challenge participants to deal with established meanings and practices of the phenomenon or subject (Törrönen, 2002, p.357). I applied all three of these strategies in different stages of my research. In Phase 1 images were selected as clues and microcosms, that together with the participant's drawing and interview, would elaborate on their perception of cloud computing as a whole. Alongside this strategy some images functioned as microcosms or metaphorical worlds, containing aspects for participants to identify with.

In conclusion, Phase 1 acted as a stimulus for thinking, opening up discussion and evoking imaginative responses from participants. With the interviews completed, I analysed the data, developing structured findings and identifying common themes.

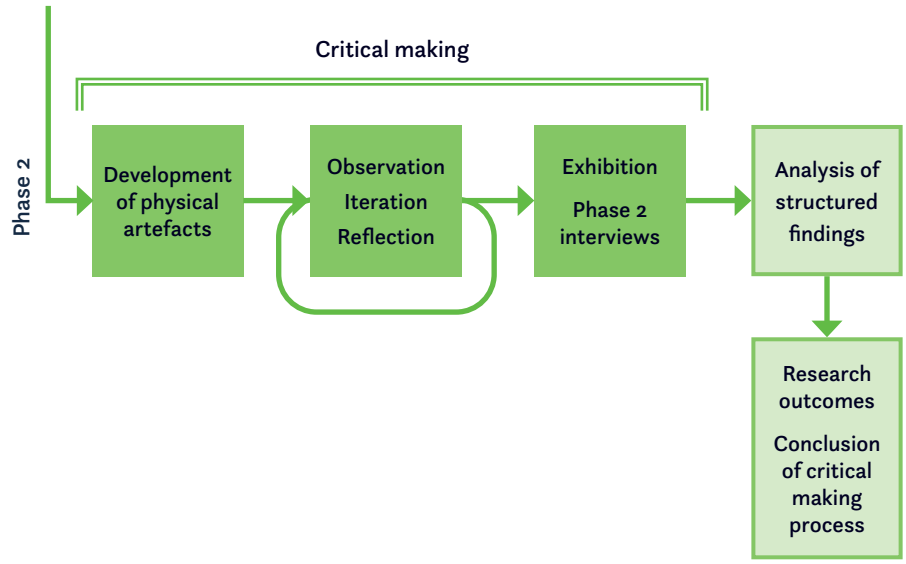
Phase 1 Data analysis

The Phase 1 Cloud Drawing exercise, the Follow-up interviews, and the Stimulus Images interview component resulted in diverse narratives about cloud computing. Phase 1 data was analysed, revealing patterns and commonalities in the drawings across network forms, the use of pictorial elements, and the position of the user within the drawing. The richness of data from the Cloud Drawing exercise reflects that of other visual drawing research projects, such as Bagnoli's research on identity and migration, and relational space maps, and Jung's study of the experiences of migrant women. Visual drawing is also often used with children and in psychological studies. (Crilly et al, 2006; Bagnoli, 2009; Jung, 2014). Analysis of the data informed Phase 2 of the research. Specific outcomes from Phase 1 are unpacked within each of the sections about the artefacts, in chapters 6, 7 and 8.

4.3 Phase 2

Following the first phase, critical making methodology was applied in the steps undertaken in Phase 2.

Table 2b: Phase 2 critical making methodology



After inviting participants to materialise internal imaginaries of cloud computing through their Cloud Drawings in Phase 1, I adopted critical making methodology to explore the resulting drawings and interview responses. A consistent factor in Phase 1 data was the confusion and ambiguity evoked by the hidden physicality of the cloud. This led me to question how the cloud might be differently experienced if it were represented in physical form, through critical making methodology.

Critical making methodology and critical design

> Critical Making aims to focus attention of the ways in which materially-engaged activities provide cognitive resources for thinking through complex individual, social, and societal issues. ... The final prototypes are not intended to be displayed and to speak for themselves.
>
> Ratto, Matt. (n.d.). FLWR PWR – Tending the Walled Garden. Walled Garden. https://www.academia.edu/4246853/FLWR_PWR_Tending_the_Walled_Garden

The methodology of critical making opens up and extends critical reflection. Mark Ratto originally formulated critical making when making workshop prototypes, rather than the building of final artefacts (Ratto, n.d.). Critical making advocates the use of hands-on techniques that complement the critical thinking process. Through an emphasis on the value of making as a focus for critical reflection, audiences can consciously consider the workings of consumer culture. Social and cultural considerations relate also to Nissenbaum's values in design philosophy, an approach that takes apart perspectives behind technological designs and how these influence social values (Nissenbaum, n.d.). Critical making methodology can encompass both physical making and technology driven products.

Building on Ratto's critical making, Garnet Hertz argues that technology and hands-on making can combine to produce provocative objects that encourage re-evaluation of technology in culture. The provocative aspect of critical making aligns with the hacking and maker culture, particularly in the creation of open source products, as critical making embodies a form of hacking. A precedent for critical making beyond

the maker culture is The Critical Making project, which argues for critical making that engages with art and technology, and art and activism (*Critical Making,* n.d.). An example of critical making as technological activism is Trevor Paglen's Tor server, which was built as a peer to peer Internet server that would function as an alternative to centralised cloud computing (*Critical Making*, n.d.). While Hertz describes critical making as building things with a critical approach 'especially using new technology', or DIY maker technologies (Hertz, n.d.), my approach employs analog means to actively challenge the technological environment of cloud computing and provoke reflection.

In my critical making process my intentions were to respond to participants' imaginaries of cloud computing by manifesting the cloud in physical form, inspired by participant Cloud Drawings and feedback. Observing a failure of this technology through the lack of trust reported by users of cloud computing, my critical making served three purposes:

1. To make the invisible visible by manifesting my response to the Phase 1 data. What would a physical, experiential version of the cloud look like? And how would people respond to that?

2. To reflect through the critical making process on the metaphor of the cloud, and how this played out in the elements represented in the narratives, particularly the interaction of the users to elements representing cloud computing.

3. To create manifestations that would dig deeper into imaginaries with a new group of participants, eliciting a response to my interpretation of the feedback from the first set of participants.

Engaging in a physical critical making process compensated for the lack of physicality of the hidden technology of cloud computing by offering artefacts for people to experience and respond to. In my initial research I observed themes of invisibility in the hidden nature of cloud infrastructure, the lack of disclosure of the industry, the default seamless delivery of cloud computing to users, and users' confusion about the cloud's physicality and functioning. In response to this I wanted to challenge the immateriality of the flat, digital, screen-based cloud by presenting the flipside of the users' experience of cloud computing. I sought to create a tangible, phenomenological experience as a way to anchor and question the embodiment of the cloud. The initial exhibition format offered all these factors in a controlled, immersive environment that is relatively free of external input. My solution incorporated temporality, spatiality and multidimensionality through the use of smoke, light and video projections. As research progressed in the making stage and beyond a first exhibition to further exhibitions, my approach evolved to resemble aspects of critical design methodology.

A core aspect of critical making methodology is the making of artefacts that exist as remnants of the making process only, and do not 'speak for themselves' (Ratto, 2011, p.253). This fits the original intention of my artefact making. However, through my primary participatory methodology, the artefacts functioned as prototypes that were experienced by participants as aspirational, speculative designs of the cloud. This resembles Dunne & Raby's critical design products that 'question norms and stimulate discussion' Hertz on Dunne & Raby (Hertz, n.d.). Dunne & Raby, as important practitioners of critical design, produce speculative products that are filmed and documented in order to challenge and provoke. In contrast, although I filmed my artefacts they were not physical working industrial designs, but fragile models of concepts for the digital cloud, that remain as more than momentary remnants. In addition, while intended as artefacts purely for participant feedback, during the construction the physicality of the steel cabinets seemed to require a substantive and more permanent presence to inhabit the sizeable structures. Because the participant-led process

was prioritised my intention of creating critical making artefacts extended to resemble the more permanent artefacts that fit with critical design. Thus my artefacts sit between a critical making prototype and a finished critical design object, demonstrating a crossover between these approaches. In section 5.8 I unpack the terms artefact and model in more detail. Ethical issues related specifically to computer systems correlate with the Nissenbaum's values in design.

Values in design philosophy

Specific to the values in design approach is the idea of ethical, societal and moral values in the design of software and computer systems. Initial research about users had shown that bias, and violation through public surveillance of users, user autonomy, and concerns about control were important. Helen Nissenbaum advocates intervention in the design of computer systems as a way to address issues established in initial research. One approach to achieving this is through computer engineers working together with social analysts and philosophers to address values in design. Nissenbaum's recommendations include the use of methodological tools for systems designers, as a means to incorporate values beyond power, efficiency and connections, into the development of computer systems, (Nissenbaum, 1998).

The Values in Design Council three-year project findings document challenges of formulating and implementing this approach. The multidisciplinary project team of social analysts and computer science engineers collaborated to explore ways to incorporate social and ethical values into future Internet architecture. Findings outline challenges of the project. These cover developing a shared understanding and vocabulary, difficulties working with ingrained differences in each skillset, and uncertainties about how to address the issues in practice. Of particular interest to my project's aims is a recommended future strategy 'to explore more nuanced notions of their users and how they think, feel, and act', as users were a 'crucial figure of inquiry' (Nissenbaum, Stark & Ziewitz, 2013). This exploratory focus on the user aligns with my project's aims. While a values in design proposed methodology is documented, this applies primarily to implementation rather than the beginning stages of designing computer systems. My exploration into user's experience, perception and imaginary of cloud computing fits within the initial values in design stage characterised as discovery. The discovery stage identifies values that are relevant to a project, both for designers and potential users (Nissenbaum, 2005, p.Lxix). A fundamental framing of the construction of computer systems in the values in design philosophy raises both questions and opportunities.

Nissenbaum's statement that current computing systems fail to engender trust and user autonomy applies to cloud computing, and points to a need to bridge this failure by employing design thinking into computer systems. My initial curiosity about users' confusing cloud experience may in part be due to systems development that is engineered without consideration of values, simply because they are built by engineers for machines, not designed with a consideration for the human experience. In response to Phase 1 input from participants, I planned the critical making outputs for Phase 2.

Cloud artefacts development

How might participants respond differently to questions regarding cloud computing when confronted with a physical representation of cloud computing? In Phase 1 participants had demonstrated a lack of awareness of cloud computing infrastructure. Furthermore, the majority of participants could not describe the infrastructure with consistent terminology.

In response to Phase 1, I identified divergent imaginaries of the cloud as inspiration for my critical making process. Investigating relevant precedents, I worked on

defining an appropriate aesthetic. I looked at work on the topic of cloud computing, media arts, early aesthetics and metaphors for digital spaces in popular press and culture, and the work of artists that resonated for me on a personal and intuitive level. Development of the aesthetic for the critical making, including themes and related precedents, is unpacked in detail in chapter 5.

Findings from Phase 1 informed my brief for the Phase 2 critical making process, covering the following topics:

- physical infrastructure and the cloud metaphor
- black-boxing
- invisibility / visibility
- privacy
- surveillance
- spirituality
- verticality of the cloud
- identity.

After defining my brief, I embarked on the critical making process inspired by my findings. I hypothesised that the characteristic black-boxed, invisible nature of cloud computing might impact on users' perception of cloud computing. The critical making process integrated information about the industry gleaned from existing literature, of which Phase 1 participants had shown limited awareness. This included the physical infrastructure, the environmental impact of the industry and data surveillance practices. The resulting artefacts are the result of problem solving, design iteration, material experiments and reflective practice.

The critical making artefacts stage a movement from the most concerning, negative narrative of Surveillance, to the Factory narrative, dealing with the system-wide view of cloud computing, finishing with the most positive narrative, Noosphere, which describes a hopeful narrative of a user in control of their cloud. How does the advertised immateriality of the cloud affect how users engage with the technology? My objective was to create a multisensory physical installation in response to the seamless, digital, invisible cloud. Using Törrönen's strategies for the use of images, I developed artefacts that function as both microcosms and provokers. Through this technique I question established meanings, practices and prevailing ideas relating to cloud computing (Törrönen, 2002). Törrönen describes this process as expressing distance or proximity, in relation to the subject positions – defining what things are positive (identification, us), and what things are negative (distinct, them) (Törrönen, 2002, p.355). The applications of these strategies are further discussed within each of the artefact chapters, 6, 7 and 8.

The critical making came to fruition in three physical artefacts that provide a phenomenological, experiential encounter in an exhibition format. The artefacts included thin, illuminated fibre optics, smoke, video, an interactive element and optical illusions. Conceived to provoke and elicit responses from participants through making the invisible visible, the artefacts presented a range of narratives and visual details for participants to agree or disagree with, enriching the research process.

Phase 2 artefact exhibition interviews

A new set of participants was invited to reflect on the completed artefacts and cloud computing, providing more in-depth responses. Sharing the physical artefacts started a conversation about the ideas and imaginaries that we have about cloud computing. Phase 2 interviews gathered more in-depth responses from participants. The

interviews for Phase 2 resembled the Stimulus Image interview component of Phase 1, in which participants were asked to respond to existing two-dimensional cloud themed images. However, the material artefacts in Phase 2 offered specific physical artefacts of cloud computing. The staging of the exhibition experience was consistent for each participant.

Participants entered the darkened exhibition space and were invited to freely look around. After approximately five minutes they were invited to sit at a desk next to me, rather than the more formal convention of sitting across from the interviewer. In this position participants first answered generic questions about their use of cloud computing (see Appendix 3 and 4). The use of a desk and chair with a desk light illuminated the desktop, and created a separate space that was more formal than the open space of the exhibition artefacts and therefore suited the structured component of the interview. Upon completion of the initial interview questions, on the perception and use of cloud computing, participants were led to the Surveillance themed cabinet, where a set of questions was asked while they observed and experienced the artefact. On completion of that segment they were led to the Factory cabinet, and lastly the Noosphere cabinet. Three similarly formatted sets of questions were asked about each of the cabinets, including questions on the themes for each artefact. Interview questions are included in the Appendix. Closing questions explored each participant's experience of cloud computing, and enquired where they saw themselves in the artefact. My analysis of responses is explored within the chapters about each of the three artefacts in chapters 6, 7 and 8.

Phase 2 data analysis

Participant perspectives from Phase 2 interviews were transcribed and analysed. Differences between Phase 1 findings and Phase 2 responses were noted as these illuminated the differences between experiencing immaterial cloud computing technology, and physical cloud artefacts. I will now discuss the planning for the critical making of the artefacts, and an investigation of design precedents that I considered were relevant to the topic of the cloud.

Figure 1: Phase 2 interview in progress

5 Positioning the artefacts

After completing Phase 1, I began to work on a strategy for the critical making in Phase 2. In the following chapter I discuss the material basis for the artefacts, and finding a site to contain the outcome of Phase 2. Determining the exhibition space and the material I would work with was crucial, as this was the foundation for the critical making process. Following this I examine various relevant precedents and aesthetics, and delineate how I came to focus on artefacts and how I employed the concept of models. The chapter closes with a brief description of the resulting artefacts, which then leads to chapters about each of the artefacts.

5.1 Phase 2 critical making preparation

Finding a site was an explorative and informative process, in which I reflected on the history of cloud computing, and investigated the materiality of the technology. In initial plans for the artefacts I considered using a cloud computing container to house physical artefacts, in reference to the shipping containers that Google first used to store servers in 2005. In these early iterations of cloud storage each container housed over 1,100 servers, along with batteries, cables, water-cooling, and fans. The containers were then stacked and networked in large buildings that housed around 45 containers (Cubitt et al, 2011). General enquiries at my university about cloud data storage led to meetings with IT staff at my campus, and a tour was given of a dedicated cloud computing server container space.

Touring a cloud storage facility was helpful as it allowed me to experience numerous physical details of the space directly that I would not otherwise have been able to observe. The custom-built server space was made to universal standards for data server containers – a form that clearly resembles the dimensions of a shipping container. Two corridors ran along the length of the structure, lined with cabinets with individual sets of doors that opened to computer servers stored in two racks, from the floor to above head height. These sliding drawers struck me as similar to museum drawers holding specimens, and brought to mind the intimacy of informative displays of the late Renaissance Wunderkammers, or cabinets of wonders, that displayed collections of curiosities. For me this resonated with associations from Phase 1 participant narratives of magical and spiritual aspects. At this point, the aptness of a container as a site for artefacts came to mind. I next enquired about the use of an empty campus cloud computing container, and about possible container hireage for exhibition purposes. After both options were unsuccessful, I pursued the use of server racks as a framework for artefacts. My search for server cabinets led to contact with an IT recycling company in Wellington (ITrecycla), which led to visits to the company's premises, and provided a valuable insight into the electronic waste industry.

Touring the IT recycling warehouse was a powerful reminder of the environmental impact of the digital communications industry. Not only does the IT industry use large amounts of energy, but the creation of digital devices and the disposal of

electronic waste is highly impactful (Cubitt, 2017; Mosco, 2016). On the premises were multiple one-square-metre bags containing individual electronic parts, such as phone batteries, electronic circuit boards, and various other components. These were stored in preparation for export to recycling or disposal facilities overseas. After initial negotiations to purchase two disused data server cabinets fell through, I obtained three server cabinets that were surplus to requirements through my university. The availability of server cabinets is a reminder of the obsolescence of IT as running costs, better management of complex data, and improved technology lead to renewal of infrastructure, including server cabinets. Companies within New Zealand generally buy servers for a five-year lifespan, while internationally one to three years is the norm. Big companies like Facebook replace their servers within a year or less. Because technology improves and becomes more efficient and compact, and less vulnerable to temperature changes, repairing individual servers is deemed uneconomical and inefficient. The subsequent disposal of servers contributes to e-waste. The environmental impact and the hidden nature of server infrastructure for the public suggested that using server units in my critical making process was a valid way to make visible the invisible. After defining the location for the critical making within the server cabinets, I began sketching concepts and defining the aesthetic approach, selecting several of the Cloud Drawings for possible translation into physical form. I was both inspired and unsure of the outcome – bare, two-metre high steel boxes were daunting objects to work with.

5.2 Materiality of the cloud

In Phase 1, participants reported that the physical infrastructure of cloud computing was incongruous with the cloud metaphor, as they perceived cloud computing as not having an environmental relationship. For this reason I wanted to confront users with the materiality of the cloud infrastructure. Inspiration for combining the materiality of digital culture into critical outputs came from the work of design group Formafantasma, particularly in their Ore Streams project (Ore Streams, n.d.). Work by Formafantasma also aligned with my earlier choice to use server cabinets as containers.

Designers Andrea Trimarchi and Simone Farresin make up Formafantasma. They take a critical, experimental material approach to design, with an interest in sustainability and seeing objects as cultural conduits (Formafantasma, n.d.). Their *Ore Streams* project for the National Gallery of Victoria (NGV) in Australia was an investigation into electronic waste. Focusing on the mining of precious metals and minerals and the prospect of new logistical structures to recycle these materials, Formafantasma proposes that the 'above-ground scavenging will out-perform and out-value digging below the surface for raw material' (2018). Emerging from Design Academy Eindhoven, Formafantasma explores electronic waste with a similar approach as Droog Design's sustainable reuse of consumer products in the nineties, through making new objects from recycled materials. However, *Ore Streams*' office furniture references environmental aspects of information technology production through the specific inclusion of e-waste materials in their designs. Familiar elements are smartphone casings, outer casings from laptops, computer tower boxes, microwave bodies, pieces of gold-detailed mobile phones. The decontextualised placement of these familiar electronic materials encourages both conscious and unconscious changes in attitude to the consumption of electronic products. The subtle integration of recognisable parts into slick, highly finished office furniture demonstrates the feasibility and inevitability of reusing e-waste metals and minerals. The e-waste shocks the viewer after an initial glance. First the viewer sees the beauty and intricacy of

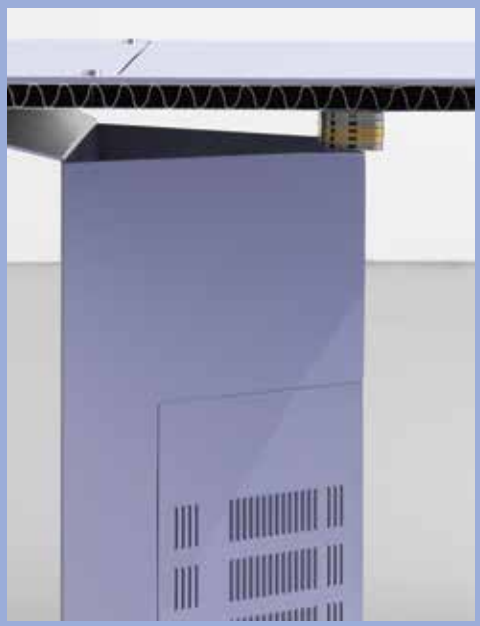


Figure 2: *Formafantasma Ore Streams chair 4*. Reproduced with permission

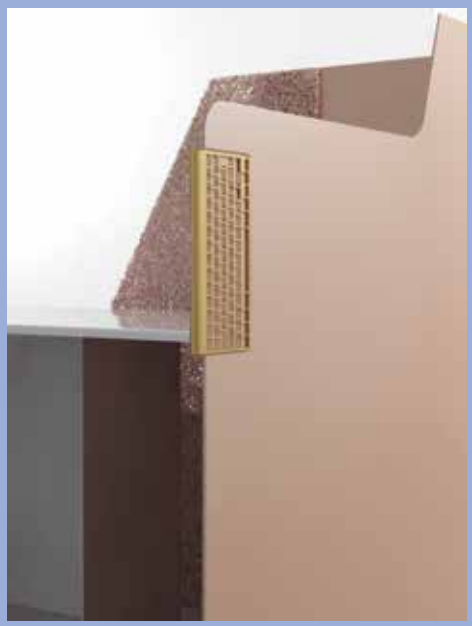


Figure 3: *Formafantasma Ore Streams cubicle 2*. Reproduced with permission

strategically placed elements, then they recognise parts from recycled keyboards or computer bodies. I was inspired by the inclusion of familiar materials and forms, and adapted this approach in my critical making process.

In Formfantasma's work the trojan horse of the sleek, functional furniture conceals the confronting message of the environmental impact of the IT industry. The figure of a trojan horse refers to the hollow wooden horse concealing Greek soldiers that entered the city of Troy. Characteristically a trojan horse describes a thing that insinuates and attacks from within. Similar to Formafantasma, I sought to use the artefact as a trojan horse presenting a metaphorical cloud aesthetic, while containing critical perspectives within. My intention was to draw the viewer in through interactive, experiential aspects of the artefacts depicting the poetic cloud, while embedding provocative elements within.

As my aesthetic developed, I planned to use primarily steel and transparent materials, with little colour, as a way to draw attention to the form and materiality of my critical making, and the subtleties of texture and light. Along with light and smoke effects, I wanted also to include a natural, human aesthetic. Including both machine-made and natural elements resulted in a complex aesthetic that I hoped would motivate participants to express their personal perspective on the artefacts. The use of natural human forms and sculpted elements could contrast with the hard, technological reality of the steel cabinets. The combination of organic and technological was also inspired by the work of artist David Altmejd, including his use of crystals as symbols for transformative processes.

5.3 Swarms and bodies

Canadian sculptor David Altmejd creates fantastical, large, ornamental sculptures with diverse materials, including taxidermied animals, plexiglass, crystals, glitter, threads, minerals and mirrors (see figures 4 and 5). The artist's interest in science is evident in his choice of subject. Heads and other body parts feature, alongside transformative processes represented through networks of fine coloured threads.

Aspects of Altmejd's aesthetic and approach for a number of works were a reference point for my approach:

> David Altmejd is a sculptor who is fascinated with the extraordinary potential of the object, and convinced that the act of making can generate meaning. Altmejd fashions intricate sculptural environments that call to mind miniature stage sets, museum dioramas, architectural models, and reliquaries.
>
> *The Brandt Foundation*, n.d.

For me, Altmejd's aesthetic of connective threads resembles that of early illustrations of cyberspace, and Phase 1 participant drawings illustrating data moving through space to the cloud. The transparent plexiglass and threads seemed an ideal material to illustrate the IT concept of layers of abstraction as sketched in figure 6 (overleaf). The transparency of the acrylic and thread also related to the perceived invisibility of cloud computing infrastructure, and the intangible quality of meteorological clouds. Inspired by this, I chose to use fibre optic cable in my artefacts for its association to fibre optic data strands, the ability to carry light and information, and the transparency of the material. Beyond the use of thread and plexiglass, Altmejd's complex, poetic and fantastical constructions are the antithesis of the slick, seamless qualities of cloud computing. Frequently organic, bodily references and figurative elements work together to create a larger, abstract form, so that more details become recognisable on closer inspection (art21, 2012). His large systemic constructions, such as *The Swarm* (2011), use transparent elements to create a three-dimensional space in which objects appear to drift. The artist describes *The Swarm* as a landscape, and the elements as 'very soft, and almost looks like a cloud, somehow', while also containing bodily elements such as hair and skulls (art21, 2012). This floating effect is one I wanted to adapt to my critical making. Altmejd's contrast of materials inspired me to incorporate organic, varied materials in my work where relevant, and to move away from the common clean aesthetic often used in digital media arts. This approach could illustrate contradictory perspectives on cloud computing, addressing both the technological and the poetic cloud metaphor. Through the artefacts I wanted to create a similar dual response – to deliver a sense of wonder or surprise, along with a disturbing provocation on closer inspection. Altmejd defines these works as experimental laboratories, systems that have their own intelligence, that can generate and transform themselves, and develop independently (2012). While unintentional, I recognised similarities between the characteristics of cloud computing as a system with many parts, and Altmejd's experimental laboratories with their own intelligence. Furthermore, the reference to autonomous transformation within these systems for me resonates with the analysis of user data, where, if enough data is collected and analysed, the numbers speak for themselves in the form of big data (Anderson, 2008). The connective networks of Altmejd's threads resembled not only Phase 1 Cloud Drawings, but network aesthetics of the early Internet.

Figure 4: *Artist at Work. David Altmejd.* Production still from the *Art in the Twenty-First Century*, Season 6 episode, Boundaries 2012, by art21, 2019 https://art21.org/gallery/david-altmejd-artist-at-work/#24

Figure 5: *Artist at Work. David Altmejd.* Production still from the *Art in the Twenty-First Century* Season 6 episode, Boundaries 2012 by art21, 2019. https://art21.org/gallery/david-altmejd-artist-at-work/#3

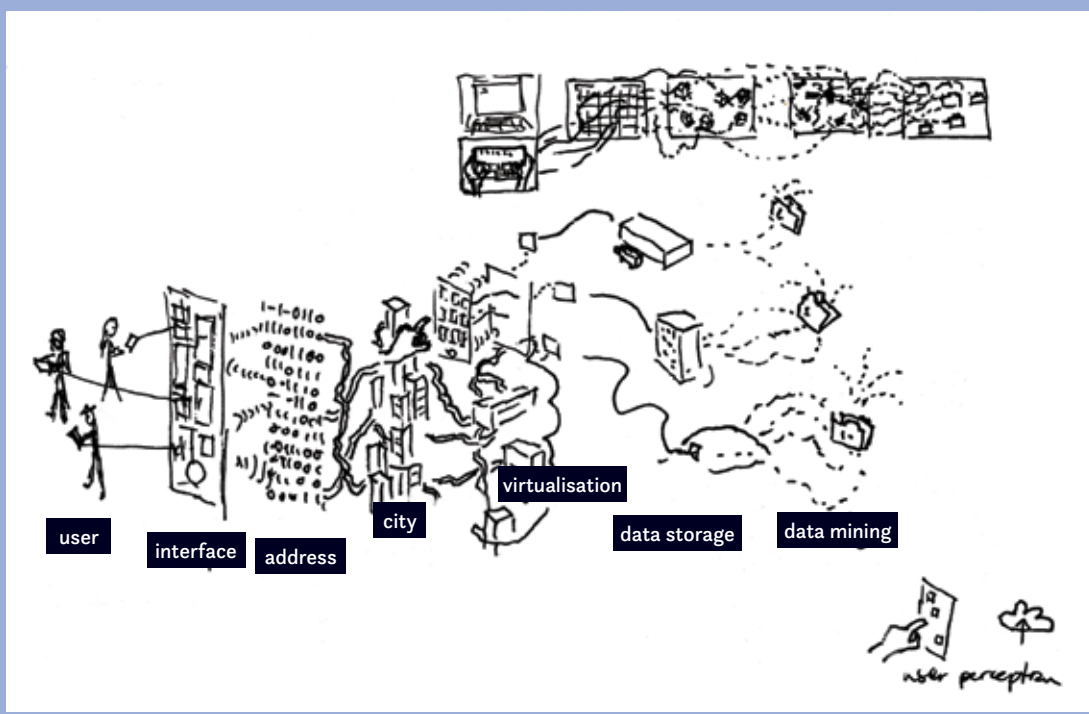


Figure 6: Layers of abstraction sketch

5.4 Past Internet aesthetic

After analysis of the Phase 1 findings it was clear that narratives and images relating to the cloud metaphor influenced how people thought about cloud computing. Metaphors have been used before in relation to the Internet. The Internet, and more broadly the space in which electronic communication takes place, was characterised as a frontier by John Perry Barlow (John Perry Barlow, n.d.), labelled as the information superhighway by U.S. vice-president Al Gore and described as an abstract, parallel world of cyberspace by William Gibson in his short story *Burning Chrome* (Gibson, 1987). In *Neuromancer*, Gibson describes cyberspace as 'lines of light ranged in the non-space of the mind, clusters and constellations of data. Like city lights, receding…' (Gibson, 1994, p.69). Cyberspace thus reflected an image of a fantastic, space-like world mediated through computer screens and separate from the physical world. Cyberspace has been theorised as a separate heterotopic space that replaces physical space (Benedikt, 1991), a space beyond physics (Wertheim, 1999), or as an experiential space (Lefebvre, 1994). Terms such as cyberspace and the cloud are examples of science communication that are used to communicate complex ideas. Evocative metaphorical terms are also used in advertising to sell products. However, I maintain that terms such as cyberspace and cloud do more than that: they convey narratives that confuse and obfuscate. This is echoed in other research into users' experience of cloud computing in I&IC (IICloud(s) – *Inhabiting and Interfacing the Cloud(s)*) research project, in which research participants reported a misunderstanding of the function of the cloud. IICloud(s) concluded that both the invisibility of the infrastructure and its confusing iconography contribute to that misunderstanding. Responses from an image shared in the Stimulus Image interviews illustrated that visual images related to the past narratives of the Internet influenced current participants' imaginaries. Accordingly, I assimilated this aesthetic into my artefacts.

Network sparks

How is cloud computing presented to the public and how does the public perceive the system? A number of visual images related to past metaphors of the Internet and the cloud were shared in the Phase 1 Follow-up interviews. The first of these is the cloud as a network, as shown in the *Opte Project map* from 2005, created with VRML (Virtual Reality Modeling Language) as part of *Opte Project*'s series of accurate 2D maps designed to depict the whole of the Internet. The network aesthetic rendered in this image is an established one, as I discuss further in section 8.1 (*The Opte Project*, n.d.). Manovich's transcoding principle applies in the making of the image, as information in the form of actual Internet nodes and connections is transcoded from the computer layer as the subject of the image, to the cultural layer in the digitally colourised *Opte Project* image. As Manovich states, the original source of the computer layer will have an influence on the cultural layer of material output (Manovich, 2002, p.63). For Phase 1 participants the data network aspect of the *Opte Project* image resonated – in all phases of this research participants imagined the cloud as both a brain-like network, and an infrastructural manufactured network (wires, pipes, cables). This confirms the relevance of older digital imaginaries of the Internet to current perceptions of cloud computing. Maps such as these obscure the black-boxed infrastructure of the Internet and cloud computing that remain in the dark. Van den Boomen asserts that the movement from digital to analog (or material) – the importing, splitting, selecting, packaging, framing – is generally hidden in black boxes and/or metaphors. This labour of transcoding from digital to analog in the creation of the *Opte Project* image is thus hidden in the interests of creating a colourful, attractive information graphic (van den Boomen, 2014, p.181).

Generated from Internet traffic data, images such as these are tuned to produce a wondrous representation of the technological sublime of neural networks. Trends in data visualisation have resulted in a multitude of images and interactive artworks that use light to represent quantified data sets. An example of this is Aaron Koblin and sculptor Janet Echelman's 2014 public artwork *Unnumbered Sparks*. In this projection mapping installation, a massive woven net hangs over a harbour, held up by posts. Illuminated at night through multiple projectors, the impressive sculpture becomes interactive as users effectively draw on the hanging net sculpture through their smartphones. Through logging onto a linked website, the audience can paint on their phone and directly see their drawing projected onto the fabric. WebSocket protocol enables audience data to be streamed directly into Google Chrome, so that data is rendered in graphics, in real time, on the hanging net. As a result, viewer's drawings appear momentarily on the physical net structure (*The Making of Unnumbered Sparks*, 2014). Koblin's *Flight Patterns* (2009) creates a comparable neon lit network aesthetic in its representation of flight paths across the U.S., mapped as coloured lines on a black background. While experimental and innovative in their construction, and the use of technology and audience interaction, I contend that these works glorify a utopian participation in the Internet cloud and data collection in a spectacular public environment (Hu, 2016). I agree with Alexander Galloway's succinct comments that 'There is one game in town: a positivistic dominant of reductive, systemic efficiency and expediency'. He argues further that attempts to map networks fail as they provide no orientation and 'exacerbate the problem by veiling it behind candy-colored lines and nodes' (Galloway, 2011, p.99). The resulting enactment resembles the wondrous civic displays of electric lights in the late 1900s (Marvin, 1988; Sconce, 2000). This digital sublime aesthetic is something I wanted to allude to in my work, while also provoking and challenging the viewer by addressing specific issues related to cloud computing.

5.5 Digital sublime

Mosco and others refer to the 'technological sublime' in narratives about the wonders of new technologies (Marx, 2000, Nye, 1994, Mosco, 2004). The term sublime was initially used to describe awe-inspiring natural and spiritual wonders. Narratives about new technologies reflect a similar religious hyperbole, in both scientific literature and advertising copy for new technologies. Late eighteenth and early nineteenth century notions of the term sublime described an exalted beauty in religion or that of wild, natural wonders (Nye, 1994). Kant developed a further distinction of the mathematical sublime to describe the immensity of a mountain landscape for example, and the dynamic sublime to describe superior and overwhelming forces in nature such as a flood or volcanic eruption (1994). Later development of the sublime is documented by Nye in a discussion of nineteenth century developments where technology provided a powerful means to manipulate and control the world. Within media scholarship Marvin has written about societal electrical imaginary at a time when electricity became ubiquitous (Marvin, 1988). Electricity and the industrial revolution enabled the construction of railways, skyscrapers, bridges and factories, manifesting a magnificent sublime through technology that was previously only experienced in nature. This technological sublime signified rationality, substituting technique for transcendental reason, celebrating work and achievement (Nye, 1994, p.295). The technological sublime of later technologies, particularly the Internet, has been documented by Mosco (Mosco, 2004).

An example of the digital sublime of the Internet is Microsoft's 2015 online advertising for their global data centre which represents a hyperbolic sublime in the

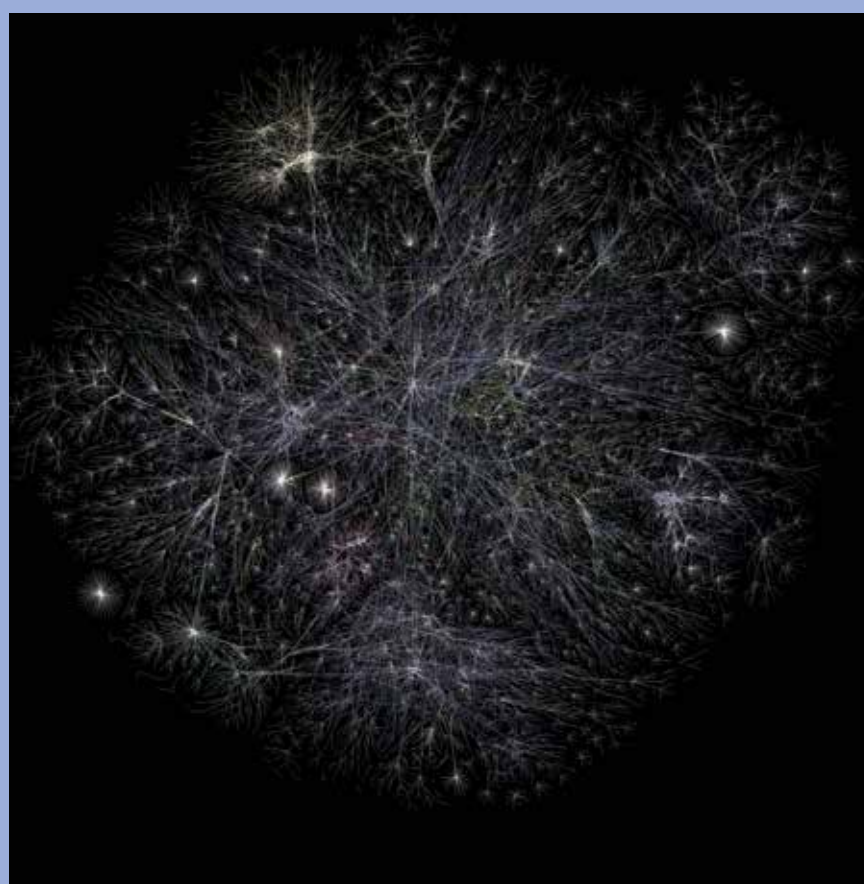


Figure 7: *Opte Project map* by Barrett Lyon. Reproduced with permission

characterisation of a Microsoft network that is connected by enough fibre to stretch to the Moon and back three times (*Azure Data Centre*, n.d.). Further inspiration and contextualisation of my aesthetic approach was developed through looking at recent research projects and art on the topic of cloud computing and digital culture.

5.6 Cloud computing projects

A common approach to design provocations that critique cloud computing is to look at what cloud computing is made of: in other words, to investigate the material infrastructure of cloud computing technology. As we cannot see the cloud in totality, investigating the infrastructure alone is not a complete solution to understanding the significance of cloud computing. Instead, I contend that the meaning of the technology can be better understood through deconstructing the phenomenological experience of cloud computing through prevailing user imaginaries of the cloud. My own task in Phase 2 was to inhabit the modular, purely functional, data server cabinets with the digital imaginary of the cloud network. This differs from other responses to the topic of cloud computing that look at the spatial location of data centres.

Louise Amoore describes this approach as a geography of cloud forms (Amoore, 2018). This aligns with Trevor Paglen's thought provoking photographic studies of surveillance systems in works such as *National Security Agency Utah Data Center, Bluffdale, UT, 2012* (Jacob et al, 2018, p.131). Skrebowski remarks that projects that focus on physical locations such as Paglen's offer little insight, as the subject remains impenetrable (Jacob et al, 2018, p.133). A project that also engages with the physicality and function of cloud computing is IICloud(s)' work that explores 'the creation of counter-proposals to the current expression of cloud computing, particularly in its forms intended for private individuals and end users (Personal Cloud)' (IICloud(s) – *Inhabiting and Interfacing the Cloud(s)*, 2018). One of the products of IICloud(s)' research is Living Rack, based on the modular form of a standard sized server rack, 'an open source variation around the standardised 19 inch computer server rack'. Referencing Eames' House of Cards project, *Living Rack* offers alternatives for decentralised domestic or office data centres (*Living Rack*, IICloud(s), 2018). Despite the fact that the intention of *Living Rack* differs from my project, both projects have in common a focus on server rack construction. Another project, *The People's Cloud* seeks to resolve the ambiguity of cloud computing through infrastructural research. *The People's Cloud* sound and film study by Matt Parker, Michael James Lewis and others incorporates interviews with key people working in the cloud computing industry (*The People's Cloud*, n.d.). In this sound project Matt Parker records and processes the ambient sound of data centres (*The People's Cloud*, n.d.).

> The piece identifies fundamental frequencies within a particular data centre. They are isolated and are then used to create a harmonic remix of the space to reflect the environment's 'sonic signature'. The piece feels immersive; lower frequencies swell as a series of animations form a caged like environment reflective of the experience of human interaction in the space but also reflective of the security aspects of the digital content stored within the endless racks of data storage.
>
> *The People's Cloud*, n.d.

The resulting atmospheric music is composed from ambient sounds within server spaces, amplified and mixed to reveal the claustrophobic nature of a data server space. The features of these environments – the low frequency sound, the lack of light, the controlled temperature, and endless racks with little space for occasional

IT technicians to work in, are conveyed as dehumanising. The evocative sounds in *The People's Cloud* communicate the experience of interacting with data server space and highlight the incongruity of these spaces in relation to users' everyday cloud computing experience. During my critical making process I considered incorporating sound as a interpretations of Cloud Drawing narratives as part of the exhibition. However, ultimately, I did not include these explorations.

Whereas a physical exposure by users of an actual data centre environment was not explored, data centre interiors were a visual reference point for my project. As an expression of cloud computing industry imaginaries, publicity images proliferate with representations of the cloud as clean interiors lit only by predominantly cold white lights. In my critical making process I used the clinical white light to evoke the 'always on' theme of data centres. Transparent elements were something I thought would allude to qualities of invisibility, and the use of box forms reference the concept of black boxes that show only the input and output and appear to hide the work inside. The simplicity of black, white and transparent materials was fitting to address the artefact themes. A relevant project that works with the aesthetic and material of cloud computing infrastructure is artist Simon Denny's contribution to the 2015 Venice Biennale, *Secret Power*.

Denny brings together the contrasting environments of Renaissance Venice and the contemporary modern location of Venice's airport, while showcasing material from Snowden's National Security Agency (NSA) leaks. *Secret Power* takes place in Venice's Marciana Library, a historic building that was key to the city's historical status as a centre of knowledge and power. The central exhibition contains Denny's interpretations of NSA data and artwork within server cabinets inside the Marciana Library. The second location for *Secret Power* consists of recontextualised symbolic Renaissance paintings from the Marciana Library that he transposes onto the floor of Venice's high security, post-9/11 airport space. The incongruity of the visual aesthetics of these spaces is forefronted, as the blue lit, steel boxes containing NSA's PowerPoint slides are juxtaposed with the warm, richness of the Marciana Library. The link is the similarity of these locations as sources of intelligence and power. While there are correlations between this work and my own, there are also clear differences. Denny uses server racks as museum-style vitrines, but the content displayed is partly corporate artwork from the Snowden materials (Brettkelly-Chalmers, 2016).

The stylistic taste conversation between the NSA material and the Marciana Library could not be more extreme – the overall effect is that of a Bond villain's high-tech den in a Renaissance estate. Denny interprets some of the Snowden material into 3D artworks, some of which are contained within server cabinets (2016). The materiality and the overall topic of *Secret Power* resembles that of my project. However, in my critical making, rather than highlighting the contrast of the aesthetic, I sought to reconcile the hard, industrial aesthetic of the steel server cabinets with the human, poetic cloud aesthetic of participant narratives. By blurring the distinction between the human and the industrial in a low-lit atmosphere, I ask the participant/viewer to consciously engage, and actively make meaning of the artefact from a personal perspective. Another artwork of Denny's that is relevant to my critical making artefacts is his Mona exhibition *Mine*.

Housed at the radical, privately owned gallery Mona in Hobart, Tasmania, *Mine* (2019) riffs off a board game aesthetic as a political commentary on data mining. As with all exhibitions at Mona, *Mine* visitors receive an iPod device called O that identifies them and tracks every interaction as they move through the exhibition. More complex and nuanced than *Secret Power*, *Mine* reflects both hope and anxiety about technology and the environment (*Mine*, The exhibition n.d.). The story of the endangered King Island Brown Thornbill bird, whose survival is aided by tracking of its

environment and behaviour, provides the hope angle, while the exhibition's theme park to extraction addresses the political, environmental and labour aspects related to data mining (n.d.). Mining is referenced in the use of various mining machinery within the exhibition, and the creation of a fully functioning board game titled *Extraction*, available through the Mona site. The comprehensive experience of the exhibition seems powerful, as the viewer is actively tracked and informed of that process, and data from the O devices are shared within the exhibits. As stated by Jefferson: 'Denny is using the visual language of an organisation to explain that organisation's culture to an outsider' (Jefferson, n.d.). Denny's board game approach carries on from earlier work and references that aesthetic, a pastiche of the game board and/or a trade-show floor at a convention (n.d.). An important aspect of Denny's work is the use of the mining metaphor, which I discuss further in the following section. Simon Denny's work was a useful reference point as I reflected on my process, although his work confirmed that my own aesthetic approach was distinct from his.

5.7 Wunderkammers and optics

To contextualise my critical making in relation to media histories, I sought to blend the server aesthetic with a more intimate aesthetic that recalled the wonder of early technologies of telephony and the gramophone. This approach resembles that of the Museum of Jurassic Technology in Los Angeles, which favours small, mysterious items that amuse and puzzle the viewer and provoke thought (The Museum of Jurassic Technology, n.d.). Related to the aesthetic of early phantasmagorical inventions, the Museum of Jurassic Technology characterises its role as 'an educational institution dedicated to the advancement of knowledge and the public appreciation of the Lower Jurassic' (The Museum of Jurassic Technology, n.d.). The low lighting and intimacy of the Museum of Jurassic Technology were aspects that inspired me in my critical making. Museum of Jurassic Technology exhibits are uniquely located between science and suspicion, challenging visitors to consider what is real and what is fiction. Displays include scientific oddities, art and mystical objects. Inspired by the earliest museums from the sixteenth and seventeenth century: Wunderkammers or cabinets of curiosities, such as Sir John Soane's in London. The Museum of Jurassic Technology displays a range of scientific, historic and ethnographic exhibits. A number of exhibits explore concepts such as those conceived by Guyot and Jesuit polymath Anthanasius Kircher, as demonstrated in the *Divination Table* (Figure 8). Based on the concept of a museum as a place to exhibit phenomena that other natural history museums do not, some exhibits are designed partly to entertain and provoke (Weschler, 1996). The concept of the Museum of Jurassic Technology references a period in which art and science were not clearly separated areas of knowledge, and researchers were natural philosophers rather than the scientists and humanists they are known as today. Consequently, poetics converged with the study of natural history. Working in with a similar aesthetic for my project is fitting, as the representation of cloud computing data servers through the poetic image of a cloud, juxtaposes the highly technological with the poetic. The aesthetic of the Museum of Jurassic Technology exhibits resonated with ideas I was forming for critical making artefacts. The idea of intimate museum drawers in the style of early Wunderkammers felt appropriate as a method for representing personal experiences of the individual users and themes of privacy. The approach of the Museum of Jurassic Technology applies to all my artefacts, but particularly to Surveillance, because the maker of the inspirational drawing for Surveillance remarked on being '*fascinated but also really grossed out*' by the cloud [A]. They also expressed suspicion, surmising that '*if your Wi-Fi is on and mine is then they're*

Figure 8: *Divination Table* from the exhibit, The World is Bound with Secret Knots – The Life and Works of Athanasius Kircher, 1602-1680. Credit Museum of Jurrassic Technology. Reproduced with permission

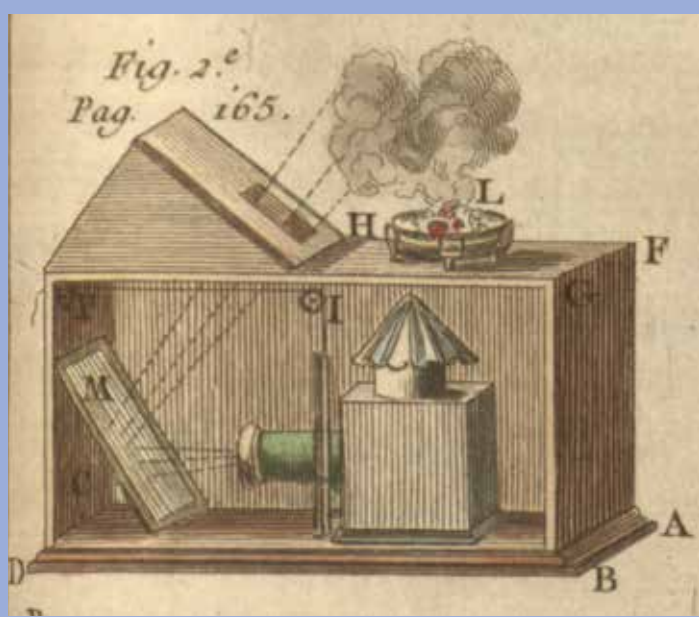


Figure 9: *Nouvelles récréations physiques et mathématiques*, Plate 16, by Edme-Gilles Guyot. Copyright 2009, Department of Special Collections, Memorial Library, University of Wisconsin-Madison, Madison, WI, U.S. Reproduced with permission

probably talking to each other at the moment' [A]. Wariness about cloud technologies echoes a history of mistrust of magical-seeming new communications technologies such as telephony and the gramophone in the late nineteenth century.

In the late nineteenth century, little understood new technologies led to imaginative and strange conjectures about disembodied voices. Carolyn Marvin (1988) draws a link between new technologies and the spiritualist movement that occurred around the same time because both describe connection without physical presence. This is evident in terms common to spiritualist seances and telephony, such as channelling, messages and connections (Marvin, 1988). As electricity became widely available, entertaining large-scale displays in various forms occurred as people found ways to make meaning of this new technology: electricity. Electrical experts in the 1890s used searchlights weighing up to 3,000 pounds to project light and messages onto clouds as celestial advertising. Many objected to the pollution of the sky with modern advertising imagery as clouds were 'turned into hideous and gigantic hoardings' (Marvin, 1988, p.187). The electric light triggered collective imaginings of both global communications and communications with other planets – proposals included reflecting messages off the moon, and sending light signals to Mars (Marvin, 1988).

The deception felt in both seemingly magical new communications technologies, and spiritualist gatherings evokes a smoke and mirrors experience that aligns with the poetic nature of clouds and the deceptive nature of surveillance. For this reason I pursued incorporating actual clouds – vapour, mist, fog – into my exhibition. The experience of fog touches on the phenomenological approach, the spectacle of early technologies, themes of spirituality, visibility and invisibility, and the physical form of clouds.

Themes of invisibility and visibility, the instantaneous quality of connecting anytime, anywhere, and mention of an all-seeing eye also relate to the magical qualities of early optical apparatus. Therefore, when developing my aesthetic approach I referenced work such as the optical inventions Edmè-Gilles Guyot's late eighteenth century *Natural Magic* books. Topics for these books included demonstrations of magnetism, electricity and optics. Guyot conceived magic lanterns that produced phantasmagorical ghosts through projection and trickery. The magic lantern pictured here in Figure 9 shows a box containing a candle that radiates through a lens onto a mirror. This mirror bounces an image onto the smoke rising from the dish at the top of the box. These influential early image projections resemble later technologies, as indicated by Kittler, who proposed magic lanterns as the forerunners of cinema (Kittler, 2010). A contemporary artist whose phenomenological work informed my own experiments with clouds is Berndnaut Smilde,.

In his *Nimbus* series, artist Smilde creates miniature ephemeral, fragile clouds in spacious, often stately interiors (*Nimbus*, n.d.). These impressive momentary displays are staged in controlled environments. Smilde's clouds are manifested through a methodical process using smoke machines and damp air while the results are recorded for posterity. His work comes from 'a deep interest in the temporal nature of construction and deconstruction, referring to both the physical state of a building as well as a moment of revelation that depicts either hope or fragility' (Martin, 2017). The incongruous appearance of a cloud floating just off the ground within a built environment appears magical and deceptively simple. Archived images of Smilde's art suggest human control of nature and the environment, themes that are also echoed in Eliasson's *The weather project* (Figure 11). While Smilde's documented process of making clouds seemed replicable for the purposes of the Surveillance artefact, initial experiments proved to be challenging, as I discuss further in chapter 6.

Olafur Eliasson's *The weather project* (2003) is another project that produces clouds through a phenomenological approach to promote an awareness of one's

Figure 10: Smilde, Berndnaut. *Nimbus II 2012*. Photo Casssander Eeftinck Schattenkerk. Reproduced with permission

environment. *The weather project* (2003) reflects the approach of phenomenologist philosopher Merleau-Ponty, who stated that in order to understand the nature of perception we must step back from it and make perception itself an object of consciousness (Merleau-Ponty, 1964). Eliasson's phenomena producer recreates sunlight and clouds within the Tate's Turbine Hall. A mist forms and fills the space, while a mirrored ceiling reflects the space below. An artificial sun made from hundreds of mono-frequency lamps emits a narrow light frequency so that colours other than yellow and black are invisible. Eliasson's phenomenological experience of space purposely uses exposed lights, pumps and wiring to reminds viewers that this is a manufactured experience, rather than a natural one. Through seeing the construction, visitors are made aware of the act of perception, as they can see themselves seeing in the reflection of the mirrored ceiling. This allows the viewer to step outside of themselves and see themselves from a critical position (May (ed.), 2003). The visitor experiences an environment that challenges their perception and their experience. Even though the sunlight and mist were artificially produced, some visitors engaged with the exhibition to the extent that they lay on the ground bathed in the light, as one might while enjoying a sublime sunset. Not only does *The weather project* (2003) create an experience of natural phenomena that is relevant to contemporary concerns with climate change, it also recalls earlier interests in clouds. Kunz et al (2005) speculate that the popular interest in the vague, unclear, and unbinding of *The weather project* (2003) aligns with the Romantic movement's interest in clouds at the time of Luke Howard's 1802 taxonomy of clouds (Howard, 1865). I suggest that the association of clouds with the Romantic movement reinforces the perspective of clouds as poetic. This repeats in the imaginary of cloud computing as poetic, vague and immaterial.

Exploring the above precedents and the existing aesthetic for the Internet led me to position my critical making in terms of the role that the outputs needed to perform. When embarking on the critical making I sought to triangulate participant responses, images of the existing Internet aesthetic, contemporary design projects about cloud computing, and art that either technically or aesthetically related to the themes of materiality, phenomenology and clouds. Reviewing the above precedents not only inspired possibilities for my critical making, they also responded to one another, and provided further inspiration for the critical making. For example, seeing the drawer system of the server cabinets alluded to specimen drawers and Wunderkammer displays. Moreover, an investigation into the server environment with its minimal lighting called to mind the lighting of a darkened theatre, similar to the site for Pepper's Ghost displays. Unlike artefacts that are made exclusively as phenomena producers, my artefacts were also designed to perform as physical representations of the cloud, motivating participants to respond. My method was both to represent diverse individual participant narratives, and to construct an installation that as a whole embodied the atmosphere of cloud. The hidden architecture of the dark exhibition space and the glow of the fibre optics referenced the blandness of server environments that are built to house cloud data. In my visit to a data centre I observed bright primary colours in the cables and switches. I noticed these colours in the Google and Microsoft logos also, and consciously decided to use a limited palette so that the textural aspects of the steel and glowing lights were highlighted. By stripping away the colour, I instead chose also to emphasise the monotony of the cloud.

Each artefact performed a distinct role, using some variations in the use of materials and embedding specific, possibly polarising, details intended to provoke participants and maximise responses. Reflecting on the precedents I tasked my critical making with visually communicating the themes that were listed in my design brief. I now clarify terms that guided the outcome of my critical making process.

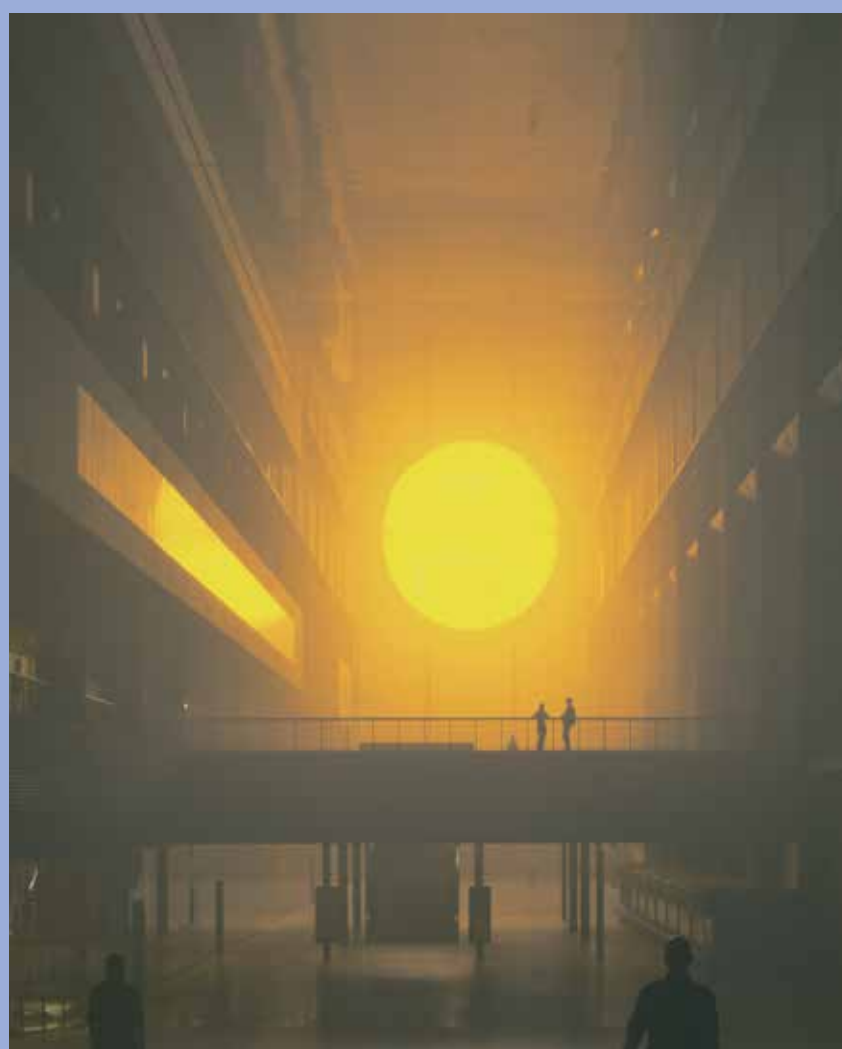


Figure 11: *The weather project*, Turbine Hall, Tate Modern London (The Unilever Series)
© Olafur Eliasson 2003. Photo: Jens Ziehe. Reproduced with permission

5.8 Artefacts and models

Artefacts

An artefact is an object made by human workmanship, as opposed to objects formed by natural processes. In doctoral research, artefact is used in reference to tangible outputs that are part of the examinable work. Ravelli et al describe the making of artefacts in this context, as iterative, personal and experiential, where direction is taken in response to insights along the way, and the written documentation builds on theory that arises from the work (Ravelli, Paltridge & Starfield, 2014, p.298). Critical making methodology (Ratto, n.d.; Hertz, n.d.) which I discussed in section 4.3, resonates with Ravelli et al's iterative approach. Both Ratto and Ravelli et al contend that the value of the research is evident through new knowledge that arises through the making process rather than the resultant artefact (Ravelli, Paltridge & Starfield, 2014, p.310; Ratto, n.d.). In this project new knowledge resulted from the post-exhibition participant interviews. On completion of the first exhibition of the artefacts, I continued my critical making as I worked through the individual challenges of each of the exhibitions (see chapter 9), reflecting and documenting the process. Ravelli outlines that the insights that are achieved along the way in critical making are dependent on translation and documentation of the process by the researcher-practitioner (Ravelli, Paltridge & Starfield, 2014, p.310). Accordingly, I reflect in writing on the critical making of my artefacts in chapters 6, 7 and 8. After Phase 2 participants viewed the artefacts and responded in interviews, several participants described the resulting artefacts as models.

Models

Models are used within the visual arts as representations or likenesses of a structure, and in mathematics as representations of a mathematical concept. Models can be valuable for exploring alternative formats and gathering responses from viewers (Bratton, 2016; Chun, 2016). Bratton speaks on a philosophical level about his concept of stacks as a model for planetary scale computation based on knowledge of the multiple levels of computing. Likenesses or models relate to metaphor, although metaphor is a figure of speech that compares something to an original object, often suggesting an abstract or symbolic resemblance to aspects of the original. This is the case in the use of the metaphor of a cloud to describe virtual data storage. Because a physical likeness or a model of cloud computing is not available for users, the cloud is experienced as invisible. The term model was not used by Phase 1 participants when they talked about their Cloud Drawing. In Phase 2 however, three participants working in information technology used the term model in IT terms, as a '*statistical model*' [D] for example. Others spoke about the artefacts as representational models, for example: '*This model could help people understand cloud computing*' [E]. This response surprised me, though on reflection it was appropriate. While the critical making artefacts were inspired by participant drawings and not intended to function as models, for participants the artefacts clearly functioned as relatable visual and physical models of cloud computing. This shift from critical making relates more to the methodology of critical design as I discuss in 4.3. Transcoding the Cloud Drawings into a physical form highlighted differences between the cloud metaphor and the infrastructure of cloud computing.

In summary, this project materialises participant imaginaries of the cloud within a cloud computing structure of server cabinets through smoke, light and interactive elements. Applying phenomenological methodology viewers were invited to look critically at the mechanism of the cloud metaphor and consciously reflect on

their experience and perception of the technology. The artefacts invited participants to contemplate industry, and user imaginaries of the cloud, and to consider their own imaginary of the cloud.

I now introduce the three artefacts, briefly unpacking the individual themes addressed in each, and the relationship of the artefacts to one another. In chapters 6, 7 and 8 I discuss each of the three artefacts – the inspiration for the creative making, relevant participant responses in Phases 1 and 2, and my learning during the critical making, woven together with reflections on scholarly and practitioner literature.

5.9 Introduction to the artefacts

I initiated the critical making process by selecting three Cloud Drawings that described the cloud in divergent ways, addressing the themes that were raised in the findings. These drawings were the inspiration for my creative making.

The first cabinet, titled Surveillance, depicts a panoptic, paranoid view of the cloud as a data surveillance mechanism that impacts on users' privacy online. Surveillance incorporates references to spirituality through the inclusion of the eye in the sky, smoke, and an optical illusion using the Pepper's Ghost technique. The viewer observes a projected video through a window at eye height, that shows three users interacting with their smartphones, while an all-seeing eye observes from above.

In contrast to the personal view of the Surveillance artefact, the second cabinet – Factory – focuses on a wider, vertical, material reality of the cloud computing infrastructure. The Factory enabled me to represent environmental issues evident in literature, addressing participants' demonstrated lack of awareness of cloud computing's environmental impact. Themes from other drawings that were represented in the Factory include complex cyclical networks, black-boxing that makes cloud technology transparent, and the dual depiction of clouds as both data server containers and meteorological clouds.

A hopeful, futuristic narrative about connecting, sharing knowledge and enriching one's identity is depicted in the third cabinet – Noosphere. Themes of identity and social connection are addressed in Noosphere. Unlike the first two artefacts, Noosphere radiates horizontally from the front outwards to the back of the cabinet. Grouped together in this way, the three exhibited artefacts form a single narrative, from the panoptic, to the infrastructural, to the personal. The journey from Surveillance, to Factory, to Noosphere was explored in the post-exhibition participant interviews, in which participants were asked questions that corresponded to the sequence of the larger narrative. Before the interview, when participants first entered the exhibition space, they were free to approach the artefacts in their own chosen order. The order in which the cabinets were placed in the exhibition was not determined by the interview order, but by the visual quality of the artefacts, and the parameters of the space. The smallest of the artefacts – Factory – was at the left when entering the space. At the centre was Surveillance, as this differed in form from the others, and because the smoke emissions were designed to disperse outwards, on either side, to the other two artefacts. The third artefact – Noosphere – was at the right. This positioning differed from the order in which the Phase 2 interview questions were posed. This variance in the order of the artefacts meant that participants weren't predetermined in their consideration of the artefacts to one another.

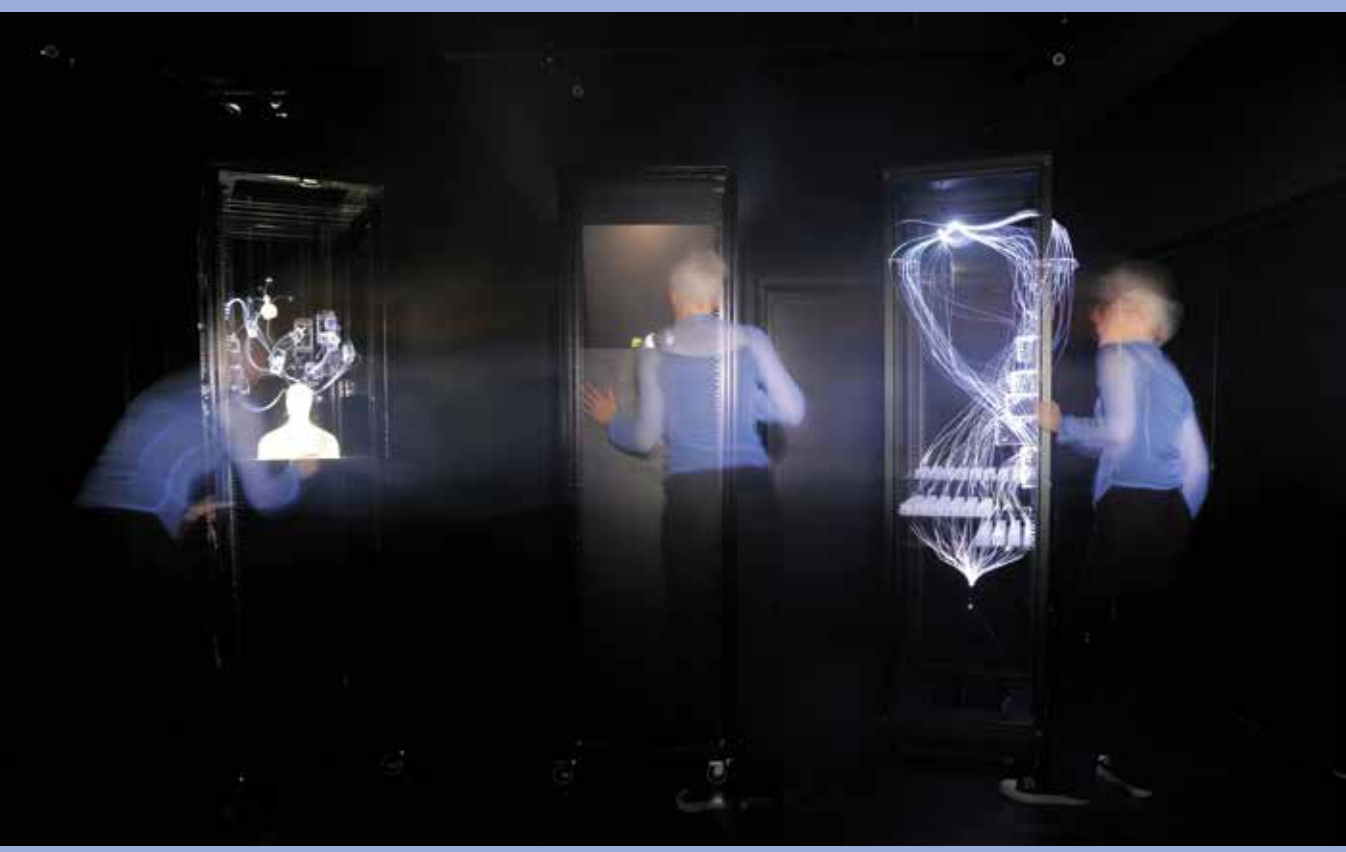
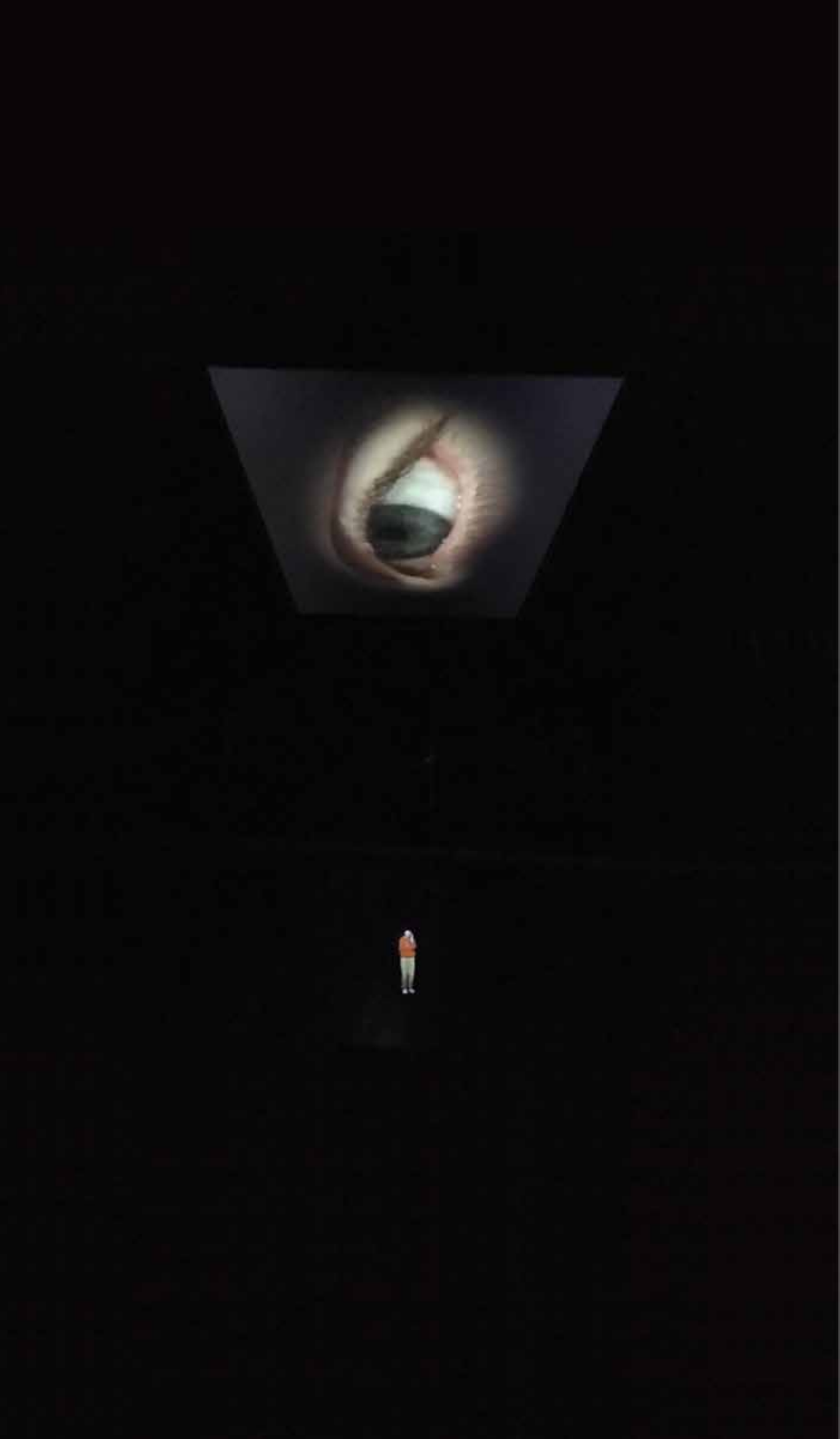


Figure 12: Noosphere, Surveillance, Factory (l to r)

Figure 13: Participant responses to Surveillance artefact

6 Surveillance



6 Surveillance

The critical making process for the Surveillance artefact responded to a participant narrative of the cloud as a place of connection, multiple identities, surveillance and spiritual connotations. Common to the other artefacts, the scale of the contents of the Surveillance cabinet is intimate and in the overall style of a Wunderkammer. A magical-seeming connection across distance and themes of identity are conveyed through the illusory Pepper's Ghost technique. The use of smoke creates a sense of mystery intended to allude to cloud computing. Representing arguably the most concerning aspects of cloud computing, Surveillance is the most enclosed and intimate of the three artefacts.

Viewing parameters for the Pepper's Ghost illusion determined the construction of the cabinet. Testing showed that a consistent viewing angle was required. Consequently, I constructed a window at eye height and enclosed the majority of the cabinet as a black box, excluding a gap across the width of the cabinet at eye height. One participant interpreted this as: '*Peering into the box, like peering into the phone*' [F]. Within the viewing window a video clip of cloud computing users using social media on their smartphones appears to hover in mid-air, while social media logos float from the users to and from the ceiling of the cabinet. Above the users, a video of a large eye plays in a loop in the ceiling of the cabinet. Smoke released intermittently moves from the inside of the cabinet upwards to the Pepper's Ghost screen, and out of the top edges of the cabinet, hinting at dispersion of data to unknown locations. On release of smoke by a timer mechanism an industrial sound of smoke emissions is heard. As the installation required a dark space with minimal air circulation, the inside and outer walls of the cabinet are painted black in order to absorb light. The infrastructure of the server cabinets is exposed, showing something of the working of the cabinet. Exposure of the construction aligns with the construction of Eliasson's *The weather project* (2003). This diverges from an industry that both obscures the physical cloud infrastructure, and the data surveillance economy that functions behind the cloud computing advertising narratives.

Interpretation of the original drawing was arrived at through iteration, reflection and material experimentation. The participant narrative from [A] described the cloud as a place to both connect with others, and a place where one is under scrutiny. Mentions of an all-seeing eye and 'weird boundaries' portrayed a sense of mystery. The author [A] described the cloud as fascinating yet alienating, qualities that align with early optical pieces by Guyot or Kircher. This inspired me to integrate smoke clouds into the artefact, as, similar to Eliasson's *The weather project* (2003) or Guyot's optical experiments, smoke provides an immediate, phenomenal experience of clouds that deceive and obscure. The end result contains the main elements of the drawing: clouds represented by the smoke, Pepper's Ghost projection to represent the multiple identities through a holographic effect as described by [A]. Moving social networking icons symbolise the movement of data between users and an all-seeing eye above. Habits of users are demonstrated in the video of the three young people on their

Figure 14: Surveillance artefact

phones, who, despite their physical proximity to one another, show a more immersive connection to the back and forward flow of messages from their smartphones than to one another.

Cloud Drawing and interview responses in Phase 1 about surveillance capabilities related to cloud computing are the topic for the Surveillance artefact. An analysis of Phase 1 resulted in the critical making brief with the following themes, each of which I discuss in the following pages. These are:

- **Visibility / Invisibility** Parameters of visibility are explored in the use of Pepper's Ghost stage illusion and smoke. The resulting artefact raises issues of aspects of cloud computing that are visible (the cloud icon, the data that is directly accessible through users' interfaces) and those parts that are hidden (the data surveillance economy, the environmental impact, the hidden labour and the infrastructure).

- **Dis (Orientation)** Through borderless transfer of data that ignores geopolitical boundaries perspectives can get confusing. Edward Quin's 1830 *The Deluge* challenges participants to think about perspectives, and the nature of space: '*I'm not sure if I'm up in the space looking down or looking up*' [E]. The poetic, tight framing of Stieglitz' *Equivalents* questions what is shown and what is left out.

- **Surveillance** While Bentham's panopticon view was defined by vision from a central tower, surveillance in the cloud occurs through analysis of a wide range of tracked 'data exhaust' (Zuboff, 2019). Data is also collected through vertical views from the god-like, all-seeing eyes of drones, satellites and the military (Steyerl, 2011).

- **Shadow Cloud** Participants were challenged to respond to Microsoft's 'secure solution that can listen, learn, and predict'. This shadow side of the cloud is the business end of cloud computing that lies beyond the user interface of the metaphorical nice, fluffy cloud.

- **Spirituality** Spiritual themes of the Surveillance artefact recalled links between earlier technologies and spirituality. The vertical hierarchy depicted in art historical images featuring clouds helped participants to further make meaning of the cloud.

- **User habits** Video footage of users being surveilled drew concern from some participants, though most did not identify themselves with the young people in the projected video. The viewer's perspective on the artefact, the perspective from the eye and the perspective from the victims of surveillance below are all subject to clouds. While the all-seeing eye observes, so do the users below: '*I find myself being a creep … looking but not posting*' [A].

I now discuss participant responses in both phases of the research in response to cloud computing themes of Surveillance.

6.1 Drawing and Surveillance artefact

The Phase 1 Cloud Drawing, Figure 15, formed the inspiration for the Surveillance artefact. I chose this drawing because it references concerns about surveillance, invokes associations of the cloud with spirituality, and depicts ways that people connect through social networking.

Pictured in the drawing is a cloud mass that dominates the users below, illustrating a clear power relationship. Social networking occurs through the Instagram and Facebook icons, while figures on the ground do not connect with one another. Three people are pictured on Internet-connected devices, directed to individual clouds floating in layers above them while a back and forward flow of information is interrupted through data surveillance in the cloud. The clouds contain multiple objects – some sections of the cloud belong to one participant's cloud alone, while other sections of cloud belong to other people. Social networking is represented, handcuffs signify contractual obligations, dollar signs to signify the monetisation of connecting online, while eyes signify surveillance. This participant saw the cloud as a place to connect

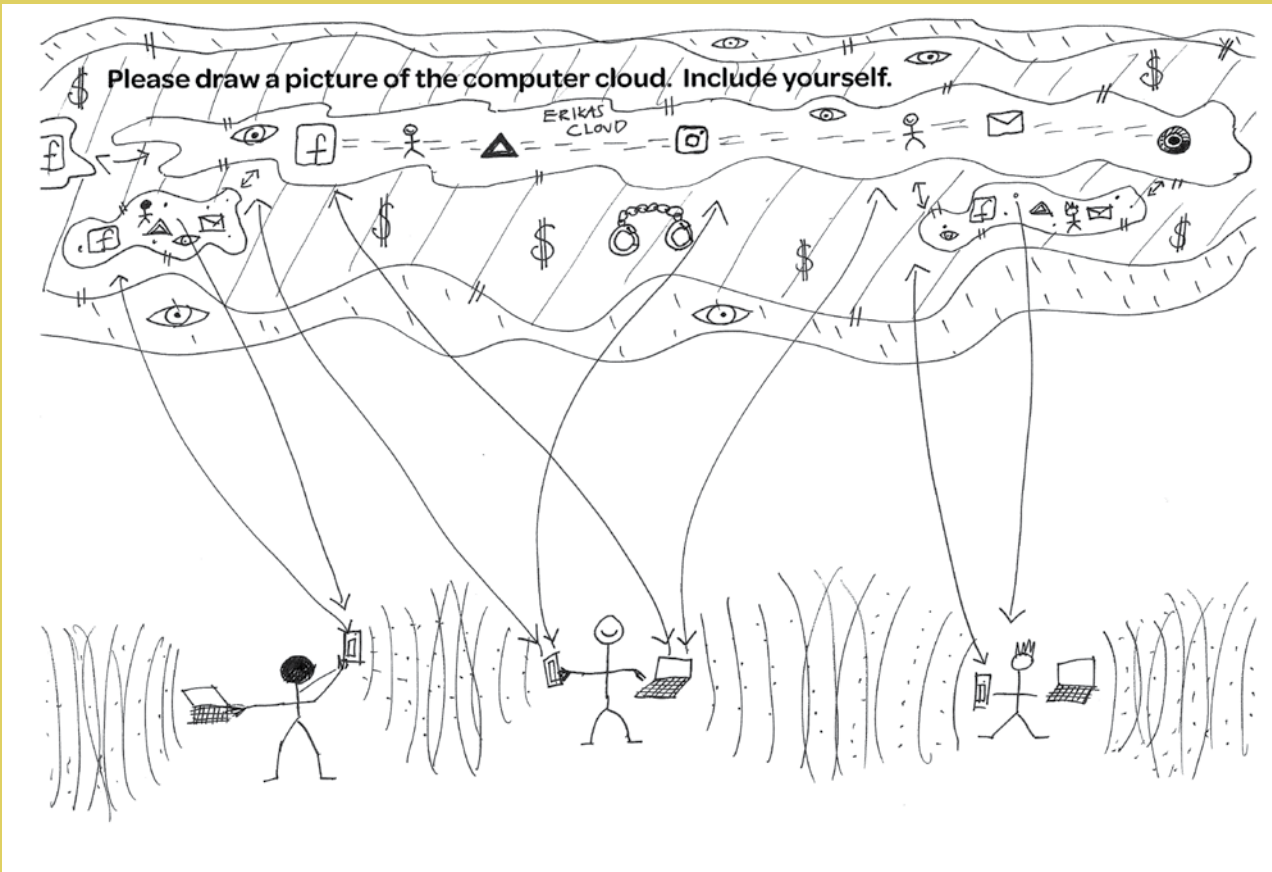


Figure 15: Participant drawing by [A], the inspiration for the making of the Surveillance artefact

socially, a place described as containing an all-seeing eye, a place with spiritual connotations, and a dangerous place where one's online behaviour and data was tracked to an unknown degree, by unknown observers. Sections of the cloud belong to each of the users pictured, thus the cloud is not singular but complex and plural. Many areas within these clouds also contain eyes:

> *'because if you do something you shouldn't be doing, 'they' are going to find out what you're doing because you're being watched, so I put little eyes inside there'* [A].

Curved lines to the side of each user symbolise Wi-Fi signals carrying the internet connection between devices: '*If your Wi-Fi is on and mine is then they're probably talking to each other at the moment*' [A].

6.2 Visibility / Invisibility

The presence of smoke in the Surveillance artefact addresses themes of visibility and obfuscation, and spiritual associations. As noted in section 5.7, as inspiration for the smoke I reflected on Bernhardt Smilde's still cloud photographs, which were captured in highly controlled environments. Though in contrast to Smilde, my three-cabinet installation was in an open exhibition space, with restraints from lighting and building safety standards limiting the release of the smoke and making the installation more difficult to control. The additional use of the Victorian era Pepper's Ghost technique explored questions about identity, illusion, and spirituality.

Pepper's Ghost technique

An interest in visibility, and spirituality arose in tandem with early media technologies such as the telephone and the gramophone in the mid-to-late-eighteen hundreds, as I discussed in 5.5. An example of this is the stage illusion trick invented by Henry Dircks, later popularised by Professor John Pepper in London in 1862 (Kattelman, 2013, p.198; Barnes, 2005). Using the so-called Pepper's Ghost technique people were able to create visual illusions, such as that of a transparent ghost walking through solid objects. This effect is achieved through an angled glass pane on which a brightly lit image of a person or object is reflected from a space below a stage. The resulting image appears to float over the stage, while the stage and the stage set remains visible to the audience. The Victorian ghost illusion was very popular among audiences and typical for this period, because it combined science, popular topics, and spectacle. Groth states that Pepper's Ghost was pertinent to Victorian era ideas about human memory, vision, and illusion (Groth, 2007). Typical for this period was a crossover of interests in both science and spiritualism as people sought to make meaning of new technologies. These dual interests are evident in the wide use of Pepper's Ghost effect in both science lectures and theatre performances (Kattelman, 2013, p.199). A number of theatre adaptations of Charles Dickens' ghost stories fittingly used Pepper's Ghost, including *Haunted Man*, in which a spectral double of the main character Redlaw grants a wish for Redlaw's memory to be erased, on the condition that everyone with whom he comes in contact suffers the same fate (Groth, 2007). Pepper also used his technique to demonstrate how popular spiritualists at the time might create their tricks (Kattelman, 2013, p.198). Though the technique is similar, unlike Victorian theatre installations, the spectral identities of Surveillance functioned at a more intimate level.

Because associations between technology and spirituality were also relevant to my project, I adopted the Pepper's Ghost technique. Just as nineteenth century

audiences before them, research participants reflected and made meaning of the projections. Similar to the people in the nineteenth century, in research responses participants also made meaning of new technologies. Stored memory and spectral doubles were mentioned in the cloud computing narrative from [A] that was the inspiration for the Surveillance artefact. The cloud was described as a '*...creepy eye. The eye symbolises that the data is yours but checked by others*' [Q]. Similar to Pepper's demonstration of the trickery behind the technique, I invite viewers to think about how technology corporations might use illusory algorithmic tricks to hide surveillance practices. References to holograms and multiple identities were also noted by participants in Phase 1 Cloud Drawings and interviews.

Holograms

A starting point for combining smoke with video projection were comments from the author of the surveillance drawing, who spoke of versions of themselves in the cloud:

> *'... there's little me's inside this cloud, cause I kind of feel like there's a sort of holographic representation of myself and parts of me, inside that cloud.'* [A].

Another Phase 1 participant conveyed a similar sense of other images of themselves in the cloud:

> *'There is an imprint of me in all these other places, they will have data on me, my preferences of what I like, there is a ghost of me, a part of me in all these other... There's a paradox, though I'm geographically there but a part of me is in the cloud, there's an extension, shadow of me in the collective cloud – it's not all of me.'* [E]

These comments recall ghostly substitutes and the aesthetic of early optics and spiritualist photography, and touch on digital identity online which I discuss also in Section 8.3. This motivated me to project figures onto smoke, similar to that of

Figure 16: Smoke containment sketch

Figure 17: Smoke box trials

Guyot's late eighteenth century magic lantern optical experiments, or images from early spirit photography. I shot footage of an isolated figure and projected this onto rising smoke, experimenting with projections from various directions. The effect was instantly magical-seeming and ghostly as the movement of the smoke caused the image to flicker, fade and reappear. After some experimentation, the projection onto smoke proved unmanageable as the smoke dispersed, causing the video image to project onto horizontal surfaces of the server cabinet walls. Consequently, I sketched other approaches – layering boxes containing smoke in the manner of Bratton's layered stacks, for example, but this proved unwieldy as the smoke was difficult to direct (Figure 16). After experimentation it became clear that the direction of the smoke would be a determining factor in constructing the artefact, and that the other core component of the all-seeing eye should be placed above.

Participant responses to the critical making outcome were unexpected. In the final artefact I placed a commercial smoke machine inside the Surveillance cabinet, which released smoke intermittently from the centre of the cabinet into the wider exhibition space. The smoke emissions drew a range of responses from participants.

I was surprised to find that direct links to cloud computing were not made – many participants were confused and did not identify the smoke as the cloud. Instead participants directly described the smoke effects as misty and demonstrating lack of clarity. Qualities mentioned by participants did however reflect the industry's tendency to obscure and make things unclear, as they saw the smoke as '*a cloud of mystery or fogging*' [D], '*blurring, something being lost, unclear*' [G], '*smoke causing a fog or something fuzzy?*' [P].

Figure 18: Testing video projection onto smoke

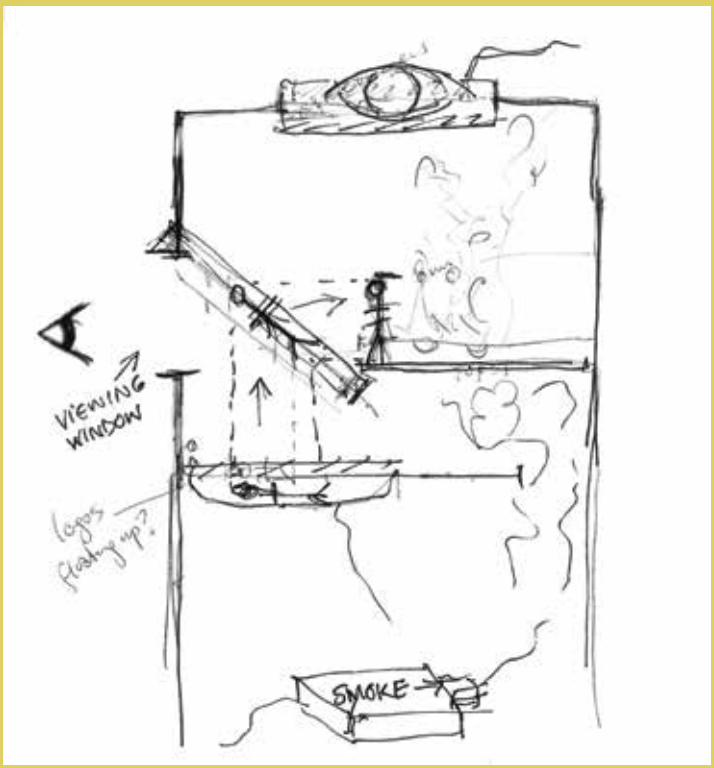


Figure 19: Pepper's Ghost planning for Surveillance

6.3 (Dis)orientation

A Stimulus Image shared in Phase 1 that brought up issues of visibility was *B.C. 2348. The Deluge*, an illustration from an atlas by Edward Quin. When research participants were shown Quin's image a sense of disorientation was reported: '*I'm not sure if I'm up in the space looking down or looking up*' [E]. Both Stieglitz' *Equivalents* and Quin's *B.C. 2348. The Deluge* offer a view, or framing, that is unlike what we view when we see meteorological clouds in the physical world. The map originates from *An atlas of universal history* by Edward Quin (B.C. 2348. The Deluge, 1836). I chose this image as geopolitical issues are hinted at in the use of a map, and the aspect of the viewer looking down from above is an unusual one that I thought might return unexpected responses. Are we as the viewer on the ground looking up, or are we in the clouds with a privileged high overview of the land below?

Participants experienced the panoptic vision from above in Quin's illustration as a depiction of power imbalance. Hito Steyerl contends that this verticality of tracking from the one-way gaze of the superior onto the inferiors below, such as the perspective shown in Quin's *The Deluge*, is the new normal. Steyerl argues that the advent of drones, satellite and military views, and surveillance perspectives have resulted in a move from horizontal singular perspective to vertical perspective (Steyerl, 2011, p.8). Phase 2 participants viewed the Surveillance artefact eye as controlling: '*Eye becomes god figure. Whoever is in control of the eye is in control of our behaviour*' [F]. In contrast to this a horizontal view, as created in the Noosphere artefact, was experienced as much more empowering, as I discuss in chapter 8. Although verticality offers freedom from the conventional linear perspective of horizontality, that freedom from perspective is primarily available to those above, and disempowering to those below.

Quin's atlas presents historical change through a series of images in which dark clouds progressively recede further in each page, in the manner of a slow version of a nineteenth century flip book, to reveal newly discovered land, ultimately showing a complete view of the world as it was known at the time. *The Deluge* is the first image in this atlas. A biblical narrative of world history is interpreted literally with Eden as the first location in the world. For one participant the representation of land was experienced as '*solid and reliable*' [I], while the cloud was '*dark and unknown and flowing and ungraspable*' [I]. This reflected this participant's earlier interview comments about the mystification inherent in cloud computing technology. Quin's aim in the creation of his atlas is to present a progressive narrative unveiling. A comparable process of uncovering is my intention in my investigation of what lies behind the cloud metaphor – the surveillance economy, big data analysis, the location of cloud computing, and the environmental impact of the so-called weightless cloud computing industry. Goffart writes of Quin's intention:

> to offset the fragmentation of history. In the successive leaves, the student would always find the same territory in the same part of the Map, [and see] by the changes of colour, the various Empires which succeed each other.
>
> Goffart, 2003, p.343

The consistent relationship to place in Quin's *The Deluge* diverges from participants' relationship to space and geography. Users of the cloud have a tenuous concept of the physical location of the cloud. Participants do not know the geographical location of their data, nor are the locations of most cloud computing data storage facilities known to the public. Lack of connection to physical space is evident in participant responses in the Phase 1 Cloud Drawings, in which maps with complex random networks of lines were drawn, with denser data traffic in bigger centres. In interviews, specific locations for data storage infrastructure were seldom specified, though the

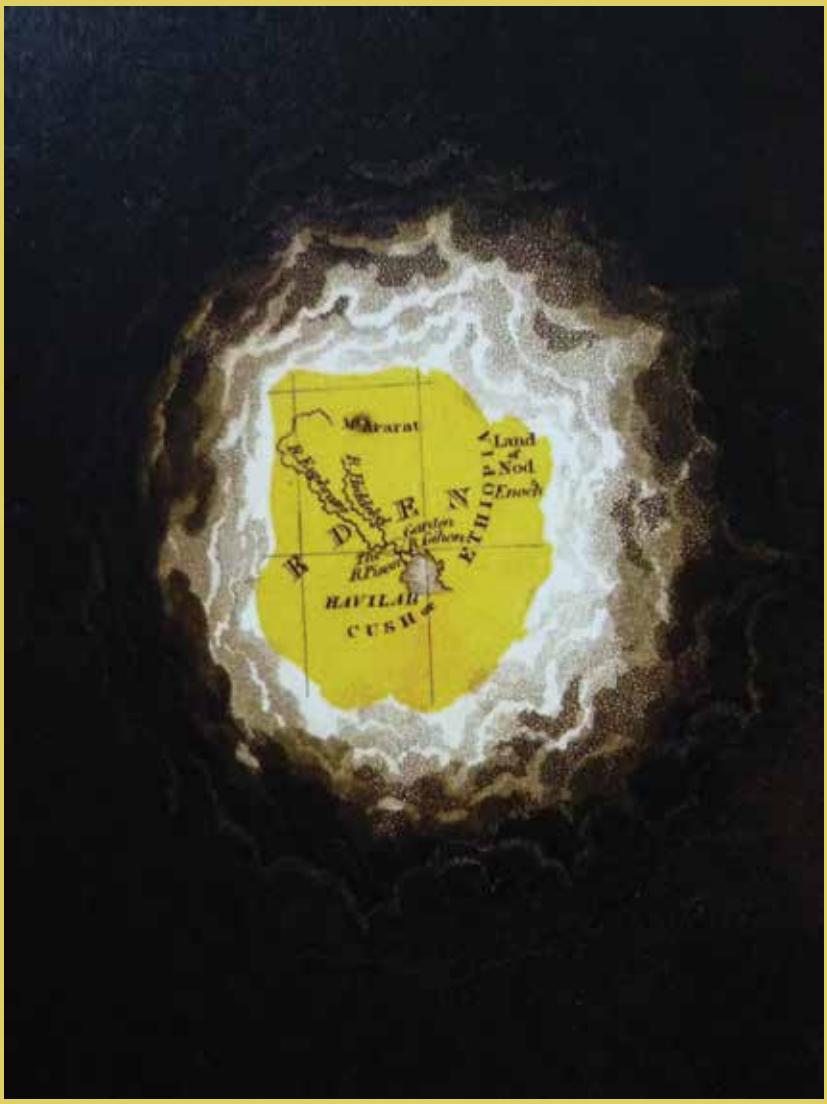


Figure 20: Quin, E. (1836) *BC 2348. The Deluge.* [Print] Persuasive Maps: PJ Mode Collection, Cornell University – PJ Mode Collection of Persuasive Cartography, NY. In Quin, Edward, *An Historical Atlas*, (p.1). London: Seeley & Burnside publishers. (1836). Reproduced with permission

United States and China were mentioned by some. This correlates with Flichy's argument that the Internet is primarily North American (Flichy, 2007). Issues of visibility and a sense of disorientation recall the public response to photographer Stieglitz' cloud photographs *Equivalents*.

Made between 1922 and 1932, Stieglitz captured the transient nature of constantly changing clouds in this series of small photographs. Although Stieglitz photographed the unmanipulated reality of nature, the framing of each cloud creates an abstract image that addresses spiritual themes (Wilson, 2003, p.747). In isolating each cloud from the context of the environment there is nowhere for the cloud to rain on, no land below affected by the density of the cloud. The tight framing of these photographs forces the viewer to focus on the cloud, though one might prefer to zoom out to see a bigger picture outside of the frame. The decontextualised Stimulus Image is comparable to Google Drive's cloud computing icon, in which the framing of cloud computing as a symbolic white cloud in a blue sky distracts from the reality of a physical infrastructure. The location and infrastructure remains invisible: '*you do get lured into this thinking of a whole 'nother universe, but at the end of the day it comes back to holes in the ground, buildings, electricity*' [H]. Rosalind Krauss describes the *Equivalents* series as evoking the language of symbolism that is intended to disorient, as the framing of the images and the verticality of the cloud forms make it unclear which way is up and which is down (Krauss, 1979, p.140). Stieglitz wrote of his intention in *Equivalents* in a 1923 letter to *Amateur Photographer and Photography* magazine as follows:

> Through clouds to put down my philosophy of life – to show that my photographs were not due to subject matter – clouds were there for everyone – no tax as yet on them – free.
>
> quoted in Annear, 2011, p.17

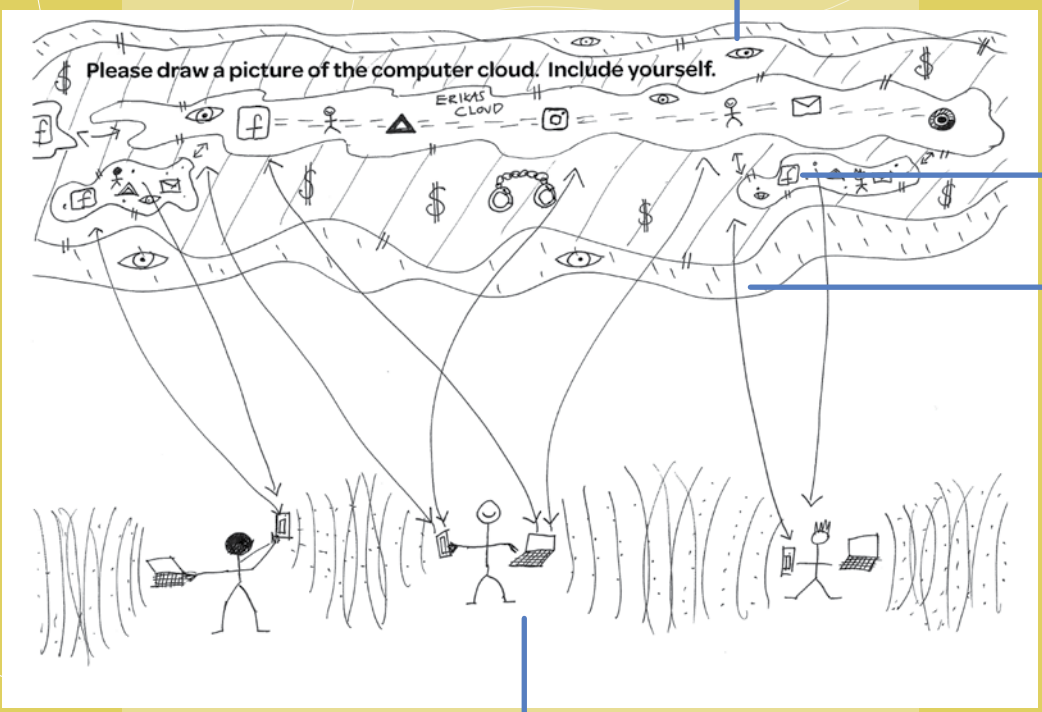
Stieglitz chooses clouds as a neutral yet poetic subject matter to demonstrate his talents as a photographer. They are an egalitarian blank canvas equally accessible to all. Yet in the context of cloud computing, from a contemporary perspective clouds are not equally there for everyone, as the visibility of data in the cloud is distributed through vertical hierarchy to unknown third parties, obscured to users, and used for machine learning. Like Stieglitz' *Equivalents*, the user experience of cloud computing is defined by a particular framing of the subject of clouds by cloud computing industry advertising narratives. However, unlike Stieglitz' free clouds, users pay for the storage of their personal data in the cloud with privacy and data surveillance. Access to so-called 'free' data storage enacts a capitalist exchange that the user is often unaware of or chooses to dismiss (Zuboff, 2019, p.172; Chun, 2016, p.16).

6.4 Online surveillance

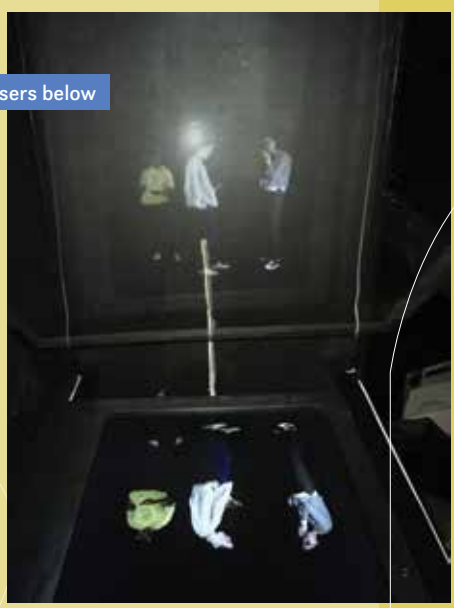
The second core element of the Surveillance artefact is the looped video of an eye positioned in the internal ceiling of the cabinet. This eye represents surveillance because it observes the people engaging on social media below. A common model among scholars for contemporary surveillance is Bentham's late eighteenth century design for a panopticon, in which a central tower provides a powerful vantage point from which to watch inhabitants within the surrounding space. Bentham's panopticon model was written about by philosopher Michel Foucault in 1975 as a societal model for disciplinary power (Foucault, 1995). In post-9/11 society, fears of terrorism have risen and surveillance has become normalised, for example in the increase of CCTV cameras and heightened airport security. Over the past 20 years visual surveillance has moved to the online space. Changes within search engine Google's business model around

Overleaf – Figure 21: Translation of participant drawing by [A] into the Surveillance artefact

all-seeing eye in the sky



users below



social media apps

clouds / smoke machine

2002 led to the online surveillance that is currently experienced by users. This surveillance capitalism is epitomised in Google's 1998 mission: 'to organize the world's information, making it universally accessible and useful' (Google, n.d.; Mosco, 2016; Zuboff, 2019). As outlined by Zuboff, Google originally collected people's behavioural data in data caches online to improve the user's online experience. In 2000, the realization was made that 'data exhaust' in the form of the users' number and pattern of search terms – including how a query is phrased, spelling, punctuation, dwell time, click patterns and location – could be monetised (Zuboff, 2019). By 2002, Google's Adwords department changed from linking users' search query keywords into delivering targeted ads to influence individual behaviour. Through Google's AdWords the highest bidding advertiser gets the top spot in Google search results. The returns from this make Google AdWords a highly profitable part of Google. Despite European policy regarding user privacy in the form of the General Data Protection Regulation (GDPR), Google parent company Alphabet posted a 73% rise in net income in the first three months of 2018, to US$31.1bn (BBC News, 2018). This use of behavioural surplus allows advertisers to distribute online ads that fit users' personal interests, greatly improving the profitability of Google advertising (Zuboff, 2019, p.74). The process of utilising user search data for targeted advertising has been adapted by other major private Internet companies, including Facebook and Amazon. The resulting behavioural data is stored through cloud computing, analysed through big data analytics, and ultimately used to inform and predict behaviour (Mosco, 2014, p.181; Zuboff, 2019, p.199).

People are subject to surveillance both offline and online. Users experience surveillance in their daily lives through computer-mediated economic transactions, data from institutional systems, data collected through the Internet of Things (IoT) sensors, corporate and government tracking of individuals, closed circuit television (CCTV) recordings, smartphone tracking, and social media sharing by individuals. Through the participatory sharing of Web 2.0, masses of user generated content are uploaded and shared on social media sites, wikis, and blogs. This includes Facebook posts and likes, Google searches, Gmail emails, movements in location tracking, purchases and page views. Phase 2 participants had ambiguous perceptions of data surveillance. One participant described the data surveillance as '*the phone company that gains more from harvesting your data, it's like a shiny fishing hook*' [N], while another participant was oblivious to it '*The info is only active when it is connected by a device, as soon as it isn't connected it disappears*' [Q]. However, users are not only subject to surveillance, they also participate in surveillance of others through social media. '*I find myself being a creep … looking but not posting, you're spying a bit*' [A]. On a larger scale the adoption of surveillance of others aligns with Paglen's *The Other Night Sky*, in which he captured images of momentarily uncloaked satellites (Paglen, 2009). However, as set out by Hu, this approach does not resolve the act of surveillance, because Paglen's participation in the same system as the NSA shows complicity. Watching the watcher 'puts us in tacit support for the state that surveys us' (Hu, 2015, p.127). The participatory sharing of data creates a space that is both private and public.

Chun states that the Internet is a semi-private, semi-public space that turns every spectator into a spectacle (Chun, 2006, p.28). All Internet users are watched and watch, as they follow and observe one another in social media apps (Chun, 2016, p.108). While this is accurate in the case of social media, a crucial difference in the broader data surveillance of private citizens is that when users observe others the resulting data is generally not stored or used for profit. In contrast to this, data gathered through search engines or location tracking by companies such as Google is done covertly, albeit via consent through obscure, seemingly endless terms and conditions. In addition, the nature of the data collected is unknown to the private user. From the

perspective of the user as the subject of surveillance, the online panopticon effectively creates a central tower that is invisible, so that the subject is unaware of when, how and who is watching them.

Comparisons to panopticon vision are prevalent in descriptions of visibility online. Online data surveillance inspired Mark Poster's term superpanopticon, a panopticon without a physical structure, towers or guards (Poster, 1991, p.93). Zuboff refutes comparisons to Bentham's panopticon however, on the grounds that the intrusion of 'Big Other' through data surveillance is inescapable because users are constantly observable (Zuboff, 2015). I argue that a crucial difference in the concept of the panopticon as compared to the data surveillance system through cloud computing is that data surveillance is non-visual and therefore not relatable for users, in the way that a panopticon tower is. Not only is the physicality of the panopticon absent, but the nature of watching through physical means is transformed into watching through gathering data. As a result of constant observation, although the convenience of mobile computing can reassure and inform, the absence of relatable physical forms of watching causes confusion of users and can instil paranoia.

Paranoia and privacy

Uncertainty about being watched was reported in some Phase 1 drawings and Follow-up interviews. Unlike the physical space of the panopticon, Zuboff affirms that when in the online world there is no space to be where the other is not, and many users are not aware of where the other is (Zuboff, 2015, p.82). This is reflected in the narrative by [I] expressing concerns about privacy (Figure 22). The drawing of this participant shows a social media sharing situation in which cloud servers with faces represent surveillance by others, both good and bad:

> *'Shadowy figures are inspecting and analysing that with their own agendas. These can even be benign or beneficial, but they may not be. It's the lack of knowing what's happening with our information and the lack of control over what's happening with it'* [I].

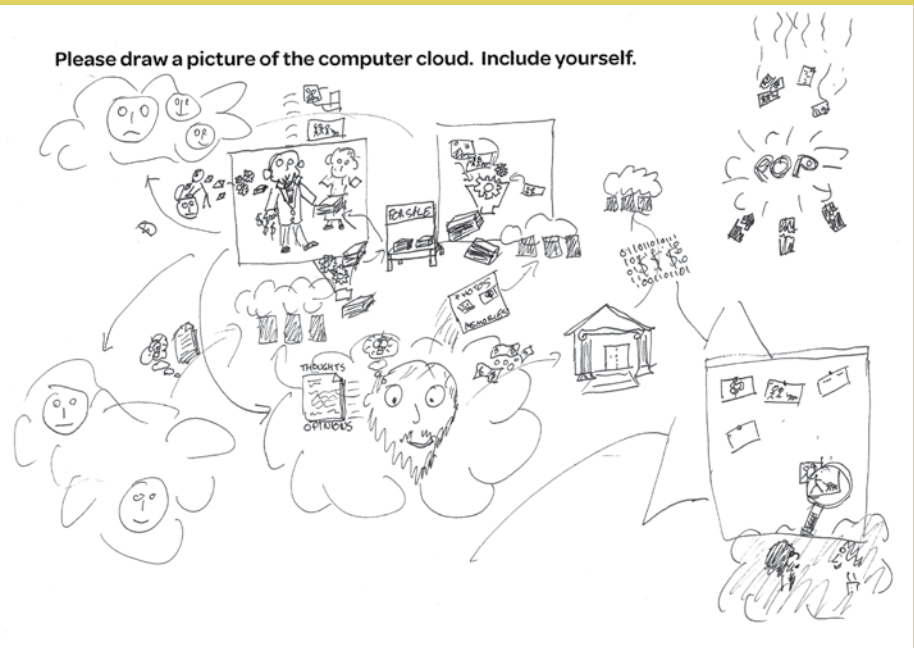


Figure 22: Cloud drawing by participant [I]

Confusion about privacy and the nature of surveillance were a concern for [A] also, who commented that the spatial separation between parts of the cloud was unclear: '*It's like all this information is super porous and the boundaries are really weird*' [A]. Anxieties about the safety of data storage is explored in Pink et al's study into the habits people engage in order to ensure their data is safe. Participants of Pink's study all acknowledged that their data could be lost, stolen or deleted. To remedy this they routinely duplicated data to different locations. With consideration of this, Pink et al suggest a rethink of data as moving, dynamic, and changing things, rather than static, fixed objects such as conventional physical archives (Pink, Lanzeni, & Horst, 2018, p.10). This mutability of data mirrors that of the cloud:

> I'd have to be really quick
> to describe clouds -
> a split second's enough
> for them to start being something else.
> ...
>
> *Clouds* by Wislawa Szymborska, n.d.

Kenneth J Gergen states that paranoia among many other characterisations, has come into common use only in the past century, impacted by a broadening vocabulary of people to make sense of the self (Gergen, 1991, p.13). Participant [A] relayed a story about a friend who believes that '*his phone is picking up on his conversations, whether it's paranoia or not*' [A]. The friend felt this was happening through voice activation, or listening through the microphone. Responses such as these reflect the perception that surveillance takes place through conventional human means of eavesdropping on phone calls rather than prediction through data surveillance online. Other participants described suspicious responses to surveillance online as paranoid. In Phase 2 interviews one participant reacted to the subject of surveillance in comments that '*I don't need to go on a desert island and get paranoid – there's nothing to hide really*' [AD]. The clinical condition named Paranoid Personality Disorder is defined as a pattern of distrust and suspiciousness, such that others' motives are interpreted as malevolent (American Psychiatric Association, 2000, p.690). Participant responses about paranoia resemble Marcus' anthropological description of paranoia as a lack of facts, combined with a leap of imagination, culminating in a conspiracy theory (Marcus, 1999, p.1). The current deployment of cloud computing discloses minimal facts, and therefore requires leaps of imagination in order to understand it, resulting in a paranoia of mistrust for many users.

Chun investigates the problem of paranoia online, arguing that paranoid views of big brother are agoraphobic, because the web is wrongly perceived as a safe space (Chun, 2006, p.249). Chun argues that the Internet was never really safe as it was sold through a general (anti-racist) racist paranoia in advertising campaigns showing people of colour (Chun, 2006, p.250). Through these images the ability to interact anonymously online was presented as agency-enabling. The safety of the web is also disputed because it was advertised through portraying a jealous desire to not miss out on what others are getting (Chun, 2006, p.132). Like any advertised product, the Internet was presented in distorted narratives, designed to manipulate and entice. Paranoid attitudes that specifically relate to cloud computing concern the safety of cloud technology and privacy protection. As argued by Zuboff, users have a right to sanctuary (Zuboff, 2019, p.474). Trust online can be challenging due to a number of factors. Namely, the ability to hide one's identity, the lack of cues, and the 'inscrutability of contexts' where traditional norms for social and professional roles online are unformulated in the switch to the online environment, causing both confusion, and freedom of expression (Nissenbaum, 2001, p.648). Social theorist Luhmann defines

Figure 23: *Microsoft Cloud Capabilities.* Text retrieved from: https://agiline.com/ms-cloud/

the mechanism of trust as necessary in contemporary life as it reduces complexity and allows people to cope with a limited number of scenarios, giving people confidence for new, limited, possibilities of action (Luhmann, 1979, p.69). I maintain that paranoia is a natural outcome of the black-boxed system of the cloud because so many aspects are unknown. Most participants did not have definitive answers to a number of questions that arose in this research. These included: where is my data?; who has access to it?; what happens to my data in the cloud?; will I get it back? While it may be realistic to accept that the cloud is never entirely safe from other individuals, confusing interfaces exacerbate users' fears of surveillance. The paranoia that sold the Internet was at least visible, whereas the machinations of the cloud are concealed. Hidden aspects of cloud computing are also the subject of the Microsoft ad pictured here that was part of the Stimulus Images component of Phase 1 (Figure 23).

6.5 Shadow cloud

Figure 23 is an image from Microsoft's Cloud Services online advertising, promoting Microsoft's big data services for business clients. I chose this image because it shows an aspect of cloud computing that users are not exposed to – Microsoft industry advertising that is aimed at cloud computing business customers. This business side of cloud computing is representative of what Zuboff calls the 'shadow text' that is separate and hidden from the users' experience. Broadly comparable to the psychological shadow, the shadow text is unseen as it exists beyond the boundary of the user's interface. As such, the tone of the advertisement contrasts with the 'first text' in the form of user-facing interface that users are normally exposed to (Zuboff, 2019, p.483). The advertisement refers to the gathering of user data to inform marketing practices, a relevant aspect of cloud computing that affects Microsoft users. Retrieved online in 2017, this image and the accompanying phrase 'The Microsoft Cloud is a secure solution that can listen, learn, and predict; turning data into actionable insight that enhances business opportunities' was sourced from Microsoft's 2017 Annual Investor Report (*Empower your business*, n.d.). Though the image is no longer live on the Microsoft website, the text tagline is still used to advertise Microsoft cloud solutions (*Microsoft Cloud Capabilities*, n.d.).

Before discussing users' responses to this image, it is pertinent to note that only three drawings in the initial Cloud Drawing part of Phase 1 depicted acts of

surveillance. Four of the Phase 1 participants had general issues about lack of control, two were specifically concerned about privacy, one mentioned manipulation of perception and two spoke of cyber security. This may be a direct response to the lack of visual representations of data surveillance as a process that occurs through digital means, or a low awareness of cloud computing practices. As reasoned by van den Boomen, the computing processes beyond the interface are invisible to users because they perceive only their role as users of the interface (van den Boomen, 2014, p.80). This occurs when users receive free data storage in the '*nice, fluffy cloud*' [H] of cloud computing. In the Phase 1 initial interviews several participants dismissed data surveillance as unimportant and inevitable. However, when shown the image of the Microsoft Intelligence advertisement in the Stimulus Images component of Phase 1, participants clearly expressed concerns about surveillance.

In a reaction to the Microsoft promise to listen, participants commented that the ad as irrelevant: '*You don't know my business, it has nothing to do with this*' [M]. All but two participants felt that being listened to and being watched was disempowering and unsettling. Participants reported feeling confused and worried about what was meant by this ad: '*I would feel insecure because I don't want you to listen to my data*' [L], '*Targeted advertising based on online behaviour? I find that a little bit creepy, that whole idea*' [K]. The perception that connecting to the cloud equated to a panopticon was confirmed by one participant on viewing this image:

> *'The words they use, like listen, and learn, it's like you're being watched over all of a sudden. That takes away the illusion of a cloud, a nice fluffy cloud, that you were storing this for me'* [L].

This response relates to Mark Andrejevic's proposal that interactive online spaces are dangerous digital enclosures where access to knowledge is given only to those who submit to monitoring. Andrejevic outlines the dangers of the asymmetrical system of private ownership of tech companies and the increasing misuse of personal data (Andrejevic, 2007, p.313). I contend that Microsoft's wording both simplifies and misleads. Microsoft neither listens nor learns in a human way that is identifiable for the user. The suggestion that the cloud is listening and learning is like an uncanny valley for participants, as the comparison with these human acts was experienced as unwelcome and disturbing. Phase 2 participants clearly felt there was no conscious submission: '*You didn't ever say yes. No permission is asked really*' [B]. [B]'s perspective complies with Andrejevic's argument that the contribution of personal data serves as a participatory form of labour (Andrejevic, 2007, p.314). Cloud labour is discussed further in relation to the cloud computing system in 7.3. Participant [I] interpreted the ad as disempowering: '*The control over self is lost', and the cloud was 'taking something I've given and they are opening it*'. Another participant compared the network graphic inside the cloud form to '*an organisational chart inside the cloud, all the nodes are linked together at different levels, so it's pointing out collaboration and referring to the cloud and security*' [AF]. The change in the participants' responses to questions of surveillance shows an important progression. While participants were initially unaware of the shadow text of cloud computing, the shift in responses after seeing the Microsoft ad demonstrates the substantial impact that educating users of the shadow texts can have. Sharing this glimpse of the business side of cloud computing inspired me to explore making a physical manifestation of the cloud to raise consciousness about the cloud. While shadow texts of the cloud lie in highly technological processes, the workings of the cloud are also associated with more mysterious mechanisms.

Microsoft's use of the word intelligence in their ad is deceptive, as intelligence can refer both to acumen, or in the case of espionage, to hidden data. In the case of Microsoft, intelligence can be interpreted to mean both machine learning

within Microsoft, and information of value in political or espionage contexts, as user data is turned into 'insight that enhances business opportunities' (Microsoft Cloud Capabilities, n.d.). Scott points out similarities between intelligence as information, and the occult, as the occult can mean 'that which it is hidden', as well as mystical practices (Scott, 2016, p.4). Here he likens the work of Renaissance astrologer and spy John Dee to NSA corporate documentation retrieved by Edward Snowden that refers to building cyber magicians (Scott, 2016, p.12), Arguing that the search for intelligence, information and interpretation are the cornerstones of both spy stories and occultism, Scott suggests that this search is fundamentally a search for gnosis. Associations between espionage intelligence and occult knowledge are also made by Kate Crawford as she draws connections between the Delphic Oracles and Snowden's NSA archive (Crawford, 2016). The drawing and interview by [A] that is the subject for the Surveillance artefact similarly associated the cloud with spiritual intelligence:

> *'To me this cloud is full of this weird intelligence which almost seems alien to me, it almost seems spiritual and god-like, and all-powerful and almost like Santa, because it can see when you're sleeping'* [A].

6.6 Spirituality

In the early period of the Internet, connections were also made between cyberspace and spirituality (Gibson, 1994; Wertheim, 1999; Davis, 2015). Stuart describes the cloud as spectral as he draws similarities between the immaterial, networked overlay of spirituality of the nineteenth century and the omnipresent cloud network. Charting the same path as I did in the making of the Surveillance artefact, Stuart compares the spatial dislocation of being online with the optical stage trick Pepper's Ghost (Stuart, 2018, p.153). The immateriality of magical Pepper's Ghost projections corresponds with users' experience of seamless cloud computing services. Although convenient, the poetic trickery of the cloud distracts from mechanisms that lie beneath – the infrastructure and the ecological impact of the industry (Cubitt, 2017; Stuart, 2018, p.154).

Hieronymus Bosch's *The Allegorie Hay Cart of men and women looking to make the most of the present time*, painted in 1516, was selected for possible similarities to panoptical vision and religious themes. A chaotic medieval crowd scene shows a broad cross section of society while a serene cloud above contains a Jesus figure observing the crowd. The outside panels of this triptych, located in the Prado Museum in Madrid, show the figure of a lone traveller, while the interior panels tell a story from left to right. At left Adam and Eve are driven from Eden, and Hell is depicted on the right. The centre panel, pictured in Figure 24, as was shown to participants, is devoted to a gigantic hay wagon, surrounded and followed by people who fight and grasp for the hay. Repeated elements across all three panels tell a more complete story, however as the subject of participant testing, this single image was considered independently, in the context of this research. Bosch's provocative work tells moral tales that include complex characters such as couples accompanied by spying men, angels, devils and half-animals. Although the significance of some of the details eludes interpretation (Galpern, 1988, p.151), scholars agree that the scene in *The Allegorie* shows avarice, as the characters chaotically gather around a hay wain, as symbolic of the ultimate worthlessness of material things. Temptations, destruction, violence and greed show a tumultuous path to salvation, symbolised by Jesus blessing those below from a distant cloud above. The chaos and complexity of the scenes in *The Allegorie* offered many details for participants to respond to, and the Jesus figure in the cloud drew mentions of an eye in the sky from some participants.

Figure 24: Hieronymus Van Aeken (Aken) known as Jerome Bosch (about 1490). *The Allegorie Hay Cart of men and women looking to make the most of the present time.* [Painting]. Central panel of the allegorical tryptic on the Pass. Hieronymus Bosch, Public domain, via Wikimedia Commons

As with other images, users were asked whether the image was in any way representative of their experience of cloud computing. Most responses identified the figure above as in control and all powerful, while half of the participants specifically referred to the figure in the cloud as Jesus Christ, a god figure, or an all-seeing eye of God. Participants who considered the figure above to be benign or neutral tended to be younger. Surveillance and panoptical vision were mentioned by three participants in comparisons of the chaos of the crowd to the uninformed end user. These participants saw the public below as representative of '*certain individuals who are being held down or targeted*' [M], such as celebrities whose photos were shared without permission. Others saw the people below as young people affected by bullying on social media. Another participant saw the association of godliness as misappropriation:

> '*... the energy and power that we used to give to god if we lived in those times has now been reappropriated for this intelligence cloud which is harvesting information and manipulating our lives for its own intents and purposes*' [I].

The idea of technology replacing the societal role of religion is one that is debated by Wertheim. Viewed in relation to Catholicism in Renaissance Italy, Wertheim argues that online space has taken the place of religion in society. Connection to a utopian online space functions as an alternative to the limitations of material existence (Wertheim, 1999, p.40-41). Davis writes about the mystical inspiration that drives the Western development of communications technologies and the digital revolution, comparing these to the search for gnosis (Davis, 2015, 10.1). The early mystical Christian Gnostic traditions follow a dualistic view of the universe, in which material reality is rejected in favour of spiritual connection to higher immateriality. I explore Gnosticism further in 8.2. The panoptical vision of *The Allegorie* and surveillance equates not only with seeing more than those below but control through knowledge.

Participants commented that the figure above observes everything that is happening, while the people below were referred to as 'we' – the general population under control of the higher all-seeing eye. The controlling aspect of unequal visibility mirrors the power aspects of Foucault's panopticon (Foucault, 2015). '*This thing can see the whole picture and we can only see a part our own picture or some of the community*' [A]. The power of the figure above was interpreted by half of participants who viewed this image as related to the ability to see everything, while the user is unable to see or understand: '*We can't see, we don't learn about it*' [L]. While this conclusion fits with the chaotic scene, it is a passive response. Instead users can claim some control through learning about these systems, as demonstrated by some participants who proactively run their own private server within their home or business, and those who opt out of social network apps. The people below were said by one participant to be reaching up to get closer to information. The habit of searching online is quantified in recent New Zealand research that states that half of Internet users go online to look up a definition at least once a week, while 62% go online to find a fact (WIPIR, 2019, p.37). Chun describes online searches as futile pursuits for information and connection, as users search without learning more (Chun, 2016, p.39). I discuss users' search habits further in relation to Pariser's concept of the 'filter bubble' on page 139 (Pariser, 2011). However, online searches can also be considered from the perspective of the cloud.

Rather than users expanding their knowledge, I argue that it is the hive mind of the cloud computing system that learns more through users' online interactions. Tracking users' interactions feeds into the understanding of user behaviour through data analytics that inform machine learning, and predict future behaviour through the capture of clicks, likes, dwell times and searches. As Zuboff maintains, users are the source of raw material for business customers (Zuboff, 2019, p.500). An image with a

similar hierarchical biblical theme, composition and elements drew associations with power and higher knowledge above.

This large fresco known as *The Disputation of the Holy Sacrament* from the Raphael Rooms, 1509–1510, is part of the Stanze di Raffaello Frescoes series, housed in the Apostolic Palace of the Vatican (Raphael, 1509-1510). At the time of painting the location for the painting was known as the Stanza della Segnatura. It functioned as the private papal library where the supreme papal tribunal met. I chose this image because it shows the heavens in the clouds as a seat of political power. The portrayal of political power and the serene atmosphere contrasts strongly with Bosch's moralistic Northern European art. The attitude of the people below to the cloud is reverential rather than oblivious and distracted, as it is in *The Allegorie*.

Central to the painting is Jesus Christ surrounded by a halo, with other biblical figures at his side. God sits above Jesus, reigning over the golden light of heaven, and below Christ's feet is the Holy Spirit. The altar is flanked by theologians who are debating transubstantiation, the process by which the bread and wine is transformed into the body and blood of Christ. The history of the eucharist is lengthy and not the topic of discussion here, however the subject under dispute is relevant to the immateriality of cloud computing. The long-standing argument portrayed here has been discussed since 100 AD and revolves around exactly how Christ is present within the sacrament. In *Summa Theologica*, St. Thomas Aquinas claims that Jesus is perceptible only by the intellectual eye: 'Christ's body, according to the mode of being which it has in this sacrament, is perceptible neither by the sense nor by the imagination, but only by the intellect, which is called the spiritual eye' (Of the way in which Christ is in this sacrament, n.d.). *Disputation* shows the seemingly magic process of the sacrament, in which the materiality of bread and wine is transubstantiated through an individual's spiritual eye into Christ's presence. A similar process of transformation and physical presence is represented in the industry narrative of cloud computing.

Users' physical interaction with the computer interface transports digital files to the immaterial cloud, as symbolised by the cloud desktop icon. For users the physical act ends at the interface, after which the computing process is rendered invisible (van den Boomen, 2014, p.16). In *Disputation of the Sacrament* the spiritual eye lends faith to the unseen presence of Christ, while in cloud computing users' interaction with the computer interface uploads data to the cloud, a process that equally requires a leap of faith in the black-boxed invisible storage beyond the interface. This confusion was expressed by some participants: '*Things go up into the cloud, but I don't know how to get them back*' [V]. Concurrently, the technological omnipotent eye of Surveillance looks on.

Without observation of a physical infrastructure, users make their own leaps to understand the magical connection to data through mobile connection to the cloud, anywhere, anytime. In associating Raphael's image with the process of cloud computing, participants mentioned control as cause for concern. Most participants recognised the image as similar to the narrative of cloud computing represented in their drawing. Many identified the figure above as the one in control:

> *'There's this intelligence up there that radiates down and there's us down here that worship this thing because of its power, so this definitely resonates. These beams, these things we don't understand and it's powerful, it's up, up there in the clouds'* [A].

The cloud is described as having the power, being unseen and vague. Similarities to social networking were made: '*People below waiting for the approval and reflection from the figure above*' [N]. Participants not only noted a power imbalance in this image, they also remarked on religious aspects.

Figure 25: Raphael (Raffaello Sanzio of Urbino) (1509-10) *The Disputation of the Holy Sacrament,* from the Stanza della Segnatura, [fresco], Vatican Museums and Galleries, Vatican City. Raphael, Public domain, via Wikimedia Commons

Religion and clouds

A number of associations occur between communications media, skies and religion. In both Judaeo-Christian and classical traditions skies are linked to gods and the heavens, while connection through early communications media has been linked to spiritual presence, and mobile communications technologies also refer to the sky in the use of the term cloud computing. Clouds, like spirits, are mysterious and insubstantial, and fluctuate in form. Mythologist Marina Warner writes of the mystery of clouds:

> Clouds and cloudiness offer a magical passkey to the labyrinth of unknowable mysteries, outer and inner; they convey the condition of ineffability that the unknown and the divine inhabit.
>
> Warner, 2006, p.83

Although science and technology are supposedly suffused with the sterile air of the empirical and methodical, there are a number of specific contexts for imaginative spiritual associations in technology. In the late nineteenth century a link occurred between new technologies and psychological or ghostly presence in the rise of spiritualism. This happened with the discovery of electricity, and the invention of the telephone (Sconce, 2000, p.30-31). At this time the adoption of technological terms such as 'channelling' and 'flow' described both electricity and spiritualist practices. Edison's work on the invention of the telephone was driven by an ambition to develop a device to contact the dead, as he believed that 'our personality exists after what we call life leaves our present material bodies' (Sconce, 2000, p.81). Though these examples of spirituality and technology combined may seem representative of the cultural milieu of the period, spiritual presence continues to appear in twentieth century Internet technology. During the early development of the Internet at PARC (Palo Alto Research Center Incorporated, formerly Xerox PARC) in 1973, the term 'ether' was used by academic Robert Metcalfe in the naming of the ethernet Internet cable (Oppitz & Tomsu, 2018, p.101). In a memo at the time he described the technology of the ethernet as an 'omnipresent, completely-passive medium for the propagation of electromagnetic waves' (2018). This religious reference to describe the transfer of electromagnetic signals recalls the ancient speculative element of ether, a substance thought to hover in the regions beyond the clouds that surrounds the gods in heaven. The Internet, ether and space exploration have a common association to the heavens. The invisible, hidden nature of the air and the heavens sparks the imagination, creating an air of mystery that lends itself to metaphor and hyperbole (Warner, 1999, p.72). The religious sublime reoccurs in advertising for anytime, anywhere cloud computing (Figure 29). I suggest that borrowing from cultural and religious connotations of clouds inspires a similar passive faith in cloud computing. The association of cloud computing to religion was evident in Phase 1 questions about the cloud as a person. Four participants referred to the cloud as a god-like figure, perpetuating a perspective of cloud computing as magical-seeming, sublime technology. Spiritual associations with clouds are discussed in section 8.2 in relation to the creation story of Gnostic belief. Several felt the religious themed Stimulus Images accurately represented aspects of cloud computing. While religious themes were noted by viewers when they described the eye in the Surveillance artefact, the eye was also interpreted as representing interest groups or corporations. At the same time, the people below were seen as isolated and sad.

6.7 User habits

In participants' reading of the Surveillance installation many identified connection as a theme. The projected people were perceived as immersed in social media on their phones, and oblivious to the eye above. While some participants identified with the users on their smartphones in the video projection, older participants tended not to identify with the depiction of constant connection. Almost all participants expressed a negative emotional reaction to the Surveillance artefact, including sadness, fear for the young people in the piece, isolation and paranoia. The eye above was perceived as ominous, dangerous, controlling and disturbing, because participants perceived that connecting online should be a private act.

Users' online experiences often cause confusion about public and private. Interactions that appear to be private can be vulnerable to being shared beyond the intentions of the user. For example, in the use of an eBook reading device such as the Kindle, user habits are recorded and shared, turning the previously private act of reading into a public one. User data is returned to users in the form of recommendations, which users experience as either helpful or intrusive. Chun states that privacy is no longer possible through social media because individuals are constantly captured, tracked and compared to people who 'like us' and those who are like 'us' (Chun, 2016, p.15). Participants were unclear on what happens to their data in the cloud. Some Phase 2 participants expressed a concern that '*stuff is up there forever*' [A], while others thought that '*...as soon as it isn't connected it disappears*' [Q]. Chun affirms that concerns about the use of user data online are excessive as much data that is collected is discarded or lost (Chun, 2006, p.6). I contend that it is not only long-term storage or archiving of data that is concerning, but the lack of explicit consent from users in the use of their behavioural data for big data analytics, to inform machine learning in the service of advertising.

Participants felt disempowered when viewing the Surveillance artefact, yet they were ambivalent in their response regarding data surveillance. Despite misgivings and varying levels of awareness of surveillance, almost all participants reported an increase in their use of cloud computing over the preceding years. This reflects users' contradictory behaviour when faced with privacy issues, as I discussed in 2.5 and 2.6. Nearly all participants felt that the scenario presented in Surveillance was the most accurate depiction of cloud computing of the three cabinets. Participants viewed the narrative as creepy, sad, and ominous, yet they also clearly stated that their behaviour would not change after seeing the cabinet. How might users better engage with the cloud?

6.8 Summary

Chun argues that the leaking of private data is essential to today's Internet and that online communications should be accepted as fundamentally non-personal (Chun, 2016, p.13). Divergent from this is Zuboff's narrative of users as victims of data surveillance. Zuboff suggests the solution lies in a legislative revision of the system (Zuboff, 2019, p.521). Chun's hopeful, but increasingly challenging suggestion is that individuals have possibilities to engage differently with data surveillance, and that we need not accept the terms offered to us by social media giants (Chun, 2006, p.76). An example of engaging differently was evidenced in two participants practice of managing their own private servers. However, these participants stated that dedication and many hours of maintenance are required to avoid commercial cloud storage.

The lack of empowerment felt by participants in viewing the Surveillance cabinet calls to mind Tom Waits' song *What's he building in there?* (Waits, 1999). This

song from Waits' 1999 *Mule Variations* album is written from the perspective of an archetypal nosy person, watching their neighbour and wondering what the neighbour is building. The assumption of the narrator is that the mysterious neighbour has no right to privacy. Without knowing the facts, the worst is assumed, rather than minding their own business.

> What the hell is he building
> In there?
> He has subscriptions to those
> Magazines He never
> waves when he goes by
> He's hiding something from
> the rest of us He's all
> to himself I think I know
> why...
> What's he building in there?
> What's he building in there?
>
> We have a right to know
>
> *What's he building in there?* (Waits, 1999)
> Retrieved from *Waits* (2009)

Similar to the intrusive narrator of Waits' song, cloud computing companies unethically claim a right to know, in the default tracking of users and the harvesting of behavioural surplus. On the other side of the fence is the user, in the form of the unwitting neighbour.

At the start of Phase 1, in response to surveillance questions, participants dismissed privacy issues as unimportant. Comments were passive and defeatist: '*data surveillance is inevitable anyway, and I am not important*' [K]. They were not important because they were one of billions, or because they were not famous, or because they would never post nude photos, or because '*they probably know everything already anyway*' [K], or because they were indistinguishable from the rest. This illustrates a lack of awareness about how data is used, and a tendency to minimize and trivialise users' lack of agency. On viewing some of the Stimulus Images, particularly Microsoft's ads, some aversion to surveillance was indicated. After viewing the artefacts in Phase 2 and talking further, participants expressed distinct concerns about data surveillance. This testifies to the value of presenting users with physical representations of invisible technologies like cloud computing, both to raise awareness and elicit rich responses to technologies.

The question of what is happening in the black box of cloud computing is an important one. What if we change the roles in the act of surveillance? If we see the intrusive narrator as representing the user, and the mysterious neighbour as representing the cloud computing industry operating secretly, we might question what the cloud has to hide. Although the cloud/neighbour exists on a private property separate to ours, these are virtual data storage services to which users have entrusted their personal data. Because these services store personal data on behalf of users, I argue that users do have a right to know what happens in the black-boxed cloud. The next step in my investigation into users' experience of cloud computing is a view of the cloud as a system in the Factory artefact.

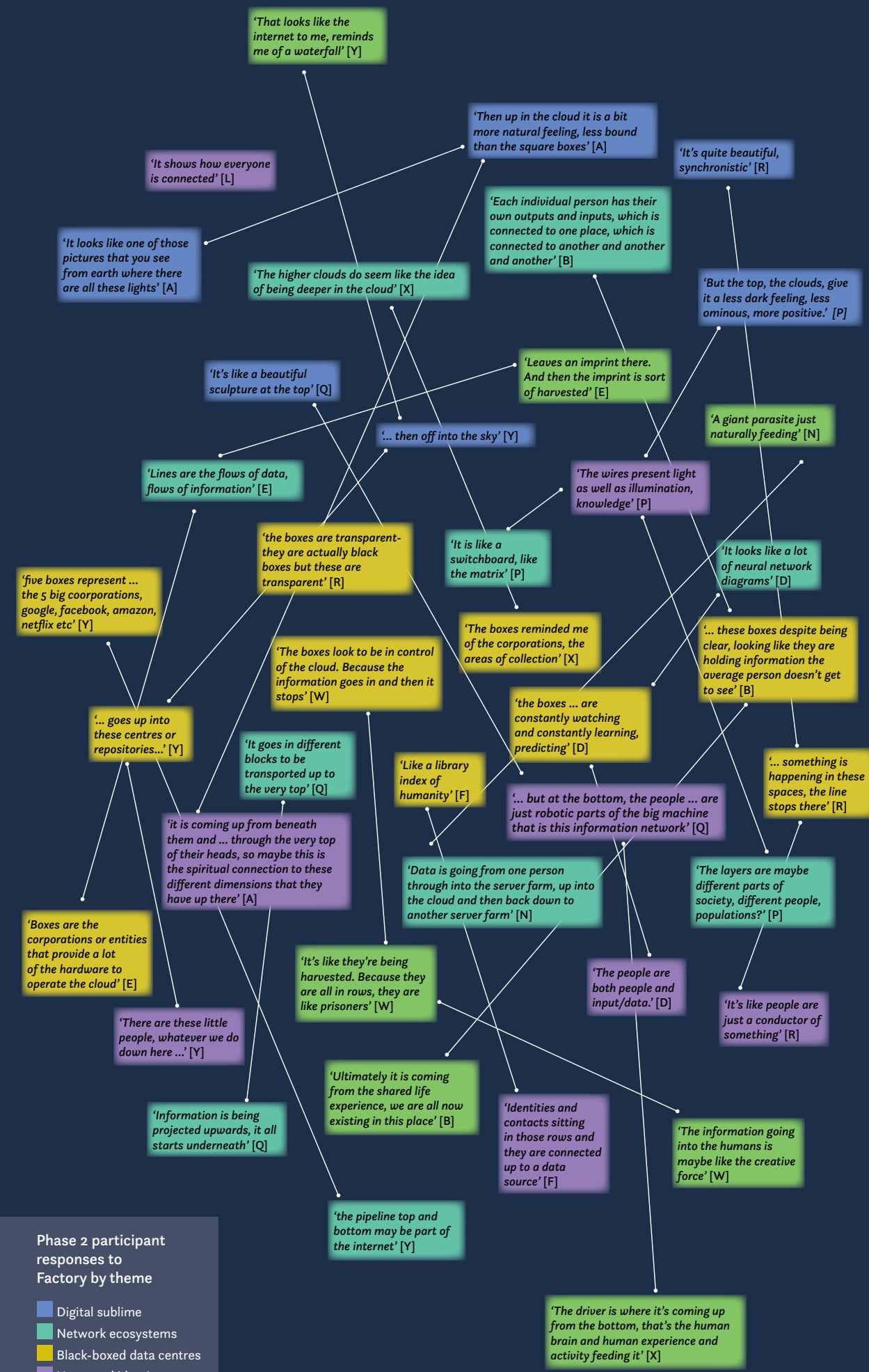
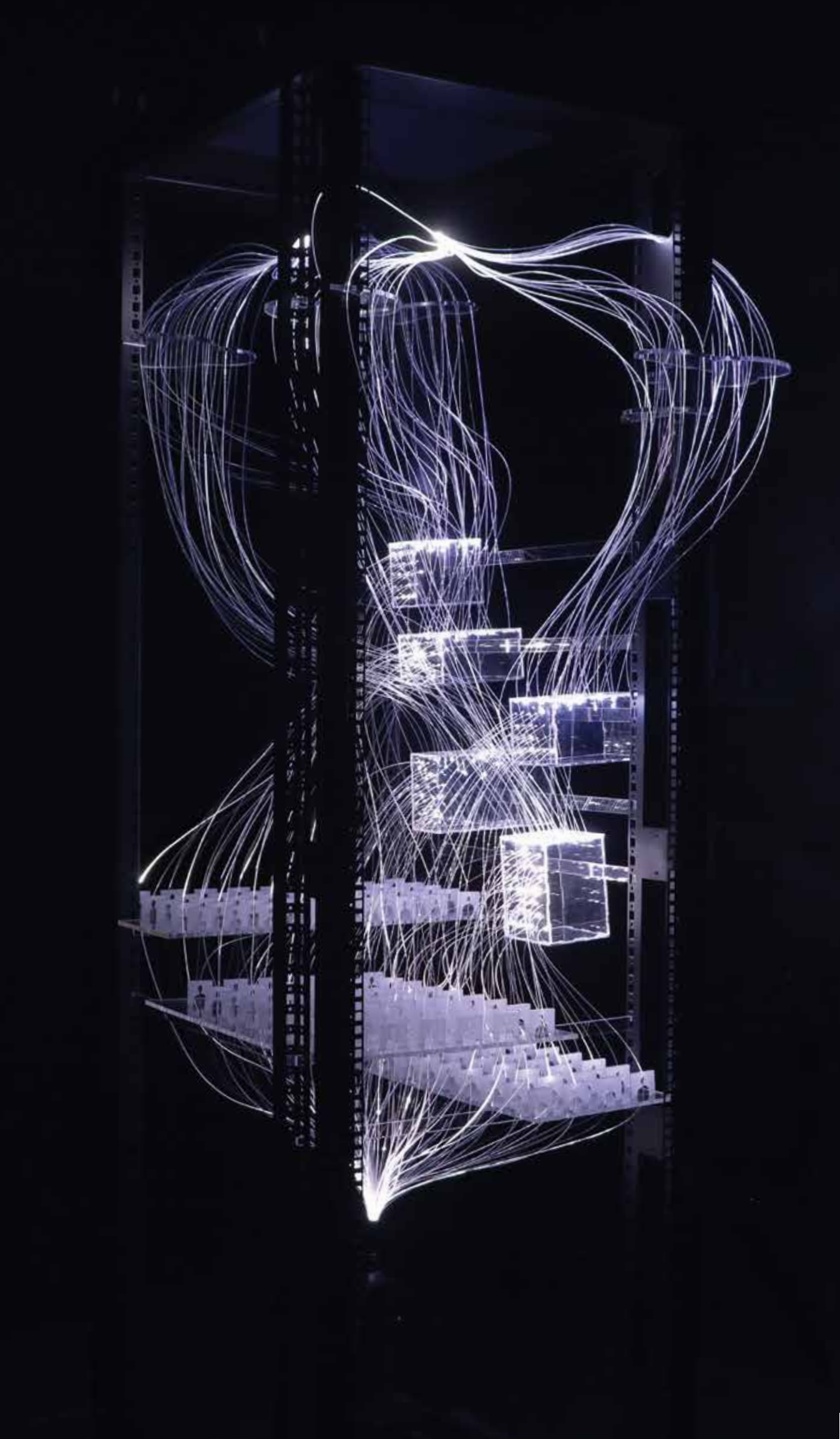


Figure 26: Participant responses to Factory artefact

7 Factory



7 Factory

Pictured at Figure 27 is the artefact made in response to research participants' narratives about cloud computing as a functioning network industry. The Factory artefact depicts the cloud computing system as a whole – cloud computing data, the underlying infrastructure, the narrative that is conveyed to the public, the role of users, and the role of the cloud metaphor.

Housed in a server cabinet, fibre optic strands lead from the bottom of the structure through tiered platforms of figurines representing Internet users, into five boxes attached to the side of the cabinet. Strands of fibre optics that symbolise shared data connect to light sources at the top and base of the cabinet. From the boxes, strands lead up to the light source at the top. The fibre optics terminate at the sides of the server boxes in dense points of light, suggesting black-boxed servers.

Choices in the critical making process express various aspects of the Factory themes. The artefact is built within a steel server cabinet, marginally taller and more compact than the Surveillance and Noosphere artefacts. Issues of transparency and black-boxing are alluded to in the material choice of laser cut transparent acrylic, fibre optic strands, and light emitting diodes (LEDs). Different aspects of the Factory narrative are emphasised in the open-sided construction that allows a view of the artefact from each of the four sides, as described in section 7.3. The perspective on the Factory artefact is analytical and system-based, embodying a wider, more impersonal view of cloud computing than the Surveillance artefact. Contents of the artefact are distributed over the height of the cabinet, underscoring a vertical movement. My critical making process involved experimenting and questioning the nature of user perspectives, particularly that of participant [B]'s drawing as inspiration for the artefact (Figure 28). The drawing described cloud computing as a societal architecture, showing the movement of data and the integration of people into the system. In response to this systemic aspect I named this artefact the Factory. Gilles Deleuze states that the enclosure of the factory is no longer relevant in Western societies as production is relegated to developing countries (Deleuze, 1992, p.6). However, in a specific reference to data centres, Cook characterises these power hungry buildings as the factories of the digital age (Cook, 2017, p.17). I concur with Cook, and through naming the artefact Factory I focus on the cloud as a digital factory. I question the production system of the cloud: the nature of the physical cloud computing infrastructure, the line of knowledge production, and the place of the user in that system.

Phase 1 participant narratives and interviews about cloud computing as a system were the starting point for the themes addressed in the Factory. An analysis of Phase 1 participant feedback resulted in the critical making brief identifying the following themes for discussion in this chapter. Each of these themes will be explored in turn:

- **Digital sublime** The cloud evokes an image of a sublime spiritual thing in the sky. Advertising for Microsoft's data centre reinforces an imaginary resembling Nye's technological sublime. Participants expressed both powerlessness and

Figure 27: Factory artefact

awe in response to the sublime cloud.

- **Network ecosystems** Participants experienced the cyclical form of the Factory as a living ecosystem. The relevance of geography is explored including the relevance of New Zealand's locality.
- **Black-boxed data centres** Latour's concept of black-boxing applies to the hidden elements beyond the interface. Within the Factory artefact transparent boxes stand in for the black-boxed elements of cloud computing. As the hidden component of cloud computing participants demonstrated little awareness of data centres. After seeing images of Facebook's Luleå data centre servers, participants presented a changed perspective of the cloud as a material infrastructure.
- **Users and identity** The seamless Web 2.0 cloud is a vehicle for sharing online. Users perceive the use of the cloud as inevitable. This impacts on participants' willingness to discount their importance and autonomy within the hierarchy of the Factory system.
- **Cloud nature** Nature themes prevail in cloud computing imaginaries. Industry advertises through green images of data centres, creating an image of the cloud as safe containment that feeds information from users to data centres.

I now discuss participant responses to the above cloud computing themes in both Phase 1 of the research, and in response to the Factory artefact. I start by discussing the top of the artefact, moving vertically down through the various elements as they relate to the aforementioned themes.

7.1 Drawing and Factory artefact

Several Phase 1 drawings illustrated wide views of cloud computing in which the participants themselves were drawn as a singular figure connecting to the cloud. Just six people drew more people and/or scenes that represented a wider ecosystem. The drawing by [B] was the most distinctively system-based narrative (Figure 28). With many users seated in regimented rows of desks with an overarching cloud above, the drawing is clearly focused on the holistic view rather than the individual experience. Geographically neutral, I called this productive, industrial space the Factory. As in the previous chapter, power relationships are apparent, though they differ from the panopticon visibility of a central sovereign power in the Surveillance artefact.

In the drawing that inspired Factory, power relationships were described by [B] in the context of user agreements with various cloud computing companies. The author of this drawing described the upload of files to the cloud, stating that they could not see anyone else's files, but the cloud computing company could see everyone's files. '*The perspective indicates hundreds and thousands of people using the same service … We all put everything into the cloud*' [B]. This resembles the decentralised power of Deleuze's control society, in which people are held in a power relationship through monitoring by computers, in this case through Internet behaviours (Deleuze, 1992, p.6). Within cloud computing, monitoring occurs through tracking of purchases, web search histories, location tracking, and participation online in the use of apps that contribute background input to the development of those apps. These Internet behaviours culminate in a cloud computing economy that most users passively accept. Compliance with the cloud was evident in responses from Phase 1 research participants who stated that targeted advertising on social media was an acceptable payoff in exchange for the use of apps and services. Replies to a Phase 1 question

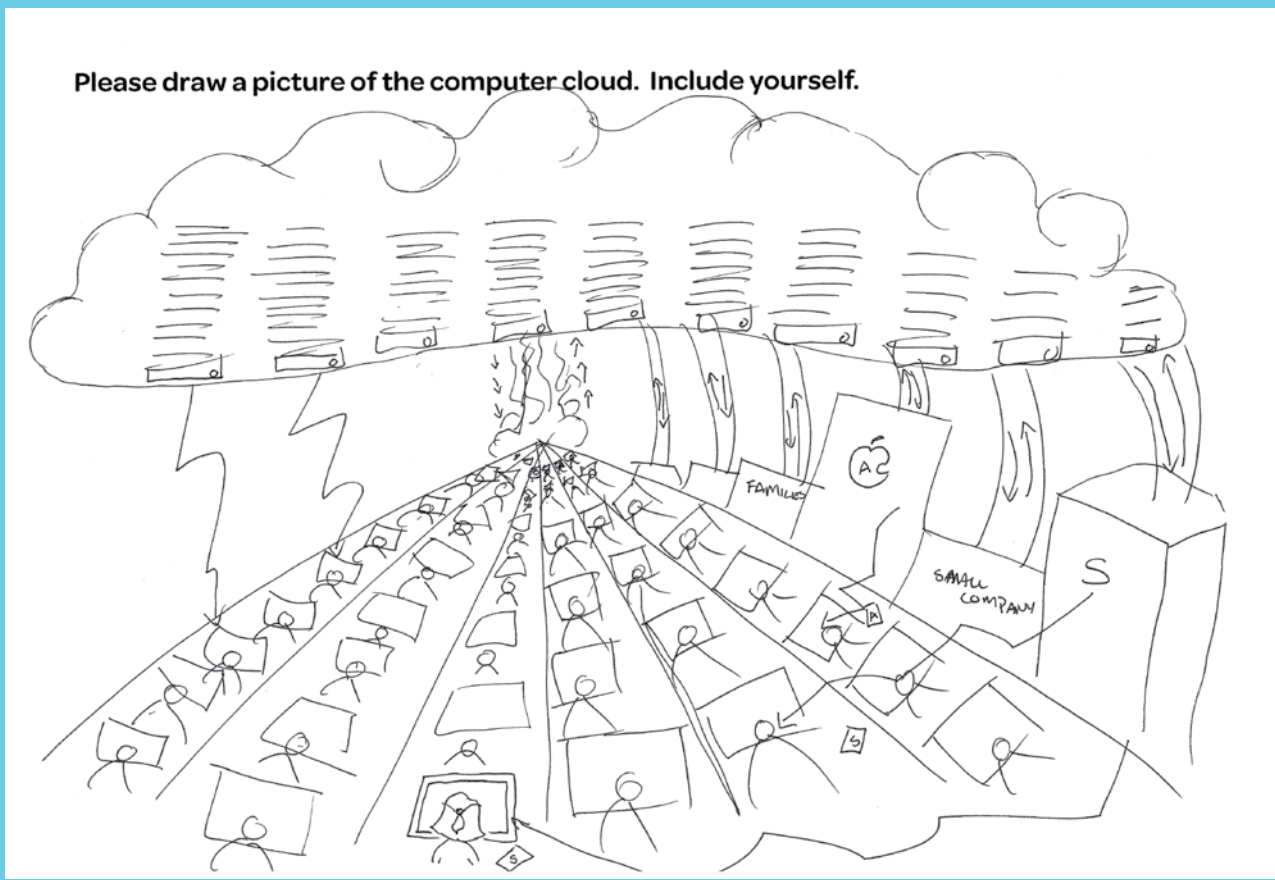


Figure 28: Participant drawing by [B], the inspiration for the making of the Factory artefact

about problems with cloud computing showed both awareness and complacency, and a sense that the system was just too big and unsurmountable to change:

> *'It's not really a concern that my browsing history comes back into ads. I can understand how other people would see it as a problem. For me it is what it is'.* [B]

Looking beyond the perspective of [B], and the physical networks on which the control society is built, Hu reasons that the cloud 'grafts control onto an older structure of sovereign power similar to infrastructure built onto older networks' (p XVI, Hu, 2015). Hu labels this the sovereignty of data as users are sold on the idea of the cloud as the safe way to manage data, and an important place to connect socially (Hu, 2015, p.XVII). With no physical models and little publicly distributed information about the scale of cloud computing, I was inspired to develop Factory as a holistic representation of the materiality of the cloud, including a portrayal of the user. The resulting artefact provides the means to investigate participant reactions and observe how this physical representation affects users' perceptions of cloud computing systems.

7.2 Digital sublime

For participants the cloud represented an awesome thing in the sky above. In Phase 1 many participants showed contradictions in their understanding, as despite a logical understanding of the cloud as a data server on the ground, meteorological clouds in the sky dominated the Cloud Drawings. In interviews most research participants identified data warehouses or servers as the main physical component of cloud computing, while the accompanying Cloud Drawings pictured cloud computing in the sky and people below on the ground. In discussions about their drawings, participants noted:

> *'I am below and the cloud is above my head because that's what clouds make me think of I suppose'* [H]

> *'I definitely see it as something up here, and [so] it has a spiritual element to it, and it shouldn't. It has an all seeing-ness to it'* [A].

The placement of the cloud instils a sense of reverence. The inherent sense of wonder for clouds is something that René Descartes set out to demystify as part of his philosophy of nature in *Discourse on Method* (1637). Descartes declared 'we naturally have an admiration for the things which are above us than for those which are at the same height or below' (quoted in Gilson, 2019, p.229). I discuss this sense of wonder in terms of the sublime within the chapter Aesthetics, in section 5.5. In Lakoff & Johnson's conceptual theory of metaphor, orientational analyses of metaphor similarly state that things above us have relational power over those that are below (Lakoff & Johnson, 2003, p.195-196). Accordingly, one might logically assume that Cloud Drawings which depict the cloud as a cloud in the sky might indicate a reverence or lack of knowledge of the physical infrastructure and processes of cloud computing. Yet those with a high level of knowledge had a similar tendency to draw clouds above them. The cloud metaphor appears to broadly embody people's imaginaries of cloud

Figure 29: *Microsoft Azure Datacenter* [video still] moon. Licensed by Creative Commons Attribution-Noncommercial-No Derivative Works 4.0 International License. Used with permission from Microsoft. https://channel9.msdn.com/Blogs/Azure/Azure-Datacenter-Video

computing regardless of their level of knowledge. This confirms that metaphors shape how we perceive technologies. How might users think differently about the cloud if shown the complex physical infrastructure of the industry?

To challenge the perception of the cloud as sublime, I showed Phase 1 participants an advertising clip for Microsoft's cloud computing services (Figure 29). Microsoft's data centre clip resonates with Nye's concept of the technological sublime (Nye, 1994). What Kant calls the mathematical sublime, related to the infinite and immense, is also enacted in Microsoft's clip (Smith, 2015). The power of Microsoft's technology is conveyed through pulsating percussion sequences building expectation and forward momentum, and a crescendo build up with choir climaxing into an emotionally charged sense of grandeur and elation. The use of aspirational metaphor: 'connected with enough fibre to stretch to the moon and back' (*Azure Data Centre*, n.d.), alongside sweeping panoramic and aerial images further add to an image of a secure, immense and powerful technological corporation. Nye suggests that the man-made technological sublime, like the sublime in nature, similarly generates a collective feeling of omnipotence of the object, and a fear of individual powerlessness and insignificance (Nye, 1994, p.xvi). The same sense of powerlessness and fear were conspicuous in participant responses to the Microsoft infrastructure video:

'I feel insignificant, I'm just a small part of this huge thing' [E]

'Overbearing, daunting, foreboding' [O]

'More complex than I imagined it' [M].

Most of the participant group responded with a sense of awe to these advertising clips. The cloud is described as having the power, being unseen, and vague, '*... things we don't understand ... up there in the clouds*' [E]. The sublime grandeur of this clip and reactions from participants later determined my intention to create a physical installation that would elicit similar awe.

The completed Factory offered a poetic perspective on the cloud. In Phase 2 participants described the top part of the sculpture as benign and positive. Several people were attracted to the cloud forms at the top of the artefact over elements below where the user figurines were:

'Beautiful sculpture at the top, but at the bottom, the people are not individuals, they are just robotic parts' [Q]

'The top clouds give it a less dark feeling, more positive' [P].

Participants preferred not to focus on the users and the closed bundled strands at the base of the artefact, but expressed awe at the sublime lights and clouds above. The ephemerality of poetic clouds contributed to participants' sense of the sublime when viewing Factory. Similarly, the poetic cloud metaphor influences how people experience cloud technology – the graceful, beautiful elements attract, while dark, robotic elements tend to be dismissed. A significant characteristic of meteorological clouds that is highlighted in the cloud metaphor is the uncontrollable, unpredictable nature. The ephemerality of passing clouds contributes to the concept of meteorological clouds as poetic, and therefore unpredictable, yet data clouds are built on the concept of predictability.

Predictive clouds

Clouds as predictors of weather are a phenomenon that natural philosophers long sought to understand. Forecasting the weather was valuable for agriculture, as it was in the sixteenth century for insurance companies ascertaining the success of

expeditions, and for military purposes (Halpern, 2015, p.5). Like many things in nature, clouds were investigated during the Enlightenment, when nature was 'laid out on the operating table and the dissecting block and parcelled up into the specimen case' (Warner, 1999, p.91). Empirical thinking at this time was a way to free understanding from belief and religion. While inventions that enhanced the senses, such as the microscope, photography, phonography and ultrasound provided objective measurement of hidden and invisible forces in the world, clouds were difficult to measure through scientific instrumentation because they were ungraspable and distant. It was at this time, in 1802, that Howard developed his taxonomy of clouds in an attempt to understand and ultimately predict the weather (Howard, 1865, p.1; Hamblyn, 2001, p.350). Prediction is an equally important driver for the current cloud computing industry.

Prediction plays out in the hidden tracking and data analysis of users' interactions online, including searches, dwell times and social media posts. Most participants demonstrated little awareness of data surveillance and subsequent personalised advertising and search feeds. In contrast to most, one participant with academic knowledge of machine learning observed: '*The only reason it is being taken is to train machines to predict your next purchase, that kind of thing*' [D]. The more common response from participants was that the cloud was inevitable and not within participants' control, as this participant noted while comparing the cloud to nature: '*It's inevitable nature that I need to use it, so I've kind of given up who I am, to feed the machine*' [D]. Connotations to nature such as 'feeding' occurred more often and are examined further in section 7.6. Through metaphor, cloud computing has also inherited cloud-like qualities of intangibility.

Invisible mutability

Participant comments reflected a vague lack of grounded location and mutability in their perception of the movement of their digital data:

> *'Because I see my digital data as intangible I don't feel the need to know exactly where it is and the cloud helps that, it makes me feel that I understand it better, because I don't have to worry that somewhere in Finland there's a strange little person going through my files'* [B].

A perception of clouds as both meteorological and imaginative is conspicuous in responses to Howard's studies of clouds. Warner writes that the distant, vaporous nature of clouds engendered research into clouds by subjective, imaginative means, as well as by scientific means (Warner, 1999, p.118). Romantic period artists who responded to Howard's studies of clouds included writer, statesman and scientist Johann Wolfgang von Goethe, who praised Howard in a series of poems in dedication to 'That which no hand can reach, no hand can clasp' (Hamblyn, 2001, p.296). On a parallel, English Romantic poet Shelley writes of the mystery of the perpetual cloud cycle in *The Cloud*, in which a cloud transforms into rain, passes through the pores of the ocean, and evaporates into the sky:

> ...
> I silently laugh at my own cenotaph
> And out of the caverns of rain,
> Like a child from a room, like a ghost from a tomb,
> I arise, and unbuild it again.
>
> *The Cloud*, Shelley (1820)
> Shelley (1907, p.18)

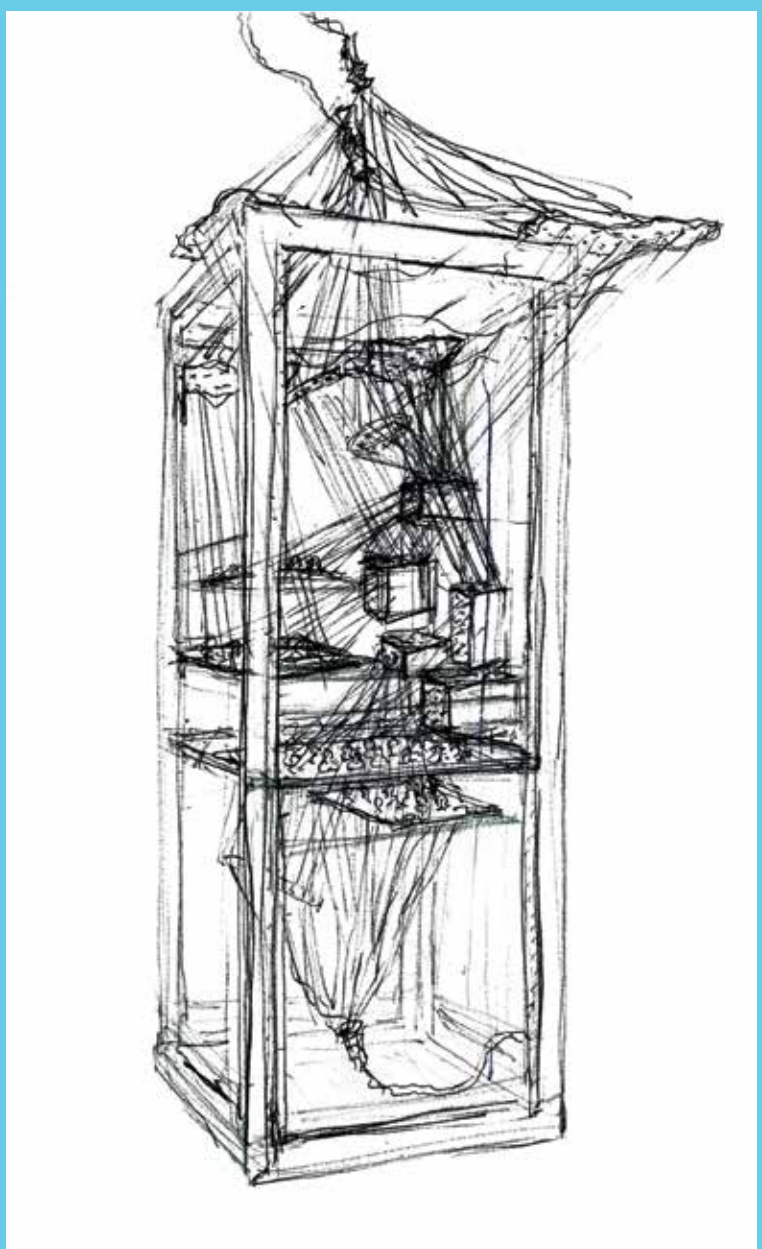


Figure 30: Final sketch for Factory

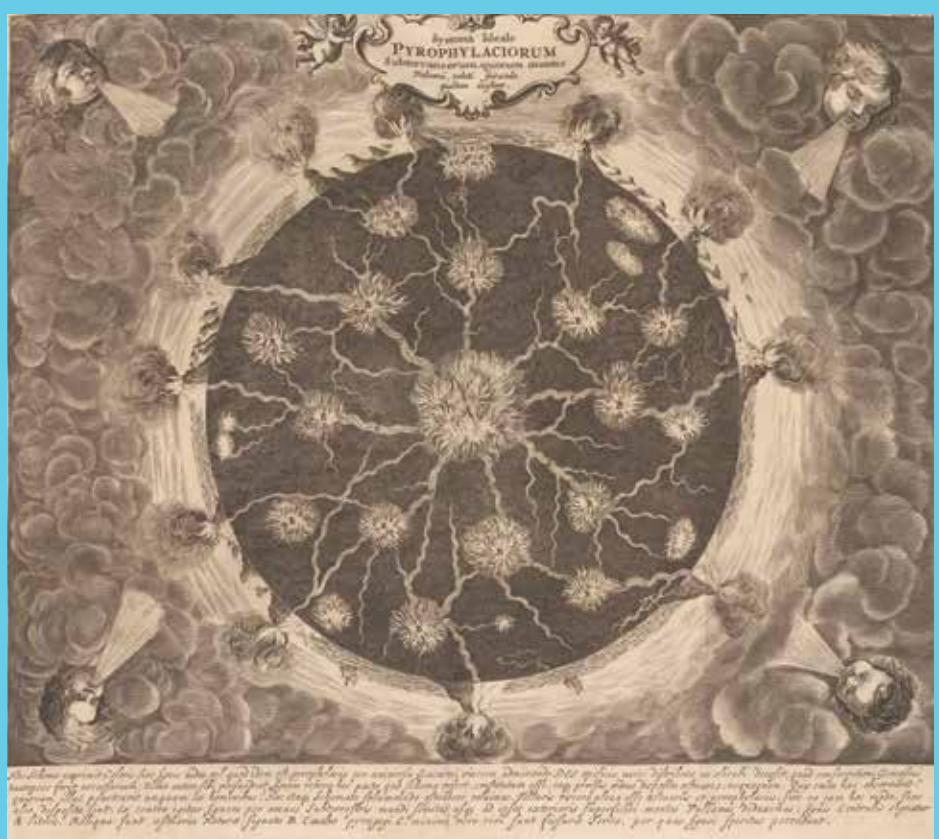


Figure 31: *Mundus Subterraneus de Athanasius Kircher* - Geology - Structure, Form and Origin of the Earth / Bridgeman Image

These existing cultural narratives of fluid, mutable clouds occur also in cloud computing in its representation as a scalable service that responsively changes as users' needs change. This fluidity contributes to an impression of invisible data in an invisible cloud, and a seamless cloud computing service. In response to the Factory one participant adopted poetic, fluid terms:

> *'Some things are 'more cloud' to me. For example, the Strata app, that records my progress on my bike feels more cloud to me. Dropbox feels more cloud just up here. Strava feels like its weaving into my life deeper, its further away from me. Less in control? I turn Strava on as I hit the record button and I release data. I want to tether how much I release but I can't. ... the less control fits with the ethereal, the possible uses for it get wider, more people plugging into it and using it. I see it as higher and more cloud like. More deity. More removed from our existence.'* [X].

Because more information was recorded by Strava than by Dropbox, [X] felt more controlled and more intruded upon. The more distant and ethereal Strava cloud was felt to be '*weaving into my life deeper*' [X]. This participant's sense of frustration was caused by their Strava data being more comprehensive, more personal and shared more widely, and therefore less within their control. Physical closeness is replaced by a magic-seeming spiritualised closeness of deity. Contrasting inferences due to the distant nature of cloud computing arose also in Phase 1 where some participants felt it safer that cloud computing data was distant from them,

> *'I feel things that are away from me are safer, if it's away from me it's not going to get hurt or damaged. It's like disassociating from it, I would want it further away in the U.S., ... I want to push it away, my data'* [L].

This dissociation from a younger participant with a low understanding of cloud computing showed a tendency to avoid thinking about complexities of cloud computing and what happens to their data. This participant conveniently reasoned that as invisible things appear not to exist and are distant, they are out of their control, and therefore safe. This was reflected in many participant narratives, as it was for [B]'s, who provided the main inspiration for the Factory artefact: not wanting to know about the cloud as they did not want to worry about someone going through their files. One Phase 2 participant described this confusing disassociation as '*awaying the problem*' [X]. However, this perspective does not align with the reality of data surveillance through machine learning. At the other end of the scale, a high level of knowledge was evident in a response from a participant [R], who is an IT professional, who commented while viewing the Factory that:

> *'the part that does not work well are invisible parts, how things work, the things we don't know, the invisible. We should know the invisible, the data should be ours and we should know what happens to it'* [R].

One of the aspects of the cloud that is generally invisible to users is the physical location.

7.3 Network ecosystem

Disorientation regarding the location of the cloud and the cloud metaphor arose in the critical making of the Factory artefact inspired by the drawing by [B], (Figure 28). During the making process it became clear to me that the cloud is represented twice – once in the data container boxes that are representative of cloud computing storage,

and once in the cloud form at the top of the drawing representing the metaphorical cloud. In the drawing by [B] the cloud form contained computer drives, though these were within a metaphorical cloud. I decided to recreate this contradiction in my artefact, to challenge the viewer about the cloud's location – was the cloud in the sky or in the server boxes? The construction and placement of these forms was challenging and required experimentation and iteration. Expansion beyond the cabinet structure hints at a lifelike form, entangled in the rigid technological structure, and referencing the possibility of autonomous machine learning or science-fiction scenarios. This organic, irregular form corresponds to Taylor's intriguing framing of the depopulated data centre as a technological wilderness, as I discuss further in 7.4 (Taylor, 2019). The viewing angle onto the cloud forms was awkward as it was just above eye height for most, so the cloud forms are a subtle element, which seemed apt for the representation of seamless cloud technology.

Van den Boomen contends that it is inappropriate to apply the conceptual theory of metaphor to cloud computing because it simplifies through downplaying aspects of the source, and additionally some aspects are de-presented entirely in user interfaces and metaphors (van den Boomen, 2014, p.99). Much action is made invisible, and much of the material network connection is allocated to the black-boxed infrastructure of cloud computing.

Cloud as ecosystem

Phase 1 drawings and interviews showed that most participants perceived the cloud as a cyclical system. The drawing by [B] that was the inspiration for the Factory artefact illustrates a complex cyclical network that is not identifiable as a physical location. To prompt participants to consider the cloud as an ecosystem, I introduced a historical image of the earth as ecosystem (Figure 31). In *Mundus Subterraneus de Athanasius Kircher*, German Jesuit scholar and polymath Athanasius Kircher depicts an ecosystem with fires inside the earth emerging through volcanoes. Smoke releasing into the atmosphere culminates in clouds. Kircher conceptualised this image of subterranean fires after a visit to southern Italy in 1638, in which he was lowered into the crater of Vesuvius to examine its interior. His investigations culminated in the scientific textbook *Mundus Subterraneus* in 1664, in which he hypothesised that water moving within the earth in a subterranean ocean caused the tides. Responses to *Mundus Subterraneus* were imaginative and diverse. Some saw the image as apocalyptic. Others referred to connectivity, electricity, communication and lines of energy. One participant interpreted the image as a web of fire in which people are:

> *'in little boats tossed by the ocean. We're sailing on it and there's the impression of the massive power in the world that we have no control over'* [I].

Another, who themselves drew their cloud as an ecosystem, interpreted Kircher's image as inverted. [N] perceived the image as people outside blowing clean data into the cloud, '*the data moves around inside the cloud and comes out as other stuff*' [N]. I wondered how a physical representation of the cycle of cloud computing might encourage speculation about environmental effects of the cloud. One Phase 1 participant did correlate Kircher's image with environmental impact: '*in some ways this cloud goes hand in glove with the consumer culture, so it produces more waste …*' [E]. While a generic world is the subject for Kircher's image, specific geographical locations were highlighted in other images.

Local clouds

The location of the cloud and the exact location of cloud user data is characteristically nebulous. Cloud computing companies and not to readily disclose data centre

Figure 32: Correlation of radio astronomy data in real time. Retrieved from: https://catalystcloud.nz/customers/case-studies/aut/

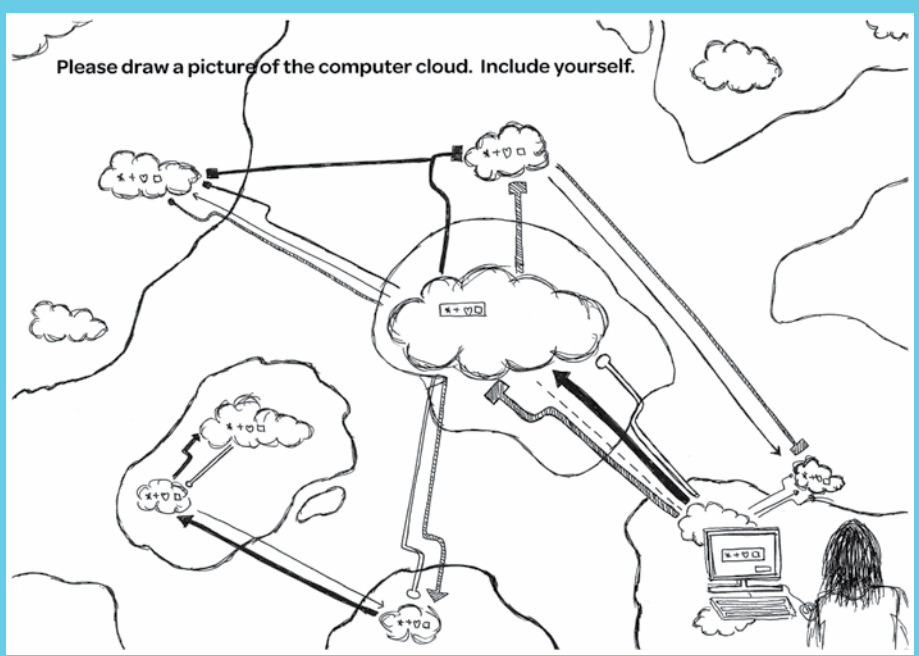


Figure 33: Cloud drawing by participant [L]

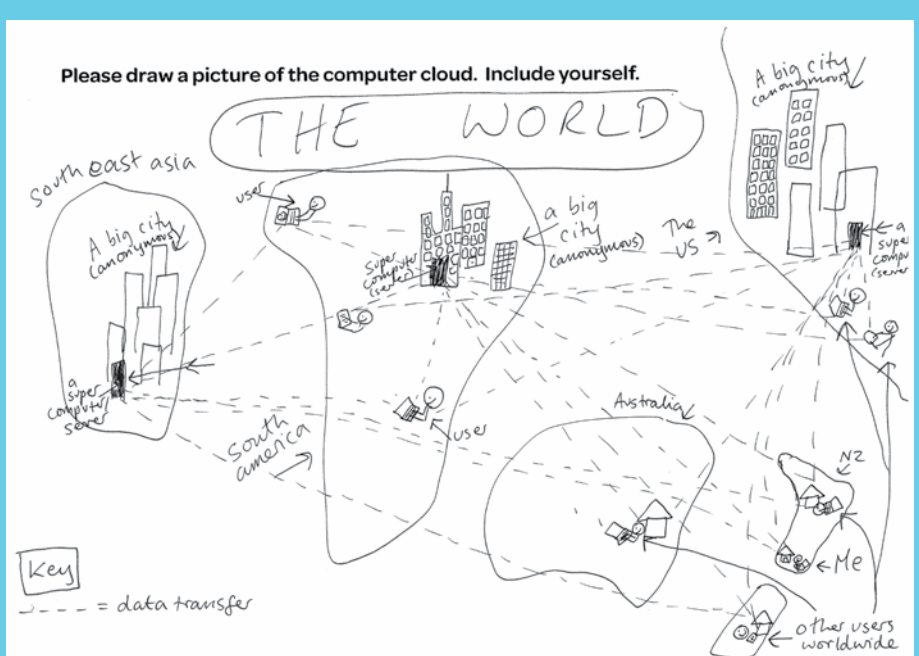
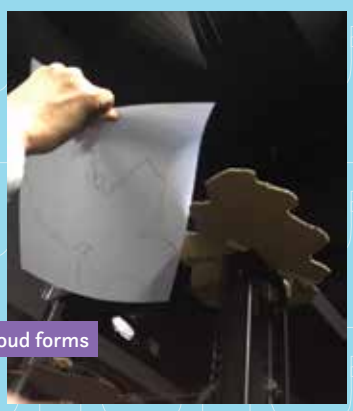
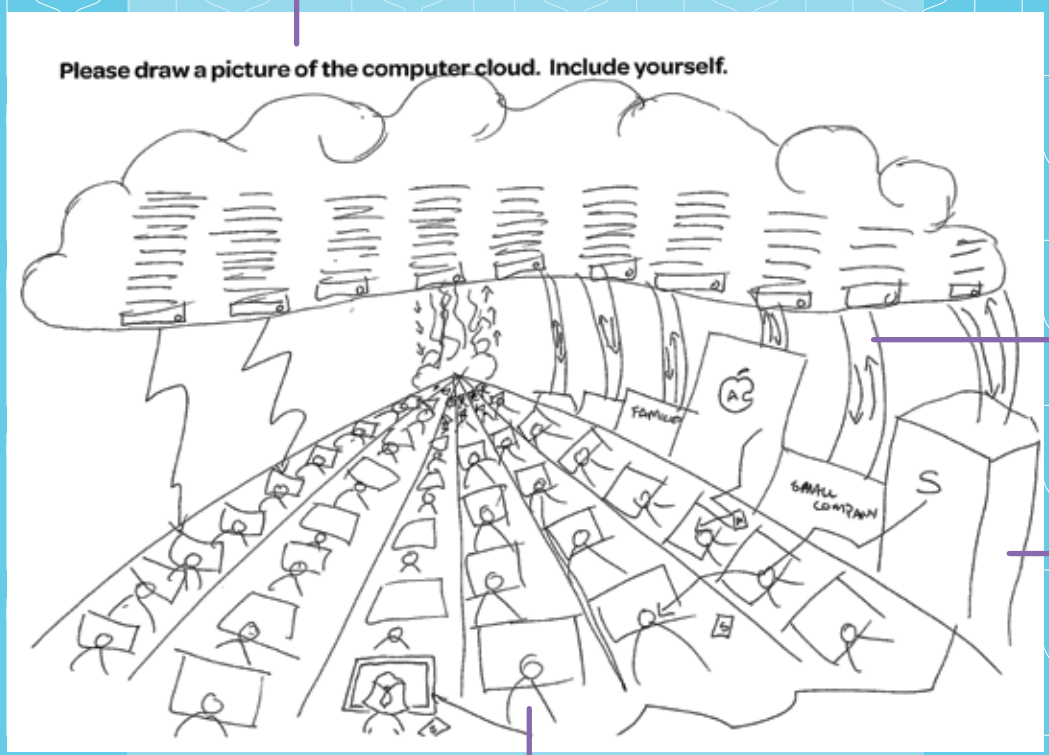


Figure 34: Cloud drawing by participant [K]

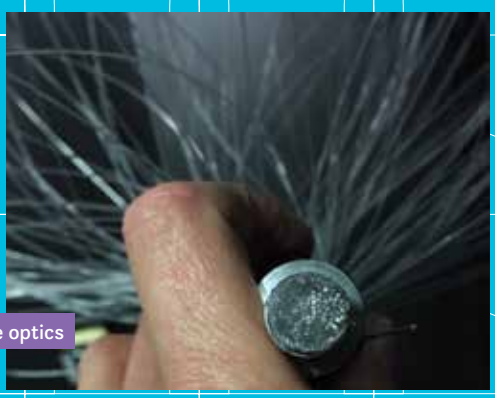
Overleaf – Figure 35: Translation of participant drawing by [B] into the Factory artefact



development of cloud forms

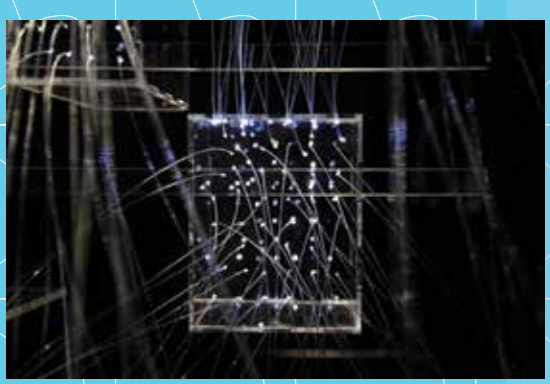


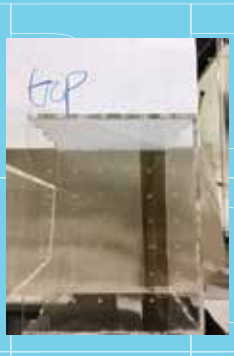
user figurines



fibre optics

server boxes





locations to the public, nor are individual users privy to information about where their digital data is stored. Many Phase 1 participants reported that they did not need to know the location of their data. Because high-speed Internet networks swiftly transport data packets over long distances, the location of data centres has minimal impact on everyday use. One participant said they preferred cloud storage because it felt safer to have their data stored elsewhere than on their own local hard drive, as cloud storage is less susceptible to local natural disasters such as earthquakes. Rather than files stored on a personal hard drive '*I want to push it away, my data*' [AC]. However, the need to push data away and not wanting to know more suggests an evasion of responsibility. While the cloud may seem safer than storage on a personal hard drive for some, research shows that users don't generally have confidence in cloud security and privacy.

Overall, concerns about security and privacy are on the increase. Recent New Zealand based research showed that content, cyberbullying and security of data were a concern for over two-thirds of respondents (*New Zealand's Internet insights 2019*, n.d.). New Zealand research from 2018 regarding Internet use in general showed that 47% of respondents had concerns about security and their identity online, and would be more likely to use the Internet more if security was better (Díaz Andrade, Hedges, Karimikia & Techatassanasoontorn, 2018, p.22). Earlier research from 2016 listed privacy (44%) and security (29%) as reasons for not using the cloud (Crothers, Smith, Urale & Bell, 2016, p.5).

Particular to this project is New Zealand's relatively isolated location. New Zealand's main Internet cable connects through the Southern Cross cable network which runs between the west coast of the U.S. to Sydney, Australia, to Raglan in the North Island. Minimal presence of cloud computing data centres and infrastructure in New Zealand may be a contributor to participants' image of cloud computing as always somewhere else, and not in New Zealand. Images showing location highlighted how users and industry communicate about conventional concepts of geography and place in relation to cloud computing.

An image that exposed attitudes about place was a promotional ad originating from New Zealand cloud computing company Catalyst Cloud, unique as New Zealand's only cloud computing provider in 2017 (*Correlation of radio astronomy data in real time*, n.d.). None of the participants knew of Catalyst Cloud and all were surprised to hear of the existence of a local cloud computing company. The image of green hills and sheep was immediately identified as a location in New Zealand, however most felt this local image was incongruous and confusing. Several participants felt that there was no need for a local company because cloud services are available anywhere, anytime, and connectivity is unaffected by proximity. This suggests the transcendence of geography, as demonstrated in participant comments:

> *'Wherever we are, our server cloud connection is not necessarily related to our geographic position. The connection between servers and users is random, could be any country'* [K].

The lack of identification of cloud storage with a specific country is evidence of the increased importance of 'space of flows' over 'space of place' (Castells, 2000, p.407). As argued by Hu, without a visible physical centre the cloud's power is decentralised within networks, which aligns with Amoore's assertion that in order to identify the cloud, we have to look outside of the data centre to 'the spatialities of perception itself' (Hu, 2016, p.XII; Amoore, 2018, p.16). While private individuals are unlikely to use a cloud provider such as Catalyst Cloud, participant responses establish the prevalent perception of cloud as elsewhere.

Phase 1 Cloud Drawings depicted various countries as testimony of the irrele-

vance of geography – just as cloud is a description of a neutral other place, geographical territories were drawn as examples of a meaningless other. Several participants thought of the cloud as being in various unidentified countries as indicated by the drawing by [L], shown in Figure 33. Others mentioned the U.S. and China as possible places for data storage, though cloud computing industry is in reality located in other locations also, such as the Arctic circle, and remote locations, as I discuss further in section 7.4. Figure 34 illustrates networks that connect land masses, with densely populated centres such as Sydney and New York drawn with more connections to remote locations. The U.S. emphasis aligns with Flichy's argument that the imaginary of the Internet is essentially North-American, as illustrated by the themes of the frontier, the community, and individual initiative (Flichy, 2007, p.210). Correspondingly, major cloud computing companies are predominantly U.S. companies, a fact which coloured participants' perspective of the cloud as U.S.-centric.

The tension between national territories and laws, and the placeless location of the Internet harks back to territorial issues in the placement of submarine cable networks that connected Commonwealth territories in the Pacific to colonial Britain (Starosielski, 2015, p.95). This tension is present in recent legal proceedings within Europe in the EU General Data Protection Regulation (GDPR). The 2018 GDPR data protection legislation was designed to hold Facebook accountable for data privacy laws within Europe, upholding the data sovereignty of the laws of the nation within which data is collected. In answer to these issues Bratton declares that an entirely new and complex political landscape and sovereignty is evolving through planetary computation that transcends the data sovereignty as reinforced in the GDPR (Bratton, 2016). Reflecting on geopolitical boundaries in relation to New Zealand as the location for this study, the particularity of New Zealand is of limited relevance. New Zealand's location is primarily representative of a small, isolated nation with minimal publicly visible cloud computing infrastructure. This would suggest a lower awareness of cloud infrastructure for this study than a location with a high density of data centres, such as Virginia, U.S. Participants demonstrated an indifference and low awareness of cloud computing's precise location. Several participants perceived that the cloud was likely to be in the U.S., Europe or China, and most stated it was somewhere other than New Zealand. Cloud computing was envisioned as transcending geopolitical boundaries. The neutrality of New Zealand's location in relation to the cloud informed my decision to build a geographically neutral environment, featuring generic elements that are juxtaposed to suggest power relationships.

Network construction

In the critical making process for the Factory artefact I looked to David Altmejd's use of threads that formed angular, poetic, ray-like bands of colour in combination with acrylic forms. In initial sketches I drew cables with a similar flexibility (Figure 30), and tested laser cut acrylic boxes which I threaded with fibre optic strands. This created a more machine-made aesthetic than Altmejd's artistic process in which he organically grows his systemic artworks, often cutting individual pieces of acrylic by hand, and without a thought-out plan for the end result. Because I had a specific structure in mind, I used pre-drilled angular, laser cut forms. Compared to Altmejd's coloured, flexible threads my comparatively stiff fibre optic strands created curved lines when draped, emulating a flowing network that participant [S] later compared to a waterfall. Initially I threaded the fibre optics through the transparent boxes, causing the form of the boxes to visually recede because the lit fibre optics dominated over the unlit sides of the boxes. To remedy this I terminated the strands within the holes of the boxes by melting the ends, creating densely concentrated dots of light. This produced a glow on the planes of each of the boxes, emphasizing the volume of the cube forms

of what appear to be black boxes, although the boxes are transparent. This proved to be a useful trigger for participants to reflect on the function of the boxes and parts of the cloud computing system. Other components that make up the cloud computing infrastructure are conventionally black-boxed.

During Phase 1 interviews, participants named the physical parts of the cloud as underground cables, servers with wires in big computer rooms, cooling systems, things with little wires, the devices, the servers, signals. Others considered satellites, some thought of satellites on the moon, vague 'spaces out there', and data that travels through the air. These suggestions may be in part due to clouds being in the sky as the reason for the naming of cloud computing. Finn lists as the hidden labour of the cloud of online retailer Amazon's warehouses in the practice of shipping goods for frictionless e-commerce (Finn, 2017, p.131). The cloud also encompasses remote workers that perform the 'human intelligence tasks' (HITs) to earn a few cents for a few seconds work for Amazon's Mechanical Turk and Captcha (Finn, 2017, p.135; Hu, 2016, p.146). Although production processes are reminiscent of factories, the wider cloud computing infrastructure is unlike a conventional industrial warehouse or factory. The cloud infrastructure includes not only remote workers, but fibre optic cable networks, cell towers, routers, and arguably also users, as I discuss in the Noosphere chapter (see 8.4). This aspect illustrates the difficulty of defining the mutable cloud of cloud computing, which is everywhere and nowhere, and extends beyond the data centre (Carruth, 2014, p.340). A broader approach is conceptualised by Amoore in her vision of the cloud as a 'geography of cloud analytic', which includes that which is not visible to the human eye by optical means, but the data gathered, the algorithms, and the resulting data analysis. Amoore compares cloud computing with scientific cloud chambers for the reason that they reveal that which would not be visible otherwise. For cloud computing this takes the form of data analyses made possible through algorithms (Amoore, 2014, p.12). To address these themes of visibility in Factory, as with Surveillance, I reflected on Eliasson's *The weather project* (2003), and the exposure of construction elements (section 5.7).

In my critical making process I left the LED light sources at the top and bottom visible, thereby inviting interpretation from the viewer on the fibre optics feeding light through the artefact. My aim was to challenge viewers through using irregular sized elements and an asymmetric placement of the boxes, and an exposed construction that I hoped might call to mind machine learning, data harvesting and organic growth or dystopic narratives. Rather than creating a perfect closed system with strands that threaded through the grid of equidistant holes of the boxes, I left some holes without fibre optics. These gaps referenced the open, scalable nature of a constantly changing cloud computing system. An incidental feature that I noticed upon completion was the difference from the front perspective that emphasised the users in rows in a way comparable to the drawing by [B] (Figure 36), while the sideview instead illuminated the data centre boxes on the side wall (Figure 37). This split between the two views reflects the cognitive disconnect between users' online behaviour where the origin and nature of the cloud is avoided, and an industry view of the 'shadow text' of the black-boxed collection and storage of data in the cloud that is hidden from the user.

7.4 Black-boxed data centres

The term black box describes technology that is made invisible through showing only the input and output and hiding the functionality inside. Awareness of black-boxing was evident in participant responses in both phases 1 and 2. Van den Boomen identifies boxes with stability and integrity, and describes the cloud as 'a magic container,

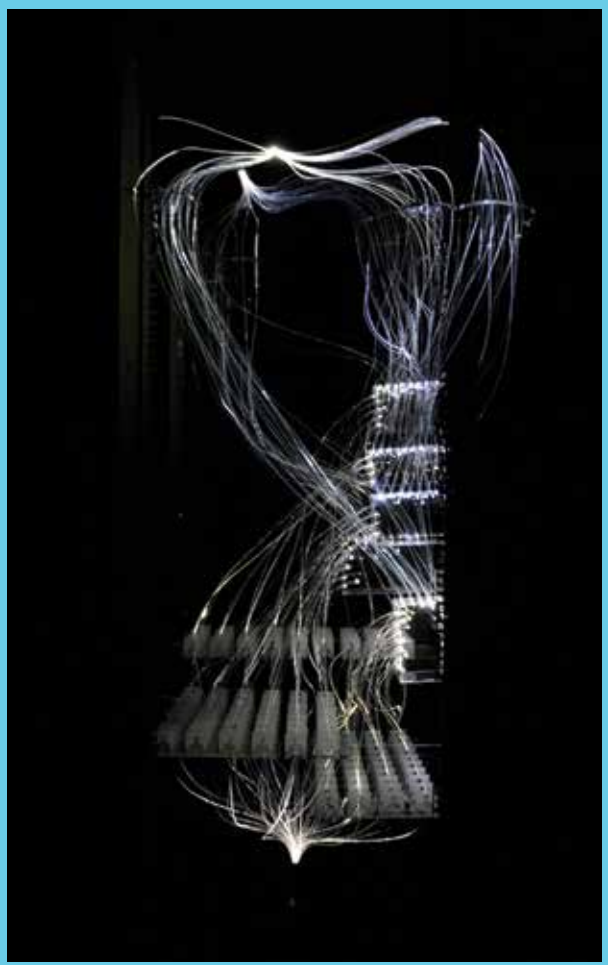


Figure 36: Factory user view

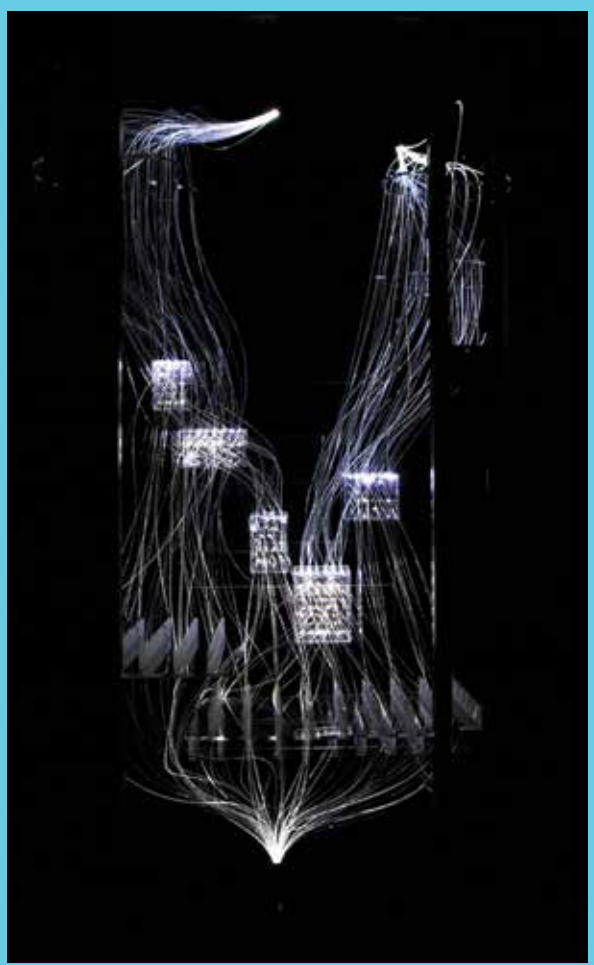


Figure 37: Factory data centre view

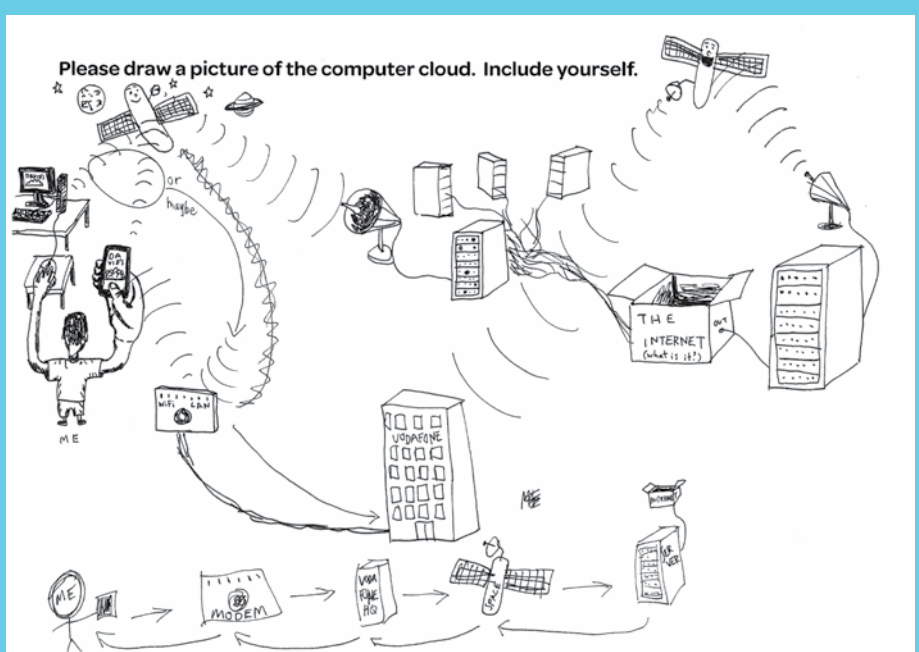


Figure 38: Cloud drawing by participant [O]

processor, and transmitter at once' (van den Boomen, 2014, p.99). I maintain that the cloud is a black-boxed technology that does more than contain, transmit and process. As depicted in the following two drawings, the closed system can be a cause of frustration for participants accessing files and data. In these examples the cloud is experienced as a black box rather than a stable container. In Figure 40 the Internet was shown as a box that the participant [O] did not understand. The participant that produced the drawing in Figure 40 described the centre area as concerning: '*You don't know what's going on in this black box area, which is quite alarming*' [T]. Other Phase 2 responses to Factory also raised the concept of a black box. While the use of box and cloud metaphors is a useful way to explain the theory of virtual computing, they give no insight into the machinery of cloud computing (van den Boomen, 2014, p.93).

Transparent voids

Many participants saw the five suspended boxes as the controlling element in the cloud artefact. There were different speculations about what these boxes represented. '*The boxes represent the five corporations, obviously*' [U]; '*Each of the boxes and disks are layers in the neural network*' [D]. [W] felt the boxes were in control because '*the information goes in and then it stops, and then it goes up or down, whereas these guys (the users) it just goes through them*' [W]. In this scenario the boxes are autonomous as they have the capability to stop the data carrier from intruding into their internal space. Concurrently the users are passively subject to a data feed that penetrates through them. Others saw the construction of the boxes as inaccurate for the present system. The stimulus of the artefact provided a useful focal point to envision how cloud computing might work better in future:

> *'The boxes are transparent – they are actually black boxes, but these are transparent, more like a sharing system. Those are the black boxes of cloud computing, to me it is a system that society maintains – they have the automatic sensory input from the world. I see this as one step further, when the system becomes transparent, after we get past the black box'* [R].

As an IT professional responding to the artefact, [R] was inspired to wonder how the model could more accurately portray how the system currently works. This proves the usefulness of the artefacts to not only raise awareness, but to stimulate thinking about how cloud computing systems work and how they could be improved. The responses from this and some others in the IT profession and in education were striking for their concern about how cloud computing currently works, their admission that much is unknown to them, and a belief from their personal experience as users that '*we should know the invisible, the data should be ours and we should know what happens to it*' [R]. Another participant with a high level of knowledge of cloud computing saw each of the boxes as layers in the neural network, a model commonly used for the system of cloud computing. They described the system:

> *'What is being taken from the people is their behaviour and the things that are being watched online. All their behaviour can be put through a neural network that learns in order to predict. ... the boxes are constantly watching and constantly learning, predicting'* [D].

Though this participant stated that the Factory best emulated the neural network model, they felt that the Surveillance cabinet was the best metaphor. It was surprising to me to hear from this relatively well-informed participant that the least structured and diagrammatic artefact for them most closely resembled their current experience of cloud computing. Stimulus Images of physical infrastructure shared in Phase 1 revealed participants views on, and level of understanding of, cloud computing.

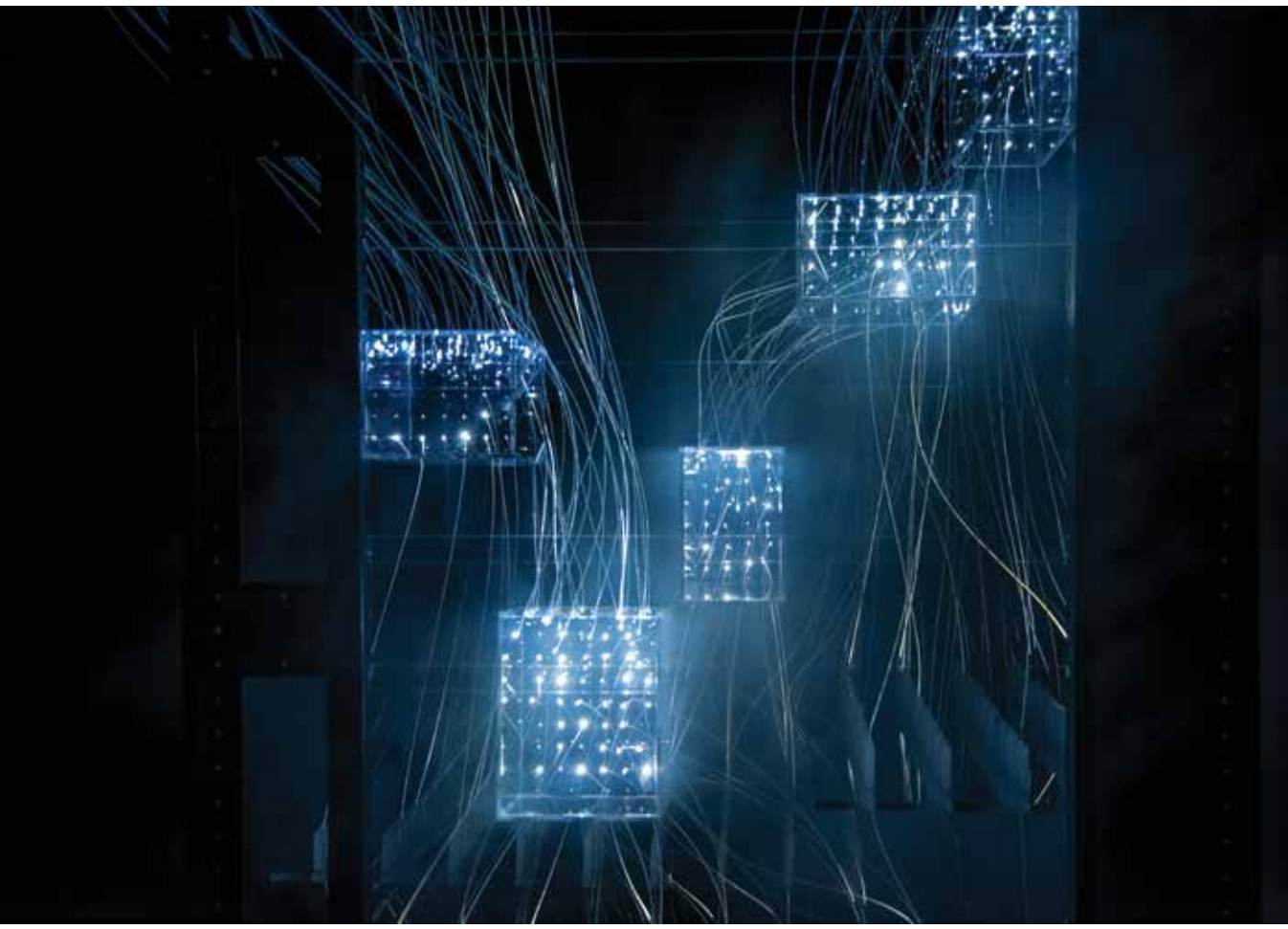


Figure 39: Cloud computing company black boxes

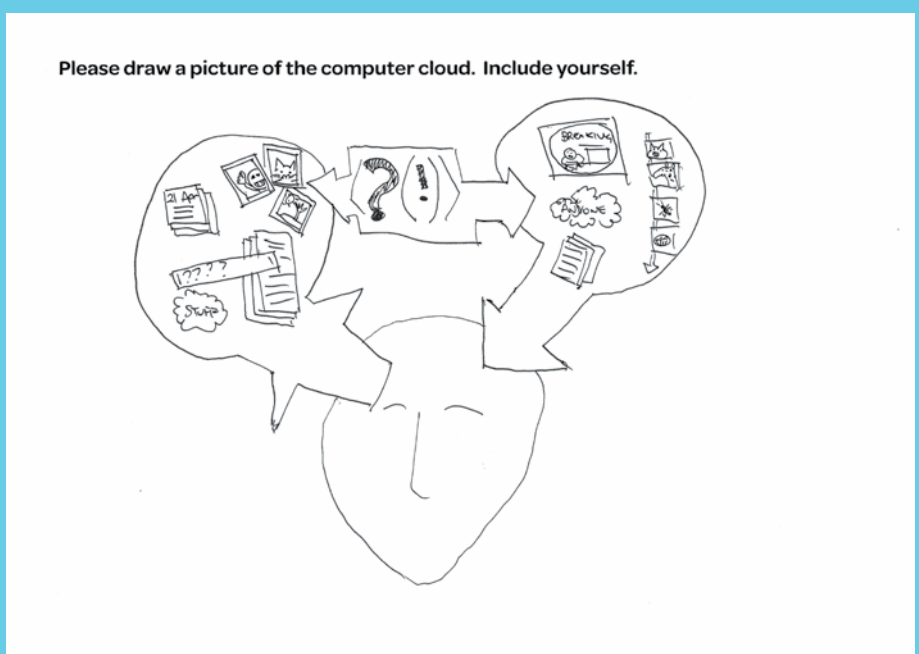


Figure 40: Cloud drawing by participant [AD]

Data centres

The still image in Figure 41 is taken from a video advertising the security of Microsoft's cloud computing service. The video shows external and interior images of a data server centre with security points, including a biometric scanner and a full body metal detector. Extensive security measures are pictured, creating the impression of a highly secure cloud computing building. While all participants who were shown this video were impressed by the efficient and secure measures of the data centre, many commented that the primary threat to security was in fact the risk of hackers accessing cloud centres or personal computers remotely: '*It is physically safe but there are a lot of means to hack or attack data*' [AE]. This points to the distracting feature of Microsoft's 'high-security perimeter fence' video, as risks to security are through hacking computer networks, and not through physical theft. Although it is a useful exercise to site the physical infrastructure of cloud computing, Microsoft's illustration of this secure data centre is conveys a deceptive narrative about security. Correlations with security are apparent in the location of data centres in secure ex-military bunkers, where the Internet is defended from outsiders. As Hu argues, this use of military bunkers is a misplaced need for security from the other as the dominant risk is from cyberattacks, not physical intrusions (Hu, 2016, p.92). After viewing the Microsoft footage, some participants became aware of the physical elements of the cloud and the effects of the metaphor. It is symptomatic of the evanescence of the cloud that this video is no longer publicly available and has not been archived in the WayBack Machine, a digital archive of the World Wide Web. Along with the prevalent imaginary of the cloud as non-physical, the singularity of 'cloud' frames cloud computing as otherworldly and simpler than it is in reality.

In common discourse the singular form of 'the cloud' lends cloud computing more importance than it should have. On seeing images of physical data server environments in the Microsoft ad, one participant realised that:

Figure 41: *Microsoft* [video still] high-security perimeter fence. Used with permission from Microsoft

> *' ...it seems like there are lots of clouds. ... I think all this talk about the cloud is slightly deceptive because it lulls you into a false sense of security, that it sits physically and metaphorically above the business of anything else, that it's more safe, more secure, when in actual fact it's just another business'* [H].

Rather than the singular cloud sitting above us, images of industry infrastructure such as Microsoft's High Security Perimeter Fence clip suggest a multitude of clouds. In response I propose that the plural 'clouds' is more fitting as it suggests choice, not something elite or godlike. Clouds is descriptive of a set of objects that has been sighted, counted and categorised, rather than a deceptive, amorphous, otherworldly form. Cloud takes away the complexity '*that I can upload data here and download data there*' [B], while uploading to the plural 'clouds' reminds us that we need to access files through different companies, accounts and apps. A tendency for participants to link clouds to the cloud metaphor rather than a data storage centre may in part be due to the low presence of public images of data centres and infrastructure. Though rare, publicly circulated images of the exteriors of cloud data centres are generally limited to those in remote locations such as Facebook's massive *Luleå Data Center* (Figure 42).

Infrastructure

When selecting the Stimulus Images for Phase 1 of the research, I sought an image that would provoke participants to think about the physicality and environmental impact of cloud computing. The image I chose is an artist's drawing from 2011 of Facebook's then planned data centre (2011). The original structure of Facebook's first data centre outside of the U.S. dates back to 2013. Based in Luleå, Sweden, this location is ideal as 35-degree Fahrenheit temperatures remove the need for artificial cooling. In sharing this image of Facebook's hyperscale 16,250 square metre data server farm, I hoped to confront participants with an element of the material infrastructure of cloud computing, an aspect that is seldom depicted in mainstream press, ostensibly for security reasons. The aerial image of Luleå was shared with participants in Phase 1 of this project, where it gathered little recognition, reflecting a low awareness of the exterior of data centre buildings. Interior photos appear to be more familiar to the public as interiors are more commonly used to represent the industry.

On participants' sighting of the image of the Luleå data centre, many recognised that cloud computing has a physical presence, several then surmised there were consequences for the environment. While many participants were unsurprised to hear that this is an image of a data server centre, a number were simultaneously confronted with the hidden, remote nature of the building. Although some participants had the sense that the cloud was safe, when they viewed this image, some commented that this site was as vulnerable to destruction as any other building. Three explicitly mentioned the susceptibility of the site to physical damage:

> *'At the end of the day, nothing is ever totally safe, someone could bomb that, someone working in the building could use the information for their own personal interest'* [H]

> *'Wow, so if that catches fire... nothing is indestructible, if we lost power'* [V].

One participant recognised the image as a data server warehouse, claiming it wasn't necessary to physically understand it. They then directly contradicted themselves as they added:

> *'It feels less safe when you think about it because it's a physical space and something could happen to it, a fire or earthquake. The cloud's perceived benefit is that it can't get destroyed, but it could'* [J].

These responses suggest that the minimal distribution of imagery and information about cloud centres contributes to low awareness of the physical infrastructure of cloud computing, which in turn results in less concerns about security amongst users. The exposure to this image made the industry more real for participants, as the cloud was brought down to earth and seen as fallible and destructible. On disclosure of the environmental impact of cloud computing some users were surprised to hear about the energy resources used by data centres. Comments like '*We don't need to physically understand it. I don't*' [J] demonstrate apathy, and a lack of awareness that is a result of low public disclosure about the industry. I argue that it is crucial that users understand the impact and working of the industry.

As the biggest driver for growth of the cloud computing industry, it has been estimated that consumer Internet video streaming would account for 82% of consumer Internet traffic in 2020, up from 68% in 2015, so users are instrumental in the growth of cloud computing. In the U.S. Netflix accounts for over 30% of Internet traffic (Cook, 2017, p.7; Cisco VNI Complete Forecast Highlights, 2016). At the time of the Covid-19 pandemic levels of video streaming have exceeded expectations as global video streaming increased by 40% between February and mid-April 2020 (Kamiya, 2020). Additionally, as data centres are predicted to use 700,000 TeraWatt hours (TWh) of electricity in 2020, and around 3–13% of global electricity, including coal use, in 2030, compared to 1% in 2010, the impact on the environment and climate will be substantial (Andrae & Edler, 2015). Industry estimates of energy use state that data centres and data networks account for 2% of energy globally, excluding manufacture, mining, e-waste, blockchain and IoT (see also 2.4). Participants' detachment from environmental consequences such as these may in part be resolved through better public information, as this research shows that sighting images of data warehouses can lead to better understanding of environmental impacts of cloud computing. Recent literature on the material reality of data centres investigates the cloud computing industry's character in marketing images of the industry, and in the labour of building and running data centres (Mosco, 2014; Finn, 2017; Hogan & Vonderau, 2019). Imaginaries of cloud computing and data centres are shaped and explored in the planning and construction of these data centre sites.

Vonderau and Johnson discuss the role of imaginative narratives as crucial in the establishment of data centre projects in the rural communities in Iceland and Sweden. The cold climates of northern countries are perceived as ideal locations for cooling data centre drives (Vonderau, 2017, p.16; Johnson, 2019, p.5). Promotional efforts to frame Iceland as a natural destination where evolution would place a data centre align with green metaphors of cloud computing (Johnson, 2019, p.5). This contrasts with responses from participants in my research, who rejected the Catalyst Cloud clean green image of cloud computing, although links were made between nature and the cloud computing system of Factory, as I discuss in 7.6. The covert nature of cloud companies is evident in the construction of Sweden's Luleå data centre, where during the construction of the data centre, Facebook only used the mysterious name *Project Gold* (Vonderau, 2017, p.13). Mayer documents a similar secretive approach in the first rumours of the construction of Google's data centre in 2014 in Eemshaven in the Netherlands. With high security, no map location available, and a deep ditch built that prevented onlookers, the repeating theme of visibility and invisibility is present. Mayer compares this to the creation of aura around sacred religious objects (Mayer, 2019, p.2). Studies of planned data centre projects such as *Project Gold* show that

Figure 42: *Artist's drawing showing Luleå Facebook data server centre*, 2011. Courtesy of Node Pole, Sweden. Reprinted with permission

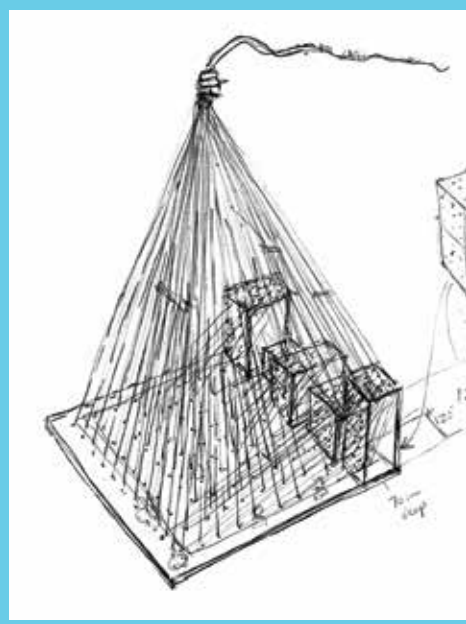


Figure 43: Concept sketch for Factory construction

Figure 44: Initial placement of Factory boxes

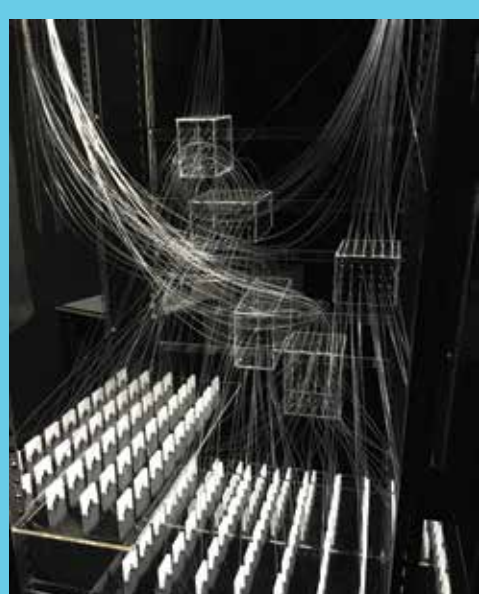


Figure 45: Partial construction of Factory

local communities respond with hopeful anticipation at the prospect of these business ventures in their communities, though the building and establishment phases illustrate that gains are in fact limited for locals.

The impact of data centres on local communities is apparent in the expansion of Facebook's hyperscale Luleå data centre to double the size. In 2018, five years after the first phase of Luleå's construction, Facebook announced plans to develop a third building, bringing the total coverage of the data centre to 100,000 square metres. While construction created 1,000 temporary jobs, permanent employees number just 200 (2018). The location and economy of data centres is defined by high impact extractive processes: cheap power, cheap cooling, cheap land through local government incentives in both remote locations and reutilised sites (Pickren, 2017, p.22; Vonderau, 2017, p.8; Johnson, 2019, p.1; Cubitt, 2017, p.19). The impact of data centre construction was also felt in Amsterdam. In July 2019 it was announced that data centre construction would be halted in the region, as property prices had hit record highs due to data centre growth (Proper, 2019). Although data centre constructions bring business to regions, features of data centre infrastructure indicate that these businesses can shift to other locations when the combination of environment and tax breaks work better elsewhere. Because servers with a life span of three to five years are the largest expense in data centre constructions, the constant renewal of servers can be a determinant for data centres to review their investment in a particular location (Velkova, 2019). Custom-built data centres such as Luleå and Eemshaven are characteristically built on a single level, covering a lot of ground to maximise air circulation. In contrast to their size and impact, hyperscale data centre structures are designed to be discrete and imperceptible from a distance. The hidden, secretive nature of Internet cable networks and data centre locations is documented in Starosielski's exploration of the undersea network infrastructure (Starosielski, 2015, p.5). The appearance and presentation of these data centres differs from that of older media infrastructures, such as vertical telephone towers, and celebratory displays of early media technologies such as electrical lights in the 1890s, that proudly showcased technological capabilities, described in 5.4.

The horizontal form of hyperscale data centres like Luleå contrasts with the perception of online data commonly moving through the air up to the cloud. While cloud centres can feasibly be housed in high rise buildings, and are on occasion, the cooling, connection to electricity, air conditioning and water access is easier in a single level construction. Like most newly built cloud data centres, hyperscale data centres such as Luleå are constructed as non-human spaces, due to low employee numbers and windowless architectures that cater to computer servers rather than people. An emphasis on thermo-cultural aspects of cloud computing is documented by Starosielski in relation on Nordic data centres. Cold arctic air is an important deciding factor for the location of these data centres, so the control of the temperature and airflow is a constant priority (Starosielski, 2015, p.114; Vonderau, 2019). The more prevalent public face of data centres is portrayed in images of their interiors.

Publicity images and videos of data centres depict interiors that neither hide nor reveal, avoiding the smoke and mirrors metaphor of the cloud and instead projecting a safe, morally clean, contained environment (Taylor, 2017, p.49). The sensory experience of windowless industrial data centre spaces, including the artificial light from server cabinets is something I wanted to evoke through the use of fibre optics and the chosen space for the exhibition of my artefacts. In advertising for Microsoft, a sublime grandiosity is evoked through theatrical music, wide angle low shots and lengthy corridors with dramatic angles (Microsoft, 2015). Taylor contends that people are intentionally omitted in the data centre narrative, in order to portray a reliable machine without human error, thereby foregrounding the technological purity of cloud

computing infrastructure (Taylor, 2019, p.49). After viewing data centre images in Phase 1, one participant showed relief at resolving the confusing image they had of a cloud in the sky, and subsequent realisation of the fallibility of the cloud computing infrastructure:

> '*That goes some way to giving you a literal insight into what the cloud, i.e. this universal storage system is like in reality. It doesn't make me feel safer. Because humans are operating and humans aren't fallible, at the end of the day if someone wants to do bad things*' [H].

The consequences of the user visibly registering an image of the cloud inspired me to progress to my critical making response in Phase 2, in order that participants could tangibly experience the cloud.

Taylor compares the data centre environment with that of a techno-organic jungle from a 1966 Marvel comics story, in which the Fantastic Four enter a machinic forest filled with electronics, vines like wires and mysteriously, without humans (Taylor, 2019). The Marvel technological wilderness of machine parts and cable salad vines mixes nature and technological themes. Like Taylor's Marvel comic environment, industry advertising images of data centres disregard the role of people in running data centres (although that staff is small), and frames servers as the foremost feature of the high-tech data environment. It also frames an environment free of human labour, suggesting an industry run entirely by machines.

Data centres are constructed in a variety of styles, as these are built in existing buildings, ranging from bunkers to disused factories (Alger, 2013; Veel, 2017, p.35). To express this, I built a range of forms and locations for the acrylic boxes, placing some higher off the ground where they suggest cloud-like floating, thereby creating more dynamic, less passive forms in the connecting threads, and including varying numbers of fibre optic strands to various locations. My intention was to provoke different responses regarding their relative size, and the overall spatial composition as it relates to cloud computing. A critical element portrayed in Factory were the users positioned in the platforms below the cloud.

7.5 Users and identity

Participants felt these users were connected, illuminated and communicative, while also tethered, watched, isolated and strung up. Participants were intrigued by attractive elements of these representations of clouds, even identifying nature-based themes: '*beautiful*' [W], '*waterfall-like*' [G], '*amazing*' [A]. However, the poetic aesthetic proved to be a trojan horse for '*disturbing*' [D] and '*depressing*' [P] aspects of the artefacts, particularly in the portrayal of users' juxtaposition to the cloud. Several participants downplayed their own significance, knowledge and autonomy in their Phase 1 narratives about cloud computing. '*I don't think I am important enough for anyone to care enough*' [K]. In reference to a lack of power some named the 2014 hacking of iCloud, in which nude images of actress Jennifer Lawrence and others were posted to a public website. This incorrectly focuses on a hack involving public celebrities and disregards more common issues of data surveillance that result in targeted advertising. The passive attitude related to participant's significance is bolstered by the intangible romantic connotations of clouds. Through discounting their own importance, participants absolved themselves from the responsibility of managing their online identity and habits. As Katherine Hayles argues, users would be well-advised to know what is going on in their machines, even when they function efficiently, because those who do not understand the workings of the machine might be at the mercy of those who do

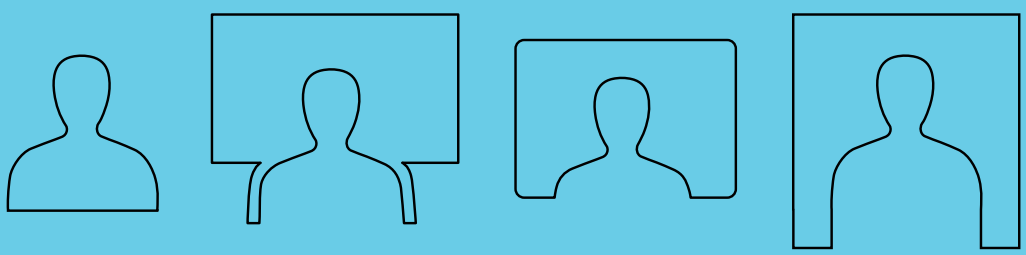


Figure 46: User figurine development sketches

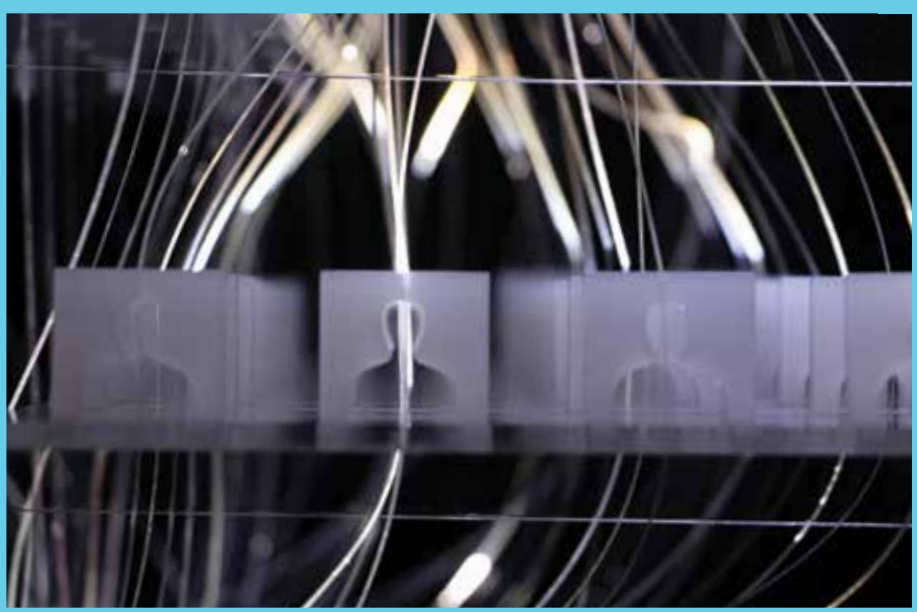


Figure 47: Final users in situ

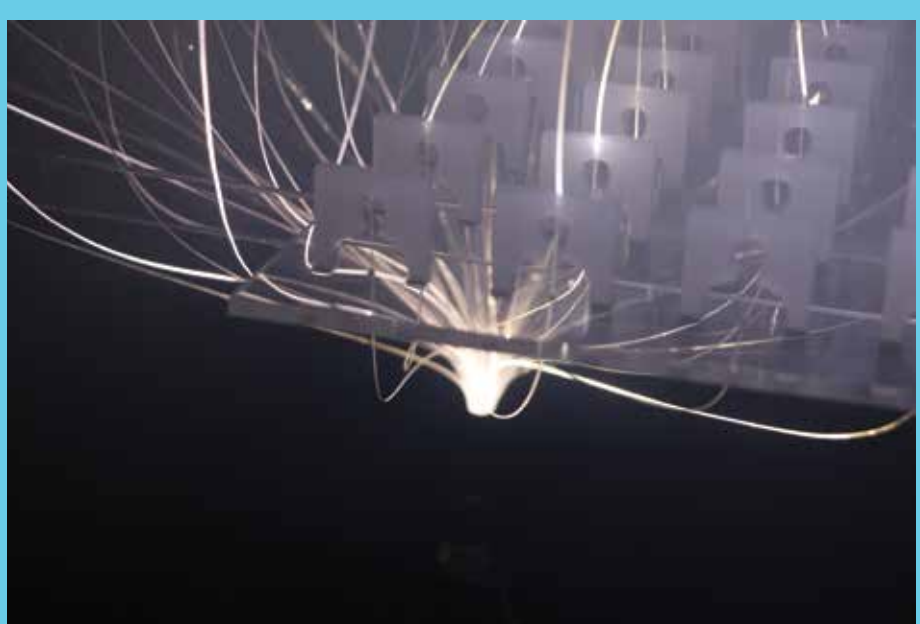


Figure 48: A floor of user figurines connected to fibre optic light source below

(Hayles, 2005, p.126). This is a highly relevant argument today when considering cloud computing technology and aspects of the technology that are invisible, including data surveillance and privacy breaches, and the environmental impact of cloud computing. However, knowing what is going on in one's machine is a difficult task when working with user-friendly computer interfaces that are designed to conceal their messy inner workings. Generally we only deal with the machine when the system is broken (van den Boomen, 2014, p.47). Yet invisible aspects of cloud computing create a seamless user experience, while also enclosing users within the cloud computing system.

While the cloud computing industry sells imaginaries of freedom of movement, and mobile computing similarly allows freedom, Andrejevic contends that users are confined to a digital enclosure in which the viewer is distracted from online monitoring through networked access (Andrejevic, 2007, p.308). The loss of control experienced by users in the exchange of data access and storage for personal information is represented in the Factory by the user/screen figurines tethered to the cloud (Andrejevic, 2007, p.311).

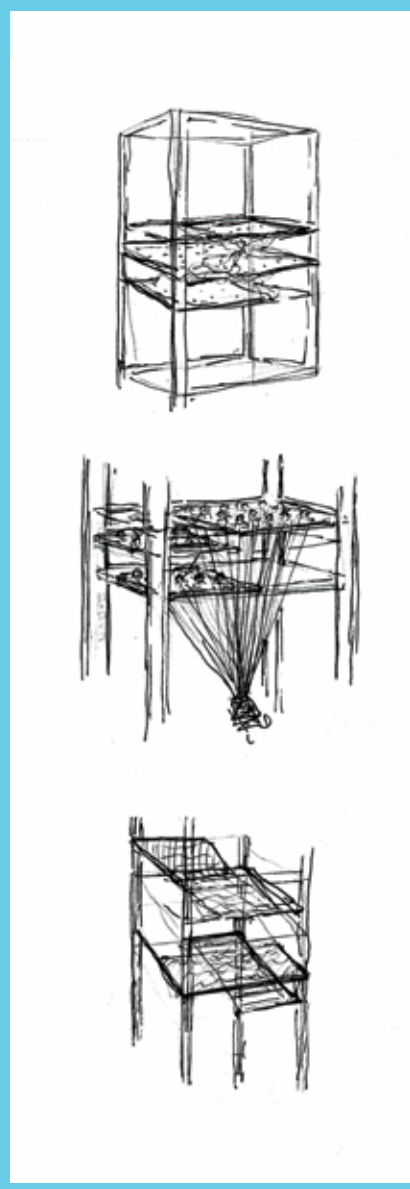


Figure 49: Sketch for design of the Factory floors

User icons

When constructing the Factory I expected that participants might be disturbed by the tethered users, because of possible associations to constant online connection, lack of privacy, or data surveillance. Mackenzie points out that the terms wireless and wirelessness, like the cloud, imply less wires, less difficulties, and less obstacles. Yet Mackenzie maintains that wirelessness in fact 'designates an experience trending toward entanglements with things, objects, gadgets, infrastructures, and services' (Mackenzie, 2010, p.5). The same could be said of the cloud. Although, on viewing the Factory most participants felt that it was an accurate model of cloud computing, some commented that Internet users were in real life free to move, not locked in like the figurines.

The critical making of the user forms for the Factory artefact incorporated exploratory thinking and iteration to arrive at the right solution. In the drawing by [B] each user is placed in front of a framed screen (Figure 28). Similar to most Cloud Drawings the users do not interact with each other. This reminded me of the dystopic identical factory workers in Fritz Lang's 1927 film *Metropolis* (Lang, 1927), and Kafkaesque narratives of bureaucratic workplaces. The regimented rows resembled the wide-angle corridors of publicity images of data centres, as columns of drone-like workers sit at desks that recede to a vanishing point. Research into the form of these figures led me to investigating common shapes for user icons, such as the form at left in Figure 46. A lengthy history lies behind the common user icon that goes back to Otto Neurath's Isotype forms designed for use in the representation of social statistics in 1930s Austria (Honeywill, 1999, p.47). Various icons have been developed for user interfaces, including pixelated symbols for early consumer interfaces such as Hewlett Packard and Apple. This has culminated in the various similarly shaped, simplified user symbols in current use, which I based my generic user form on. The history of generic symbolic figures representing people is a long one, however the twentieth century Isotype images are an important development that has led to the contemporary user figure (Meggs, 1992, p.303). During the design of my user figurines I became aware of how graphic symbols of computer users typically exclude the lower body, symbolising the upper body only as that which engages with computers, or perhaps that part of the body that extends beyond the line of the desk. When reflecting on participants Cloud Drawings, many had similarly drawn only upper bodies, with some drawing large hands that emphasised the digital through a literal depiction of bodily digits. For the construction of my user figurines, I laser cut a number of different versions in opaque acrylic to distinguish the figures from the transparent acrylic used elsewhere. My intention was to thread a fibre optic cable from each user to one of the boxes, this cable would need to move through a user figurine into a container diagonally above. After testing this approach, I found threading through the user icon was too obvious, as it directly tethered each human figure to the cloud. I chose instead to imply the possibility of tethering and allow space for viewers to agree or disagree with the idea of tethering.

Originally the figurines on their own appeared small and too directly derivative of a user symbol, so I made screen forms to sit alongside, but these appeared clumsy. Subsequently, I produced a form that incorporated the screen and user together as a unit, making the user a negative form within the screen. This reflected repeated depictions throughout the research of users focused on their screens, rather than on other users, irrespective of their surroundings. I threaded the negative space of the user silhouette with fibre optic strands, fitting the forms into the acrylic floors. It may be understandable that users experience the cloud as benign, as cloud computing is designed to be seamless, discreet and user-friendly, through endearing sounds

that verify saving and moving files, to naming of folders in personal terms as 'my documents' and cloud servers as 'iCloud'. Chun refers to this promotion of the individual in the prevalence of 'YOU' in YouTube, and the Facebook status update prompt 'What's on your mind?' (Chun, 2016, p.3). This personal focus is also evident in Gmail account emails that are sent to oneself – the sender is listed as 'me'. A contradiction is apparent in the semantic web's focus on individual user-generated data. While the user-generated data is promoted, it is only when connected with others that the individual matters – we only matter in the aggregate (Tomasula, 2019, p.186).

A few Phase 2 interviewees responded to the artefact with comments regarding disempowerment: '*It's like people are just a conductor or something*' [G]. Others, such as [W] were more explicit, identifying the fibre optic strands running through the imprisoned user figurines with the film *The Matrix*, hinting at the user's function as the source for valuable big data that forms the core economy of cloud computing (*The Matrix*, n.d.). The floors themselves were developed together with the user/screen figurines, with consideration for the wider 360° view of the cabinet. As the Factory cloud stretched vertically through the height of the cabinet, floating floors distributed the users across three levels. I positioned the floors at different levels, creating another detail for participants to interpret. The data server boxes and floors were distributed over the height of the Factory cabinet in reference to the metaphor of a floating cloud, the wireless radio signals that carry Internet signals, and the perceived lightness of the environmental impact of the industry. The differing levels were readily interpreted as indicating a power relationship. One participant saw the levels as an indication of the relative distance to technology, or a difference in the level of use. Another related the different levels to a class system, in which:

> *'those with the nice data power would be higher, more decision-making power'* [W].

[P] discerned the platform levels as layers of society, where the top one felt:

> *'more controlling and white collar, and the lower two more subordinate, blue collar, and lower socio economic, but bad things happen to them, too'* [P].

This reflects the digital divide of the unequal distribution of digital connection and cloud computing in poorer countries and societies. At the other end of the economic scale, Lovink argues that the digital elite are those that are not available 24/7, as they delegate digital communication to others (Lovink, 2019, p.36). Phase 2 participants similarly commented that ready access can result in loss of autonomy. When digital networks are always on, expectations from employers can result in slavish attendance to digital devices [P]. The remaining element to discuss is the base of the artefact containing fibre optic strands that converge below the platforms and the unexpected response evoked in these elements.

7.6 Cloud nature

In the creative making of the Factory artefact I chose to construct a form that expanded beyond the frame of the steel cabinet. This alluded to an organic cloud as presented by industry – a green and natural element growing beyond the containment of the server cabinet. Some Phase 1 participants had associated the cloud with nature, so I wanted to represent this in the artefact to elicit further comments.

The LEDs were directly connected to the fibre optic cables, so that the light travelled through the strands, illuminating the full height of the cabinet. I bundled the fibre optics into LEDs at both the top and bottom to maximise the amount of

light. Similar to other creative choices, such as the user figurines and shelf placement, the positioning of the strands drew some unexpected comments from participants as they made meaning of these details. The incidental bundling of the strands led three separate participants to envision the cloud as a thing driven by a creative consciousness rising from the bottom of the piece. Almost half of the Phase 2 participant group asserted that '*it all starts underneath*' [Q], with two stating this in spiritual terms as originating from the '*spirit of the people, coming from below*' [A]. This expressed the influence of participant [A]'s religious beliefs on their assessment of the Factory. The idea of energy growing from below aligns with further comments from participants on nature-based aspects of the Factory.

Participant's association of the cloud with nature affected their consideration of privacy and data surveillance in the cloud. Applying the conceptual theory of metaphor framework to participant responses, the use of natural metaphors emphasises a living organism that grows in response to need. This is mirrored in the scalability of cloud computing. Two participants that described the Factory as organic had the least knowledge of cloud computing and were passive in their thinking about the cloud. [G] observed *'something feeding into the people, the same thing is feeding out of the people ...'* while simultaneously outlining that the artefact felt *'very smooth, it's easy, it feels natural'* [G].

They showed no concern for where the data feed was going or the ramifications for the users. When asked where they were within the Factory artefact, this participant replied that they were probably one of the user figures. The juxtaposition of cloud computing with nature is repeated in industry narratives about the cloud.

The organic, natural associations mentioned by these participants echoes the reassuring, ecological metaphors of the Internet, such as those portrayed in technology news and tech company visions of media streams, server farms and hive minds (Carruth, 2014, p.339). Natural themes are reflected in the Microsoft clips shared in Phase 1 that showed large building complexes within nature. These images misrepresent the industry, distracting attention from the growing 3% per year global energy consumption of the cloud computing industry. The nature aesthetic is also utilised in the local image of sheep and pastures by New Zealand company Catalyst Cloud, as discussed in section 7.3. Themes of nature contradict an industry that in actuality consumes large amounts of energy, water and often coal, and is driven by cheap energy, cheap water and tax breaks (Levenda & Mahmoudi, 2019, p.3; Carruth, 2014, p.345-6; Taylor, 2019, p.44). A connection with nature also occurs in connotations with earthly resources.

Prosperous mining discoveries and profits for locals are suggested in Facebook's *Project Gold*. The preliminary naming of Facebook's Luleå data centre as *Project Gold* implies riches through mining for natural metals, as though Facebook were in Luleå to exploit a gold rush and all the accompanying prosperity for a local population that would go along with it. In actuality, prosperity for Facebook lies with local tax incentives and the base of Sweden as the location with the cheapest electricity in Europe. The built-in obsolescence of cloud computing data centres and their independence from land resources means that data centres are flexible to shift to whatever location is most efficient and cheapest, though with consideration for the only resource specific to the geographical location, the cool northern climate (Velkova, 2019). The *Project Gold* name reinforces an imaginary of data surveillance and collection as 'data mining', connecting the data centre to nature and the mining of the earth's resources. Use of natural resources is an aspect that is indirectly relevant to cloud computing as it is an integral part of the digital industries in the manufacture of personal mobile devices that stream content from the cloud through social media, cloud storage, email, and especially data heavy video streaming by services such as Netflix. Unlike

other major extractive industries in Sweden, such as forestry, iron or steel, there is no relationship to the earth in the form of mining local natural resources. Although Facebook does make use of the cheap electricity harnessed locally through renewable hydropower, the core resource is user data which can be harvested irrespective of location. As remarked by one participant, the creative force at the wires at the base of the Factory symbolised a creative source that powers the artefact. Both data centres and the Factory artefact recalled containment themes that relate to the feminine.

Infinite containment

Cloud computing data storage equates both with womb-like containment and the perceived information resources and generosity of Mother Nature (Sofia, 2000, p.183; Cubitt, 2017, p.7). Participants felt that the containment of the clouds was safe: '*We don't need to physically understand*' [J]. The metaphor of containment is easily applied to the data centre, as these spaces protect, enclose and transport data, thereby providing stability (van den Boomen, 2014, p.97). However, the perception of data centres as safe womb-like spaces that supply infinite resources without consequence or individual awareness is both ignorant and irresponsible. Technology theorist Zoe Sofia states that the Western view of modern science is that nature as the Big Mother is there to be plundered of her infinite resources (Sofia, 2000, p.181). This view is substantiated by Sean Cubitt, who states that we have extended these expectations to anytime anywhere mobile technologies (Cubitt, 2017, p.23). The perception of earth as an infinite source challenged some participants once they viewed images of data centres in Phase 1. This shows that visibility of images, information about the industry and artefacts that function as models can lead to a greater awareness of the environmental impact of cloud computing. Informing users of the environmental impact of cloud computing was not among my core objectives in building my artefacts. However, I observed that the environmental impact of cloud computing is one of the key aspects that is avoided in cloud computing industry imaginaries shown in advertising and publicity images.

An important consequence of nature-themed imaginaries of cloud computing is participants' notion of the cloud as inevitable. Thinking about the cloud as an inevitable part of nature leads to a passive mindset regarding the use of cloud storage. Referring to Mumford's sociology of technology and his definition of protective containment technologies as traditionally feminine and passive, Sofia contends that containment qualities are devalued in comparison to masculine qualities of speed, motion and expansion (Sofia, 2000, p.188). This is valid in relation to the cloud, where data storage spaces get away with being perceived as benign and static places, in contrast to the more public, dynamic, speedy technology of high speed 5G cellular networks. Clearly the cloud is far from a safe womb-like space, as data is subject to acts of data surveillance and hacking, and leads to environmental damage. I argue that themes of nature generated in images of cloud computing as a trustworthy reliable lifeforce detract from both data surveillance and environmental damage. Alternately, using gender-neutral terms and metaphors could lead to better understanding and less disassociation from the impact of cloud computing technologies.

7.7 Summary

Most Phase 2 participants perceived the structured, wider view of cloud computing in the Factory as less uncanny and confronting than the Surveillance artefact. The broad systems perspective was felt to be less personal and confronting than in Surveillance, and reassuringly objective as a filtering vision of a '*library archive of humanity*' [F]. This aligns with the sterile technological spaces captured in publicity images of pristine data centres.

To conclude, discussion of the Factory artefact resulted in an unexpected positive response from one participant on the bundled fibre optics at the top and bottom. For this participant the light that streamed through Factory was interpreted as consciousness: '*That though people are connected, consciousness exists before and after the cloud. That's positive*' [A]. Positive perspectives were even more prominent in the third artefact, which I will focus on next.

Unlike the Surveillance and Factory artefacts, the Noosphere leaves behind the vertical composition, and conveys a narrative in horizontal form that most participants felt was more empowering and aspirational. The focus for the Noosphere was the first-person perspective of the user in the form of the leading bust, and the concept of the cloud as a knowledge base and archive, and an important means of connection.

Figure 50: Participant responses to Noosphere artefact

8 Noosphere

8 Noosphere

The Noosphere artefact was inspired by a narrative about the impact of cloud computing on users' identity, access to knowledge and social connection. The topic for Noosphere is not exclusively private users' cloud storage of personal files, but also social networking. This aligns with my definition of the cloud, which includes music and video streaming, cloud software and social media. While Phase 1 participants expressed confusion about the parameters of cloud computing, most Phase 2 participants responding to the Noosphere artefact stated that cloud computing includes sharing information online through social media and streaming content, as both deliver a richer user experience through cloud computing. Virtual computing in the cloud and faster network speeds mean that larger than ever, video, photo and sound files can be more easily streamed, sent and received. This delivers an online experience that is more accessible and more immersive than ever before.

The experience of cloud services and social aspects of Web 2.0 affect users' privacy and sense of identity. Social media, personalised search engine results and cloud computing services are all engineered to encourage users to share information, because sharing facilitates the production and collection of valuable behavioural surplus. Participants' connection to the shared knowledge of the cloud, the seamless use of devices, and the empowerment it affords are the topic for the Noosphere.

The construction of Noosphere expresses the effects of connection and knowledge sharing on users' identities. Built within the steel frame of a server cabinet, the main component is a bust that sits at the front end of the structure, facing away into the cabinet. The bust is cut from multiple layers of transparent acrylic inscribed with etched patterns. Bundles of fibre optic strands connected to the bust coil outwards from the front of the cabinet, moving through multiple phone-shaped mirrors. Suspended phone shapes cut from mirrored acrylic carry multiple, illuminated fibre optic strands that weave through miniature sculpted plaster busts similar to the leading bust. Crystals and mirrors are connected by strands that terminate towards the back of the cabinet. In the base of the bust is a small sliding drawer containing a smartphone with its flashlight on. Participants approach the darkened exhibition space from the head end of the artefact, where the viewer looks out along the depth of the cabinet to strands that wind loosely away. The leading bust is so-called because viewers interact with, and identify with this first person element. In response to the viewer moving the sliding phone drawer through the leading bust, the individual acrylic layers light up, revealing etchings. The etched layers within the leading bust depict a bodily, biological network of branching dendritic lines as drawn in the participant drawing by [C]. In a reference to visibility, a glowing third eye is in the centre of the artefact. The etched eye forms light up and fade out as the phone is moved across the layers in the depth of the head. The light from the phone flashlight also reflects off the suspended phone-shaped mirrors and mirror shards that are connected to the fibre optic strands.

Viewers are able to walk around the artefact and view it from different angles – seen from the side the fibre optics move horizontally away from the bust. The critical making of the Noosphere artefact departs from the format of the other two artefacts

Figure 51: Noosphere artefact

in a conscious effort to present a positive, empowering narrative. This is achieved through a number of factors: horizontal rather than vertical movement, the addition of an interactive element, and a focus on the first-person perspective. The making process was a creative, explorative process in which I reflected on themes specific to the Noosphere. In response to participant feedback and a review of literature I elaborated on some features, dismissed others and added new elements. Overall, participants experienced the Noosphere artefact as human-centric, positive and inspiring. When interacting with the artefact participants felt empowered, as they confidently identified with the leading bust.

Based on a narrative with an aspirational perspective on the enriching experience that connecting online affords, [C]'s experience is about connection made possible through the Internet and cloud computing. The source interview and drawing for this creative manifestation described the cloud as a '*nervous system*', and a '*collective intelligence*' [C]. For me this brought to mind the idealistic god-like narratives of the early Internet, subsequently I named this artefact Noosphere after Teilhard de Chardin's theory of the noosphere (Teilhard de Chardin, 1959, p.180).

Phase 1 participant narratives and interview responses were a starting point for the themes addressed in the Noosphere. First phase drawings and interview responses, along with Phase 2 responses to the Noosphere inform the following themes for discussion in this chapter. Each of these themes will be explored in turn:

- **Noosphere** Philosopher Pierre Teilhard de Chardin theorised the noosphere as a sphere of collective consciousness that supersedes the biosphere. This theory of the noosphere as a fluid connection of communities was adopted in the early development of the Internet during the nineties by *Wired* writers and Internet technologists. What is the relevance of the concept of a noosphere in current participants' experience of cloud computing?

- **Knowledge clouds** First century Gnostics believed in salvation through transcending the material world and striving for higher knowledge in the clouds. The gnostic search for knowledge is re-enacted when connecting to the cloud, as users search online while cloud companies harvest behavioural surplus to predict future behaviour. What role does 'knowledge' play in cloud computing?

- **Identity** '*The dispersion of identity...*' [X]. Participants reported emotionally lighting up in response to likes and social connection online, while also feeling wary about always being available. The multiple phones and strands, and the layered construction of the bust was interpreted as a fragmentation of the identity. How do users make sense of their identity in the cloud?

- **Human machine** '*It's a humanistic kind of machine*' [U]. Through the Internet and the cloud, connection is available online, anywhere, anytime on mobile devices. Noosphere merges the biological and the technological as human capacities of memory and calculation are augmented by mobile smart devices in combination with cloud computing storage. How do users experience this combination of the human and the technological?

- **Empowering horizons** The horizontal construction of the Noosphere artefact tells a story of data moving through time, as users connect socially and share information. Overwhelmingly perceived as empowering, participants felt in control in this artefact as it provided the most positive cloud computing imaginary of the three artefacts. In the critical making process for the wider project, the Noosphere is the culmination as the horizontal composition offers a contrasting perspective on users' experience of cloud computing.

8.1 Drawing and Noosphere artefact

Inspiration for the Noosphere artefact was derived from an in-depth interview and drawing by participant [C] (Figure 52). The drawing shows a figure at the base of the page, facing away from the viewer. Branching dendritic lines radiate outward, similar to depictions of neurons within a nervous system. A third eye is contained in the head. Connecting lines in various forms radiate out from inside the central figure to external space: '*The signals might exist in us and our impulse of what we might send out*' [C]. Complex lines connect to a number of simplified smaller figures that resemble the user forms commonly adopted for computer interfaces. This same symbol that reduces the essence of a person to an outline of a torso and head was used in the participant drawing for the Factory artefact, although the Factory and Noosphere narratives otherwise diverge in several ways.

The positive narrative of [C]'s drawing resembled that of early Internet imaginaries, and expressed a hopeful perspective on cloud computing that differed from perspectives in other narratives. Esoteric and conceptual in their approach, this participant defined the infrastructure of the cloud as the current manner in which people

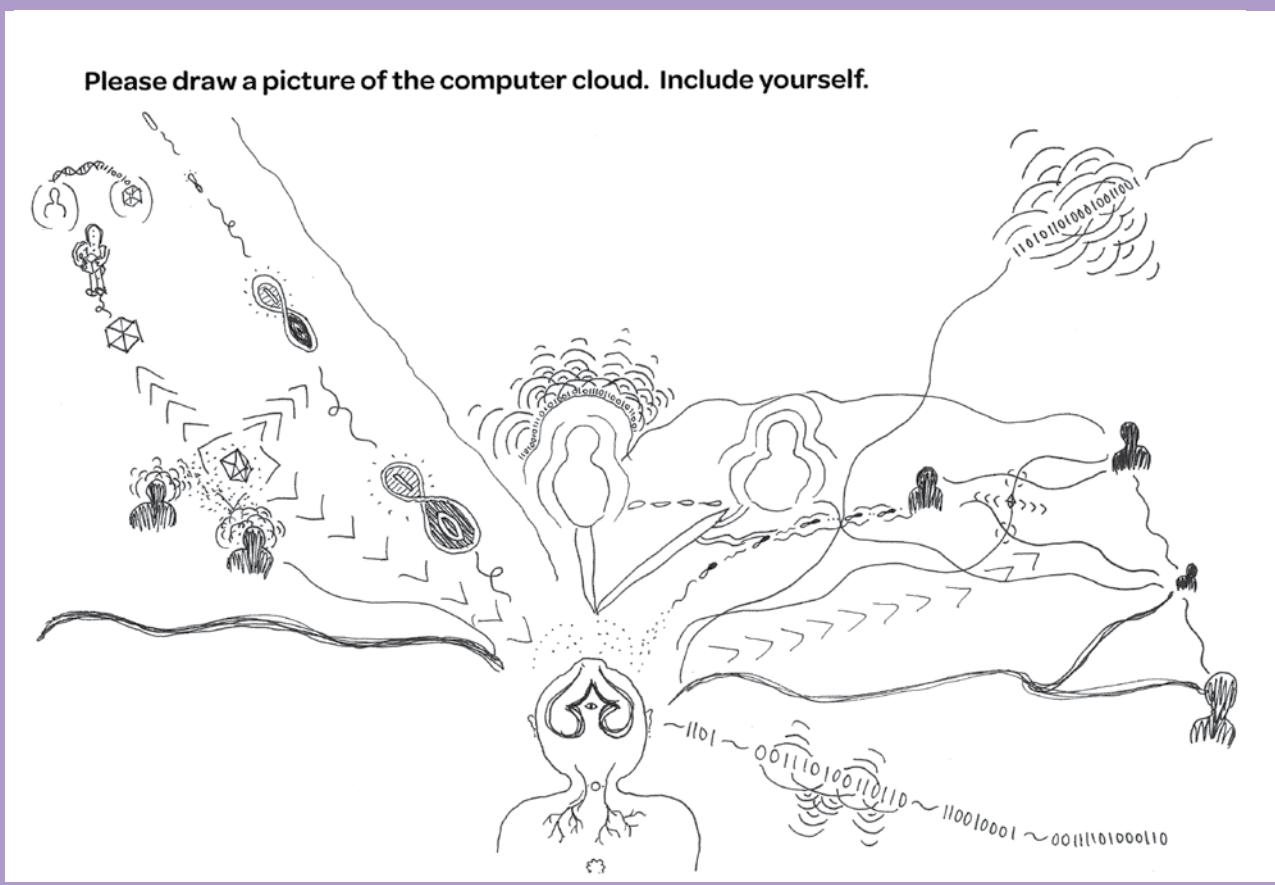


Figure 52: Participant drawing by [C], the inspiration for the making of the Noosphere artefact

connect through cloud computing. [C] projected that cloud computing technology would become increasingly seamless and allow limitless, enriching connection to others. This enthusiasm for the cloud, along with mention of '*a holistic organism*' [C], and '*collective intelligence*' [C] resonated with imaginaries of the early, publicly available Internet, evident in the work of John Perry Barlow, the founder of Electric Frontier Foundation and *Wired* magazine. Reviews of *Wired* content in the nineties also reflect a pro-technology, free, open, utopian viewpoint of Internet culture (Flichy, 2007, p.99; Streeter, 2011, p.119). It was unexpected to hear this vision, as it came from a young participant with no lived experience of the imaginary of the cyberspace of the nineties. As a digital native, participant [C]'s drawing and interview characteristically framed the Internet and the cloud as a defining part of [C]'s identity. This motivated me to sketch a similar bust figure that would challenge participants to identify with it and respond from that position.

Once I sourced a server cabinet for the Noosphere, I found that the internal space was deeper than expected. In response I took the opportunity to use the space to make a horizontal structure in contrast to the other artefacts, with fibre optic strands drifting out from the leading bust sculpture. My approach throughout my research was to make transparent the workings of the cloud – to make the invisible visible. Therefore, the use of transparent acrylic, as used in the Factory artefact was apt, as it exposed internal details and lent cohesion to the set of the three artefacts. When making the leading bust, I began to experiment with etched forms on the transparent acrylic layers.

I planned to create a sculpture that was more human and relatable, and less abstract than the user figurines in the Factory artefact. One Phase 2 participant related the Noosphere bust to the Factory users: '*The factory cloud is the inverse of what it should be, if you flipped it that is how the cloud might work*' [P]. This aligned with my intention in the construction of the Noosphere artefact. The empowered Noosphere user called for a more human, expressive, expansive form than the flat silhouette of the multiple users of the Factory. The narrative by [C] outlined an immersive cloud infrastructure that was a step towards a utopian vision of connecting without infrastructure: '*The technology will just blend into us and become part of what we carry around with ourselves all of the time*' [C]. The transparency of the acrylic evoked this permeability. This ideal of connection aligns with John Durham Peters' angelic communication that happens through thought, without devices or written words (Peters, 1999, p.74). A relevant perspective that was also adopted into the utopian imaginary of the Internet was that of philosopher and palaeontologist Teilhard de Chardin.

Teilhard de Chardin

Jesuit priest Teilhard de Chardin's theory of a noosphere references noos, the Greek word for mind, to describe a sphere of thought that grows denser as information proliferates and spreads across the surface of the globe. Teilhard de Chardin's theories were developed from geochemist Vladimir Vernadsky's concept of the Earth's atmosphere as a series of thermodynamic envelopes, or the biosphere, which includes living matter, and the geosphere, or the earth's crust (Vernadsky, 1998, p.91). Applying Vernadksy's thinking, Teilhard de Chardin proposed that the Earth would, through increasing human cognition, evolve a thinking layer – or noosphere – that ultimately leads to Omega point, a peak of consciousness. At the advent of the Internet some adopted the concept of the noosphere to describe the Internet. In a 1995 *Wired* feature, Kreisberg suggested that Teilhard de Chardin predicted the Internet 50 years before its inception in his vision of a noosphere (Kreisberg, 1995). While the theory of the noosphere was adapted from Vernadsky, earlier theories of collective intelligence predate this.

Islamic philosopher Avicenna conceived of a collective intelligence in the eleventh century (Spadaro, 2014, p.14). Similarly, as the electricity infrastructure grew, American novelist Nathaniel Hawthorne wrote in 1851:

> ... by means of electricity, the world of matter has become a great nerve, vibrating thousands of miles in a breathless point of time? Rather, the round globe is a vast head, a brain, instinct with intelligence!
>
> Hawthorne, 2014, p.193

The inclusion of Teilhard de Chardin's ideas into media theory is noteworthy, as he is not a media theorist writing on media in his time, but a theologian, palaeontologist and philosopher writing in the 1950s on the development of human consciousness. The association of noosphere to Internet theory was spread through Marshall McLuhan's interpretation of Teilhard de Chardin's noosphere concept in *The Gutenberg Galaxy* (McLuhan, 1962). McLuhan's disregard of the theological origin of Teilhard de Chardin's work contributed to the notion of the noosphere as a premonition of the Internet. Teilhard de Chardin's posthumously published *The Phenomenon of Man* (1959) was highly influential in ideas about the Internet (Krüger, 2007, p.141). Early entrepreneurs of the Internet applied Teilhard de Chardin's faith-based, holistic thinking to their grand vision of the Internet landscape for the nineties: 'the vast thinking membrane would ultimately coalesce into 'the living unity of a single tissue' containing our collective thoughts and experiences' (Kreisberg, 1995). This idea of a vast thinking membrane was echoed in participant [C]'s vision of the cloud as a '*collective intelligence*' [C].

The recurrence of characteristics of the noosphere illustrates the resilience of early imaginaries of digital technologies. When interviewing [C], a participant in their twenties, I was surprised to hear a narrative resembling the early Internet's noosphere theory in relation to cloud computing. Although cloud data storage has greatly increased users' access to information in a similar way as Teilhard de Chardin envisioned in his theory of a noosphere, the cloud differs from his theory of peak consciousness. Rather than Kreisberg's living unity of a single tissue, in the cloud the emphasis is on intelligence through the collection of user data. I argue that peak consciousness and collective intelligence contradict the siloed information collected from user interactions. While data storage, surveillance online and network traffic are consistently hidden from public view, the less complex nature of the early Internet inspired people to generate graphic visualisations of active Internet networks over time. One such initiative was Barrett Lyon's *Opte Project*, in which he used open-source systems to create images representing the entire Internet as a brain-like network.

Neural networks

The utopian noosphere vision of an egalitarian, free meeting space for diverse online communities has evolved into something more complex. In 2001 Electric Frontier Foundation's John Perry Barlow interpreted the Internet through Teilhard de Chardin's noosphere: '... the physical wiring of collective human consciousness. The idea of connecting every mind to every other mind in full-duplex broadband...' (Barlow, n.d.). An image that coincides with the theory of a noosphere, and one that participants identified with neural networks is the 2005 *Opte Project map* network depiction, pictured in 5.5. The irregularity and complexity of the *Opte Project* image appears organic and brain-like, similar to an abstract globe floating in space, or a vision of a global brain. When Phase 1 participants viewed the *Opte Project* image in relation to the cloud, the complexity and implied speed was overwhelming: '*It seems instantaneous how fast it spreads, just the idea that it's everywhere with or without your control. You might want*

it in one other location, but they could have it in 30' [L]. Rather than a communal joining into a collective mind, responses in Phase 1 spoke of intelligence in the cloud in terms of a power relationship: '*There's this intelligence up there that radiates down and there's us down here that worship this thing because of its power*' [A]. A sense of a lack of containment was mentioned by another participant:

> '*It feels like it's coming over your head, above your house, above the building, just because it's how it's been described. It's cloud, it exists up in the air. You don't need to know where it is, or how it works, as long as it provides the tools you're using*' [AE].

The current translation of Internet technologies into the cloud metaphor reinforces this imbalance of power and knowledge, as the cloud floats above the user. The loss of visibility felt by participants is something that early Internet pioneers did not envision for the Internet, but participants and users contend with today (Chun, 2005, p.2).

Transitioning from Teilhard de Chardin's influential early concept of the noosphere, I now focus on themes that were expressed in interviews, drawings and participant responses to the Noosphere artefact. The first theme I discuss is the view of clouds as a source of knowledge through the beliefs of Gnosticism.

8.2 Knowledge clouds

Gnosticism and the cloud correspondingly deal with issues of materiality, immateriality and knowledge as means for salvation. Gnosticism originated in the first and second century in the Mediterranean region, spreading to Persia and Northern Africa. There is no consensus among religious scholars on Gnosticism – some consider Gnostics to be Christian heretics, others see Gnostics as esoteric cultists. The beliefs of Gnosticism influenced a number of twentieth century thinkers, including Carl Jung and Jorge Luis Borges, particularly after the discovery of the *Nag Hammadi* codices in 1945. The history of Gnostic religion is long and complex and not the topic for this discussion – Gnosticism is discussed here in relation to cloud computing and communications media, rather than from a scholarly religious perspective. What follows is a discourse on characteristics of Gnosticism that I correlate with cloud computing, namely those of materiality, immateriality and the search for gnosis. In Gnostic belief salvation occurs through transcending attachment to the material world. In cloud computing transcending an attachment to the materiality of physical hard drives appears to be the object, though in reality the cloud comprises a substantial material infrastructure.

In the vision expressed in the Cloud Drawing by [C], connection to the cloud occurs through networks flowing from the central subject, transferring information both through DNA and binary code. Information travels along various connecting lines, growing and strengthening social connections, educating and spreading knowledge. This aspect of knowledge relates to both gnosis and digital communications facilitated through cloud computing. Links between Gnosticism and information technology are discussed by Erik Davis, who uses the lens of Gnosticism to understand the 'unconscious metaphysics of information', including religious impulses and their relation to digital communication (Davis, 1998, p.3.1). In Gnosticism, spiritual knowing supersedes the material world. Gnostics envisioned a God from which human beings were created. Through birth a divine spark from this God is locked inside each human being, to be released when gnosis – absolute knowledge – is reached, at which time the divine spark returns to the divine realm. The immaterial, divine realm is considered superior to all matter, while in contrast to this the material world was created by

a false god known as the Demiurge. This tension between the material and the immaterial is present also in the cloud.

Cloud computing is marketed as an immaterial, weightless solution to communication and information sharing through centralised cloud data storage. Seemingly immaterial, virtual computing replaces personal data storage, in a similar way that digital inscription replaces text on paper. The technology of the weightless cloud offers an alternative to the costly investment of powerful computer processors, high capacity hard drives and desktop software. The cloud is experienced by the user as an idealised 'immaterial' solution. Participant narratives in Phase 1 viewed the online space created through cloud computing as '*hubs to connect rather than paper trail, saving energy and resources*' [C]. This common assumption negates the substantial materiality of cloud computing infrastructure, as I discussed also in the Factory chapter. A comparable struggle with materiality and immateriality is repeated in Gnostic texts.

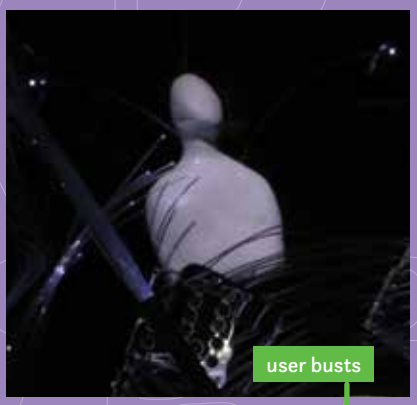
A fundamental creation myth of Gnosticism highlights tension between the material and the immaterial. Gnostics believe the material world is negative, therefore the aspiration of Gnostics is to awaken the divine spark by returning to superior, original, non-material realities. The aeon, a feminine religious figure named Sophia (meaning wisdom), who is part of the divine Pleroma, or fullness, secretly sets out to create something apart from the divine totality. Subsequently, she gives birth to the monstrous Demiurge and, being ashamed of this, she hides him in a cloud.

> She cast it away from her, outside that place, that no one of the immortal ones might see it, for she had created it in ignorance. And she surrounded it with a luminous cloud, and she placed a throne in the middle of the cloud that no one might see it except the Holy Spirit ...
>
> *The Apocryphon of John (The Secret Book of John – The Secret Revelation of John*, translated by Frederik Wisse. http://gnosis.org/naghamm/apocjn.html)

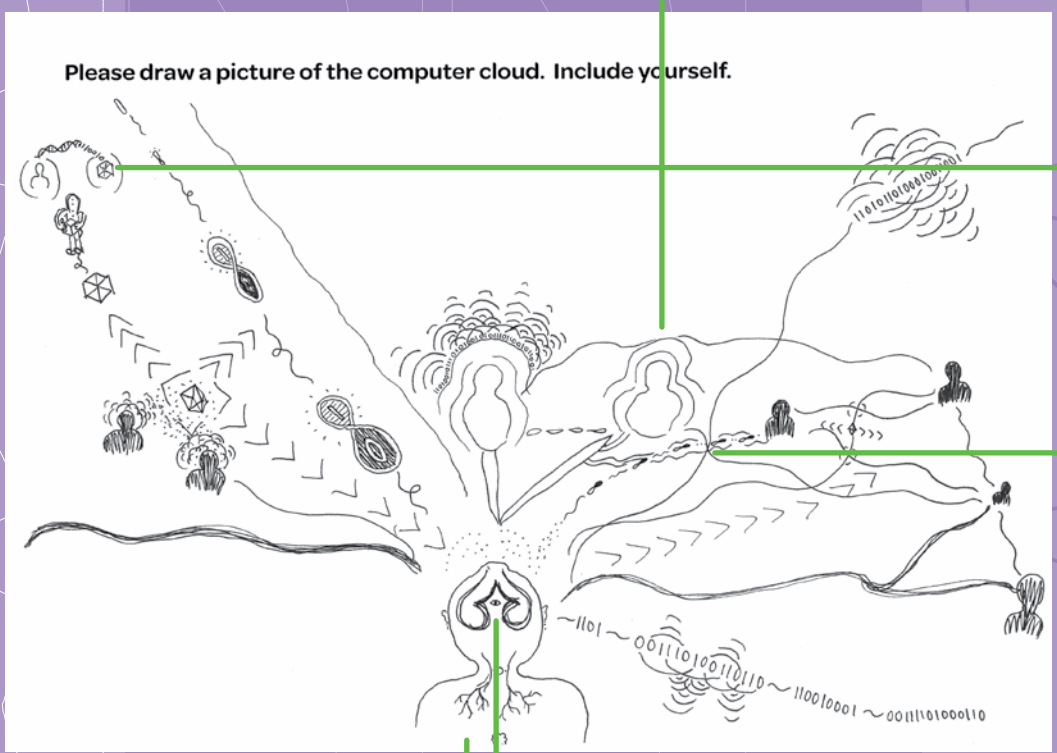
The Demiurge does not see his mother, nor anyone else, and concludes that only he himself exists. Isolated in his cloud, the Demiurge sets about creating the world and the heavens as a negative version of the Pleroma. The Demiurge creates a group of archons, or rulers of the lower world, that look after this restrictive, flawed material world. Consequently, Gnostics believe that the material world on earth is created by the Demiurge, and that salvation lies in the divine spark of wisdom that is enclosed within the flawed material world. I argue that the luminous Gnostic cloud parallels the cloud of cloud computing, a space that equally contains a negative representation, in this case of the material world. The Gnostic creation myth resonates with participant responses to the Noosphere as a representation of the cloud. Cloud computing similarly obscures practices of data surveillance, cloud infrastructure and environmental impact. An additional link to knowledge is evident in the use of the term archon to describe the ruling magistrates of the Demiurge's lower world.

Older meanings for the word archive referred to magisterial or public office. Related to this is the term archon, which correspondingly describes a magistrate or ruler. Derrida & Prenowitz define archons as the superior magistrates that not only guard and command the law, but also have the power to interpret and consign or classify the archive (Derrida & Prenowitz, 1995, p.9-10). The role of the archon and archivists epitomises the archival of data as formulated by Google in their mission statement: 'to organize the world's information and make it universally accessible and useful' (https://about.google/ n.d.). However, the process of consignation is subjective and not neutral, as decisions are made on what is archived and how content

Overleaf – Figure 53: Translation of participant drawing by [C] into the Noosphere artefact

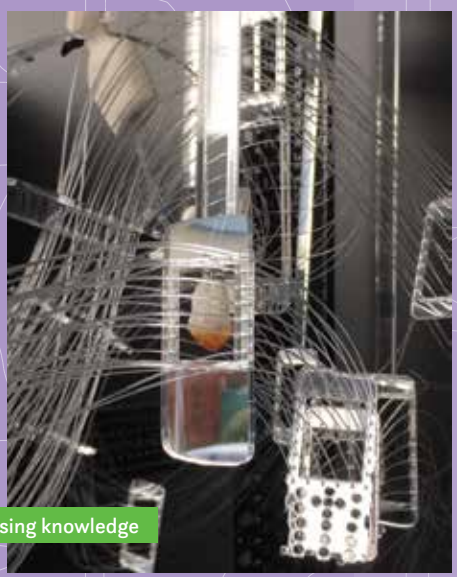


user busts



third eye

dendritic lines



crystallising knowledge

social media connection

is classified. Participants' experience of interacting with the cloud can be deceptive when they perceive the cloud as a neutral archive. One Phase 1 participant first compared the cloud to an archive:

> '*As a person I see it more as an archivist. If I want a piece of information, I'd go up to the person and say what I'd like, and they would give it to me … A clinical process, they would give me what I requested*' [K].

However, on further reflection they noted that they did buy recommendations on Kindle and experienced those recommendations as helpful, and that the cloud was therefore more than a neutral archivist. [K] concluded that the cloud '*might be like a friendly librarian, but when it doesn't work it's like an aggressive salesperson*'. [K]'s perception of the Internet as a reliable source of information aligns with statistical figures from WIPNZ 2017. This study found that 32% of participants thought that information online was mostly reliable, while 47% felt about half of the information on the Internet was reliable (Díaz Andrade et al, 2017, p.31). The subjectivity of the archival process is addressed by Derrida & Prenowitz in relation to Freud's archive, as they question whether to take Freud at his word when he '…presents his Moses as a historical novel' (Derrida & Prenowitz, 1995, p.11). On the subject of data, Lisa Gitelman refutes the idea of data as facts because this belies the subtleties of data and the framing that has always occurred in the capture and use of data (Gitelman, 2013, p.5-6). Daston states that an elusive ideal of scientific objectivity is based on a fear and avoidance of subjective framing in favour of subjectivity and the core self. Subjectivity is not to be controlled and denied in favour of objectivity, but rather that subjectivity is the self and that subjectivity is the precondition for knowledge (Daston, 2007, p.374). I proffer that the behavioural data gathered through cloud computing culminates in the flawed creation of archival clouds that are presented as objective knowledge. Users experience connecting online as gathering somewhat reliable information, yet data from those same personal user interactions is in turn gathered by online services and birthed into 'big data'. This contributes to machine learning and is used to market products and services back to users in the form of personalised search results and targeted advertising in social media feeds. The historical search for data provides context for the value placed on user data in the cloud.

Objective data

Orit Halpern outlines the underlying principle of the collection of data as 'if we know more, we can be more powerful and freer' (Halpern, 2015, p.9). The use of the term data can be traced back to the eighteenth century and the Enlightenment, when rational enquiry led to new ways of making sense of the world. Artefacts and data from colonial explorations were organised and analysed in institutional archives; libraries and museums were established to store this knowledge. These institutions represented reason and good governance for the powerful modern state. The current preoccupation with data, data visualisation and big data made possible through cloud computing further reflects an ideal of power through data (Halpern, 2015, p.13).

Google search results are not neutral or purely based on relevance, but are determined through paid advertising. The resulting personalised search results are targeted to individual users, along with advertising. This impacts on users in contradictory ways.

More connection, less connection

Access to information and endless choice online is not consistently experienced as advantageous. Users cognitively map their social connections to navigate their physical environment, resolving confusion, and empowering the individual (Chun, 2016,

p.39). As participant [C] stated:

> *'I feel connected, I feel like a social creature. It's a constant desire to share. It validates my experience and enriches people around me that we are able to come together and thrash out ideas of how we can improve our situation'* [C].

On the other hand, participants in Phase 1 expressed concerns about lack of control and lack of trust in the system. In Phase 2, after seeing my manifestations of Cloud Drawings in the form of the artefacts, a smaller proportion of participants reported having no problems with cloud computing. Many felt confused and separate: '*We are more connected, but actually we are less connected though*' [S]. While users search online and purchase goods, the process of big data captures momentary daily traces such as purchase and flight records and location data. As noted by one participant: '*the choices are overwhelming and play on our insecurities*' [C]. Chun portrays the neoliberal subject searching endlessly online, forever zooming and searching, and not ultimately gaining control (2016). Crawford describes a similar effect in her study of the Snowden Archives, as an overwhelming quantity of intelligence data confuses, causing analysis paralysis, as intelligence staff struggle to see the right connections and fear missing something (Crawford, in Poitras & Sanders, 2016, p.137). Meanwhile, data harvested from user behaviour is analysed to make users more predictable. Chun describes this as a move away from subjective narratives to actions that are analysed and knitted into a 'monstrously connected chimera' (Chun, 2016, p.40). To me the chimera of isolated captured actions of data analytics resembles the restricted, flawed cloud space of the Demiurge. This chimera stands in sharp contrast to Gnosis or higher knowledge. Themes of knowledge and mistrust were further highlighted by participants in Phase 1 comments about the characteristics of the cloud.

Cloud persona

At the close of the Phase 1 interviews, I asked participants to describe the character of the cloud as if it were a person. My intention was to uncover the personal characteristics that participants attach to their perception of the cloud. This process is comparable to the user experience practice of user personas, first popularised by Alan Cooper in the eighties, a technique that used to define a product's archetypal customer (Cooper, 2004). User personas are a widespread user experience (UX) tool for arriving at a better understanding of user needs. Personas can help clients and designers develop solutions through focusing on a description of a typical user as a real person (Holtzblatt, Wendell, & Wood, 2004, p.181).

In response to the question about the character of the cloud one-third of the group described the persona of the cloud as '*all-knowing*', an '*all-seeing eye*', '*a know-it-all*', '*a smart person who gives lectures*', '*an archivist*', and '*insanely smart*'. This repeats themes explored in 8.2 regarding the cloud as a source of knowledge. Several mentioned qualities of neutrality, variously portraying the cloud persona as a '*blank slate*', '*dispassionate*', and about '*information for information's sake*'. This is descriptive of [K]'s neutral archons guarding cloud archives. Qualities of neutrality would be desirable attributes for caretakers of one's personal data. Less desirable is the lack of trustworthiness expressed by other participants. While in the first part of the Phase 1 interviews several participants dismissed the importance of tracking online, after dwelling on the topic of the cloud, participants did raise concerns about trust. In answer to the Phase 1 closing question about the cloud persona one participant stated that there was '*something just slightly off about them, they want some information, they're not being open about it*' [I], '*Shallow*' [B], '*a tempter, give me your soul*' [H]. This reflects other research on trust in cloud computing in the aforementioned

2017 World Internet Project, in which 42% of participants reported concerns about private corporations violating their privacy online, and 72% actively protected their privacy online (Díaz Andrade, Hedges, Karimikia & Techatassanasoontorn, 2017, p.24-25). This reveals a tendency of users to underreport privacy concerns. The confusion about cloud computing expressed in Phase 1 was not resolved after seeing and experiencing the physical artefacts, but it did provoke participants to think about privacy issues.

Comments from Phase 2 participants when viewing the Noosphere showed confusion about where information went and what happened to it:

> *'...can I recall the information at any time?'* [B]

> *'If this person were to create something, it would just travel on and on and on, through all those people's consciousness, who would retweet it or repost it or whatever'* [E].

In response to the cloud, participants were not only confused about cloud computing, but their own significance and sense of identity was disrupted.

8.3 Identity

Definitions of identity have evolved in response to changes in society, culminating in the vernacular of identity expressed by participants in this research. A traditional Christian era meaning defines identity in relation to the soul, while Jaime Banks summarises the postmodern identity as emerging from the concept of the self as external to the body, and revealed in fleeting, societal interactions that are determined by complexity and flux, resulting in the self as a network of networks (Banks, 2017, p.421). While Turkle argued in 1995 that exploring multiple identities online was a positive thing, Banks contends that the postmodern self can lead to a loss of the 'essential' self, through liberation of the self from physical embodiment (Banks, 2017, p.430; Turkle, 2017, p.2). For computer users and participants as the subject of my project, identity is defined by a variety of experiences off and online, in the workplace, on social media, through email, gaming and informal messaging. I suggest that liberation from a singular identification with the body through connecting with others online and creating identities can result in both a sense of liberation and a sense of a loss of self. Both reactions were evident in participant responses to the Noosphere.

Always on

Overall, Phase 2 participants felt the Noosphere narrative was positive and human-centric. Many felt that social media kept them connected, especially with family and friends overseas. The originating narrative by [C] lauded the possibilities for connection and the growth of ideas through sharing and documenting online. Banks' multiplicities describe the challenging nature of identity through online communication as affected by multimodality, multiplexity and multispatiality (Banks, 2017, p.422). Drawing on Latour's actor network theory (ANT), Banks defines the first of his multiplicities – multimodality – as representative of the identity as free of embodiment. The multimodal identity emerges from connections to discourses and systems, and may include material or immaterial objects (Latour, 2005). Multiplexity is the second quality, which includes complex relationships with different kinds of things. The third quality is multispatiality, which in the context of digital spaces includes atemporal experiences, outside of geography, materiality or an audience. Thus, 'the self is a network of many different kinds of things that are linked across spaces' (Banks, 2017, p.423). Outcomes of these complex multiplicities include the trolling and insults that

occur online and a tendency not to seek consensus but instead to reinforce one's views. This contradicts the somewhat naïve narrative of the Noosphere that participants described in interviews about the artefact, painting a less hopeful picture than the Noosphere artefact. Responses from many participants in both Phase 1 and Phase 2 interviews showed a sense of freedom due to the convenience of connecting to the cloud regardless of location. Yet Barlow's vision of connecting every mind to every other mind is read by many as a mixed blessing (Barlow, n.d.). Participant [K] stated that cloud computing '*adds value to social connection*' [K], while they also felt '*unease. Loss of privacy. I am always available whenever it suits others*' [K]. Disillusionment in relation to social media was verbalised as follows by one participant:

> *'Nowadays you open Instagram, and everything gets lost in the mix. If I put something up that really means something to me, it just gets lost. So, identity gets skewed and lost in this matrix'* [K].

The social aspects and data sharing capabilities that are part of the Internet today were conceived in the development of the Semantic Web, or Web 2.0. Web 2.0 prioritises rich user experiences, integration of data across systems, and flexibility. Cloud computing is an integral part of the Semantic web in the efficient provision of lightweight data storage and retrieval. You, the individual user, rather than community, are the target for Web 2.0, as participatory computing through user-generated content is prioritised (van den Boomen, 2014; Chun, 2016). Here Teilhard de Chardin's concept of shared knowledge in the noosphere is framed as a profitable business model. O'Reilly speculates that 'an essential part of Web 2.0 is harnessing collective intelligence, turning the web into a kind of global brain…' (O'Reilly, n.d.). This has led to a flourishing of user data on social media, though the vision of the Semantic Web 2.0 has soured for some.

The ubiquity of online connection has led Geert Lovink to suggest that a digital divide 2.0 currently exists, in which being offline is a luxury the global poor cannot afford (Lovink, 2019, p.36). An early critique of the Internet, the digital divide was first described in U.S. government research in 1998 (King, n.d.). Lanier argues that distraction through broad distribution of digital services is partly due to the free distribution of apps in exchange for personal data (Lanier, 2018, p.105). Similar to Turkle, Metahaven declares that viewing social media displaces time and causes a loss of time, delivering a social experience that requires users to present themselves as simplified, reduced versions of themselves (Turkle, 2017, p.185, Metahaven, n.d.).

As a solution to the constant stream of cutup, juxtaposed images on social media, Metahaven suggest a return to Tarkovsky's cinematic slowness, while Lanier et al suggest unplugging from social media for 10 reasons that range from the political to the social to the personal (Metahaven, n.d., Lanier, 2018, p.5). It is important to provide context for Lovink's digital divide 2.0. Worldwide, digital services continue to be unevenly distributed along social and political lines, as overall Internet use in poorer countries, such as Egypt (38%) and Tunisia (58%), contrasts with that in the UAE (96%) and New Zealand (94%) (Cole, Suman, Schramm, Zhou, Hah, Hernandez, Kim, Mei, Robbins, & Sones 2019, p.17). I argue that it is not only the excess of connection that Lovink describes as a luxury of the global rich, but, as Cubitt points out, the global poor suffer much more from the pollution of the IT industry (Cubitt, 2017, p.14). Lovink's digital divide 2.0 is a luxury for those with available access, whereas the digital divide affects far more people worldwide. Responses from participants explored the level of awareness of personalisation.

Personalisation

Although participant [K] sees Google and the Internet as a reliable source that is epistemically significant when searching Google, personalisation in search results threatens the objectivity of the search results (Simpson, 2012, p.427). The personalisation process is illustrated in Amazon and other companies' recommendations, such as 'people like you also bought...'. This illustrates Chun's argument that Web 2.0 is about 'you', people who are like you, and the people who like you (Chun, 2016, p.16). Ridgway defines personalisation as the currency of being online, because user data is utilised by marketers in exchange for user engagement (Ridgway, 2017, p.380). For participants, targeted recommendations were considered to be both helpful and annoying: '*I buy recommendations on Kindle, so I'm not invulnerable. If it's done well enough, we don't think it's advertising, if done badly it's advertising*' [K]. It is all about how it is done. Simpson maintains that while personalisation can engage users with familiar content, it also caters to, and reinforces, confirmation bias. This is also called the filter bubble effect, whereby we tend to align our opinions with facts that back up what we think rather than taking on ideas that conflict with our established beliefs and opinions (Pariser, 2011, p.66; Simpson, 2012, p.438).

Figure 54: Exploratory sketch on the concept of the filter bubble

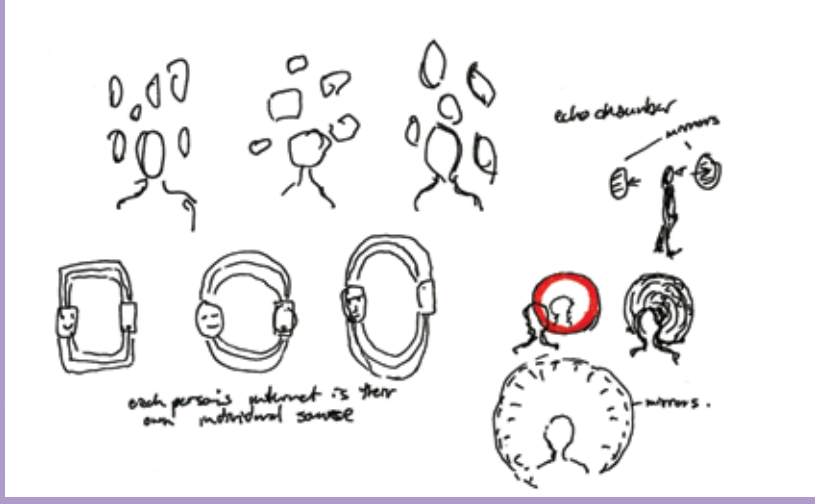


Figure 55: Exploratory sketch on the concept of the personalisation

Personal bubbles

Filter bubbles operate in social media and search engines by feeding stories that are similar to those that users have previously liked, or match one's location or search history, effectively creating ideological bubbles. Eli Pariser describes the filter bubble as an identity cascade (Pariser, 2011, p.127). This isolated ecosystem approximates the cloud of the Demiurge – an insular environment separate from other points of view. Enclosed within his cloud, the Demiurge is unaware of an outside world and believes he is alone. This parallels the user experience with Google's search engine, where individual users like [C] believe they are part of a homogenous community. Users are often unaware of the fact that the data they view on search engines differs from that which others view. Most Phase 2 participants responded positively to the imaginary of the Noosphere and the connection it represented, demonstrating a lack of awareness of this type of personalisation: '*Connecting through technology connects you to other humans or users, and it allows information to flow back to you*' [SR]. Phase 2 participants tended to be more aware of the negative outcomes of personalisation than Phase 1 participants: '*If you can control what people see and read, and form their world view, you have a lot of power. So potential for big power imbalances*' [N]. The precise extent and processes of personalisation and data surveillance was unclear for all participants, including the IT professionals, throughout the research. This personalised vision of the Internet is one I wanted to address in my artefacts, so the idea of a filter bubble as a concept of a space that reflected only each user's ideology and opinions, is one I explored in early sketches. Upon viewing some of the complex and subtle mirror artworks by Olafur Eliasson (Figure 54 and 55), the idea of using mirrors inspired me to incorporate shards of mirrors in reference to online identity and social media. The use of mirrors in Noosphere also referred to the digital organising metaphors of windows, frames and screens (van den Boomen, 2014).

Mirrors and screens

As a device often used to connect on social media, and most visible in public spaces, the smartphone epitomises ubiquitous mobile computing. In Noosphere the numerous phones represent social connection to the cloud. Arguing that media are extensions of ourselves, McLuhan suggests that we become numb to seeing media as things in themselves (McLuhan, 1994, p.46). This occurs when using mobile devices – the material presence of the smartphone disappears, and we see only the images on the screen rather than the phone itself (Nesselroth-Woyzbun, 2013, p.119). The transparent screen denies its frame and materiality by revealing the image that is visible through it (van den Boomen, 2014, p.110). Van den Boomen points out the ambiguous, deceptive nature of transparent media, as a mixed metaphor occurs in digital devices. For the user the interface is the visible boundary of the personal experience of cloud computing – beyond the interface is the start of the black box. Our devices are 'black boxes posing as transparent screens', as the interface hides the machinery and outsourced labour within (van den Boomen, 2014, p.108). Bolter and Gromola describe the user-friendly graphical user interface (GUI) as a transparent window that delivers seamless immediacy (Bolter & Gromola, 2003, p.44). Users generally identify the screen as the computer itself (van den Boomen, 2014, p.112). This was confirmed by participant [B], who remarked that the screen they drew in their Cloud Drawing represented their computer. Within smartphone technology, immediacy is enabled through speed of connection, high sound quality, high screen resolution, and apps that seek to create the most authentic and lifelike experience possible. In cloud computing the ideal of immediacy is aimed for through its seamless operation and convenience, 'anywhere, anytime, and one click' (van den Boomen, 2014, p.104).

The seamless, immediate process of an instant connection from phone to phone is the subject of Noosphere: '*There's a quickness to it, the way light travels through it, like the speed of light*' [A].

On closer inspection, the use of familiar IT components is evident in the Noosphere artefact. This was inspired by the work of Formafantasma (see 5.2). Recreating forms from familiar devices was a way to encourage viewers to reflect on their use of cloud computing, smartphones, social media, and content shared online. An example of this is the use of crystals: they initially drew the viewers in, and secondly provoked the viewers to think about the environmental impact of mining precious metals for the manufacture of digital devices and cloud computing servers. Experiments with materials for the crystals further distilled my aesthetic direction for the artefacts. I also reference temporality, through depicting content shared through devices over time, implying also the constant cycle of obsolescence over time.

Users maintain multiple online identities and find reassurance and validation through social connection online (Turkle, 2017, p.302). Figures contained in the Noosphere artefact symbolise two such online users as smaller versions of the leading bust (Figure 58). By displaying pieces of phones instead of individual phones, I refer to the multiplicity of identities that users create online and suggest these shards may be part of users' multiple identities. Participants had varied responses about interactions and reliance on smartphones after viewing the phone forms displayed in the Noosphere artefact. One participant noted the preoccupation with their phones: '*I find it funny, the absolute obsession with their phone*' [S]. Though later, the same participant noted their own attachment: '*I missed the bus and walked all the way home for my phone when I forgot it*' [S]. Another participant was more explicit about the inclusion of mirrors in the Noosphere: '*The mirrors could be me thinking: what are people thinking of me, going through my photos? The constant need for approval getting more and more likes*' [W]. Attachment to devices is taken one step further in [C]'s suggestion that cloud technology will be intuitively operated and not separate to our bodies in the future.

8.4 Human / computer

Fundamental to the narrative of the Noosphere is the theme of merging the human and the technological. Supplementary extensions of the body were addressed in a Phase 1 response: '*People will start using these sites more unconsciously in place of actual memory, because it's easier, it's there and impermeable supposedly*' [T]. This recalls Vannevar Bush's theoretical Memex, where memory and data are stored externally in the form of an indexable Memex as 'an enlarged intimate supplement to his (an individual's) memory' (Bush, 1996). In participant [T]'s drawing the subject receives data from within the black box above his head, where existing data is captured, shared and analysed through algorithms, and fed back to the user's mind: '*the algorithms of the things the algorithms think you will like, ... like media, animal pictures, other people's thoughts*' [T]. This data is not memory in the intimate, human sense, but data determined by algorithms to be of interest to the user, that are then fed back to the user.

I sought to allude to a blending of human and machine through weaving and embedding technology within the human forms of the Noosphere. I initially sculpted smaller heads from plaster as models for the larger bust. These sculpted heads were later used as figures for the inside of the cabinet. The aesthetic of the physically sculpted smaller heads purposely contrasted with the technological aesthetic of the main form, highlighting the differences between the natural and technological. The plaster heads were simplified, natural forms, rounded on all sides, positioned at

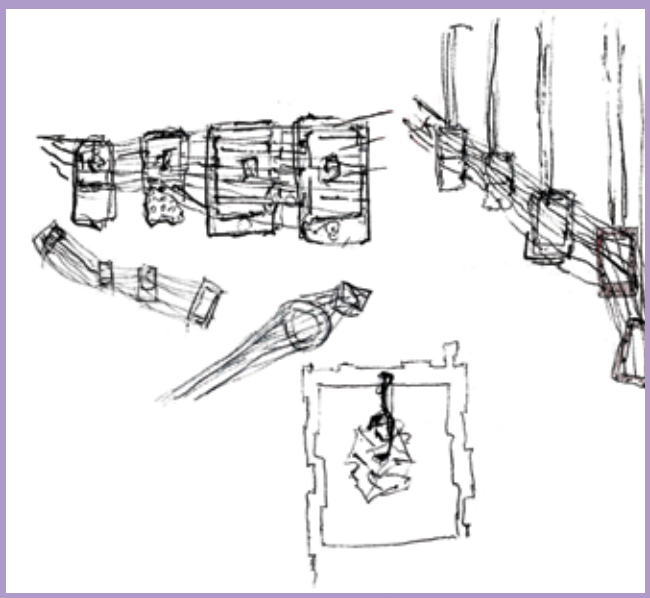


Figure 56: Phone and crystal sketches

Figure 57: Open source bust form

Figure 58: Individual smaller busts with mirrors

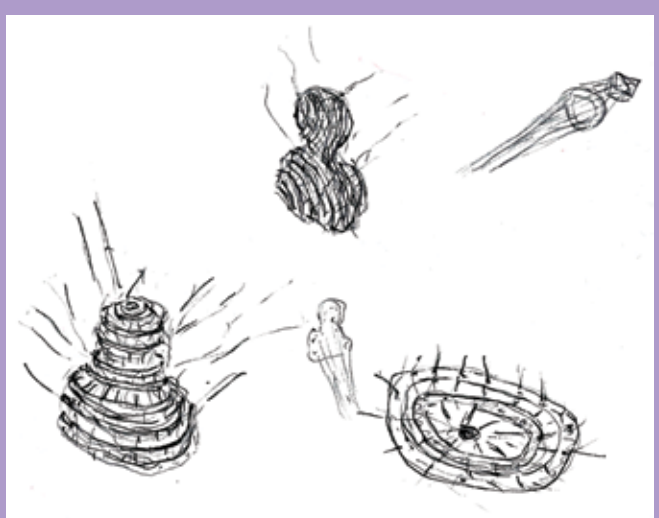


Figure 59: Concept sketch for layering and lighting construction of the leading bust

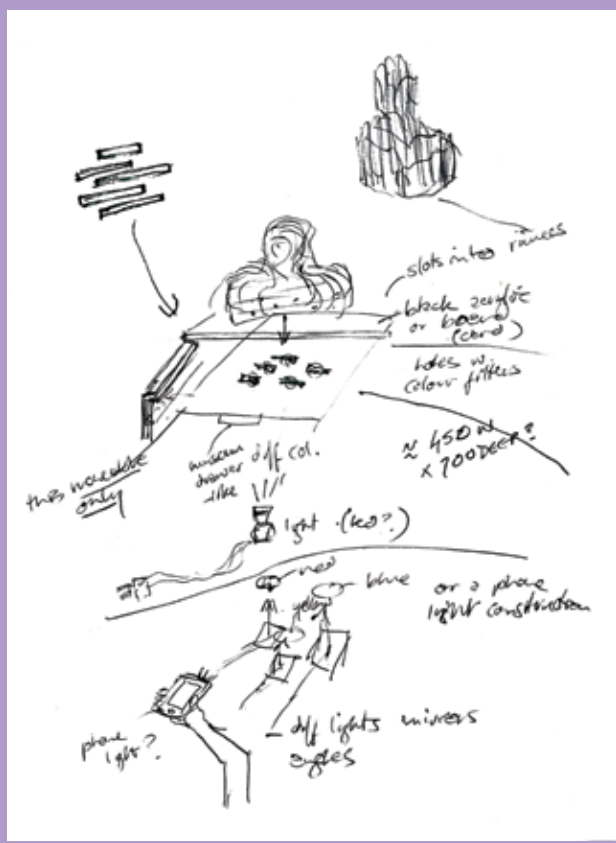


Figure 60: Sketches for integrating light within the bust form

Figure 61: Scaled bust for testing of a light drawer

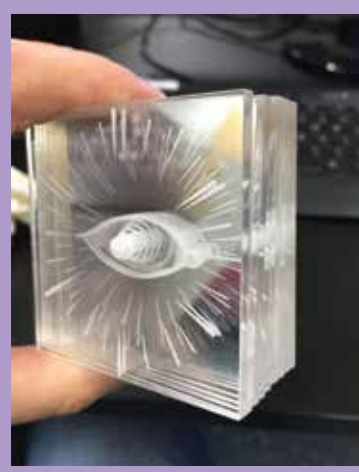


Figure 62: Testing layered acrylic for the Noosphere eye

varying angles, connected through wires, and floating rather than grounded. In the drawing by [C] these elements symbolised not only people receiving and sending messages, but also an active, creative process of clouding that affects others:

> *'These shapes between these two people (points to two people with a connecting line between), how that ripples, what they create, affects me as an observer, as I am connected to them also, as are others. These people are 'clouding'! They're in the present, rippling out'* [C].

In an effort to provoke viewers' responses to the idea of the human and technological aspects, I incorporated fibre optics into the main bust. As with the Factory artefact, the glowing lights of the fibre optics symbolise the transfer of data. After considering various forms (vertical layers or a series of profiles) I decided on a layered construction of acrylic (Figure 59). The layering aspect of the Noosphere relates to Bratton's concept of global computation stacks, the computing term 'layers of abstraction', as discussed by Hu, and Lovink's Stacktivism (Bratton, 2016; Hu, 2015, p.XXV; Lovink, 2019). Stack has long been used in IT to describe:

> a set of registers or storage locations which store data in such a way that the most recently stored item is the first to be retrieved; also, a list of items so stored, a 'push-down list'.
>
> OED, n.d.

Lovink also argues for an activism approach through Stacktivism – an awareness of multiple vertical layers of infrastructure online: private, state and public (Lovink, 2019, p.74). While forms presented by Bratton and Lovink divide the Internet into vertical stacks and types, I instead chose to structure the Noosphere imaginary of cloud computing in horizontal stacks. My aim was to unify the technological with the cloud metaphor, while referencing a fragmentation aesthetic, exploding elements of the original drawing on the horizontal plane.

After iteration, sketching and careful planning, I cut the individual pieces for the leading bust from transparent acrylic sheets, enclosing etchings of nerve-like dendrites and a third eye within. As sketched in Figure 60, I planned to place a light source beneath the head, directed upwards through the head into the cabinet, mirrors and contents to signify connection. Initially I hoped to incorporate copper or fibre optics inside the bust, within the etched layers (Figure 59). The integration of a type of receptive facility within the body aligned with [C]'s narrative: '*The technology will just blend into us and become part of what we carry around with ourselves all of the time*' [C]. When researching the forms for the dendrites I realised that the lines resembled acupuncture body meridians – internal nerve networks that carry an energetic, electrical charge through the body. This in turn recollected early Internet metaphors of the Internet as a neural network. After testing I ultimately attached the lighting to the outside of the leading bust. I joined fibre optics to the LEDs, and threaded these through the mirror phones.

Bodies and networks

The internal networks drawn within the head by [C] in Figure 52 resembled both a nervous system network and a telegraph network. Van den Boomen classifies the nervous system network metaphor as a natural network that develops organically through adaptation and self-organisation, while the constructed human-made telegraph network is built through imposed standards and rules (van den Boomen, 2014, p.172). Applying these terms, the lines of the Noosphere resembled a natural nervous system aesthetic, though it was a constructed form resembling a telegraph network. After iteration during the critical making process I attached wires to the outside edge of the

bust. The fibre optics radiated out through the phone forms and smaller heads. After completion, associations to bodily networks were made by Phase 2 participants who experienced the body meridian lines in the finished artefact as natural and positive.

The merging of technology within the human forms depict an acceptance of embodied technology, and a positive personal experience of communicating online. Donna Haraway proposes that rather than dehumanising technology we should accept that we are all a combination of technique and flesh – cyborg (Haraway, 1991, p.150). To challenge participants about the combination of flesh and machine, I incorporated a smartphone that sits in a drawer underneath the bust form, allowing the participant to illuminate the various layers of the bust. My expectations were that participants would reject the strands within the human forms. Reflecting on Haraway's cyborg, Flichy suggests that the hybrid of machine and organism is also a hybrid of material reality and imagination, and that this is true of both virtual reality and the Internet, as they interact with both technology and imagination (Flichy, 2008, p.152). I was surprised to find that participants appeared to agree with Flichy: '*This one is the heart, the mind and data. The phone going into my chest is charging me up emotionally and mentally*' [P]. Participant's positive experience of the technology within the leading bust appeared in part to be due to the empowering interaction of moving the drawer back and forward to control the light: '*Feels quite powerful in a sense, with the active act of moving something I feel more in control*' [G]. In the physical act of sliding the phone drawer, users felt in control, in the same way that smartphone users find the haptic interactions with their phones both rewarding and distracting. As a result users can spend more time than intended on their devices. The blend of human and technological aspects in the making of the Noosphere parallels associations of nature with the data server storage.

Nature and cloud technology

Nature based metaphors appear to soften the perception of cloud computing and the accompanying collection of data through cloud computing. If we consider what is presented and what is de-presented following Lakoff and Johnson's conceptual theory of metaphor, O'Reilly's metaphor of harnessing collective intelligence for the utilisation of personal data tells the story of a wild, free, living thing (O'Reilly, n.d.). In the act of harnessing, the free thing is tamed, disciplined, and transformed, taking the power of the untamed (data) to become part of a system (big data) (Lakoff & Johnson, 1980). The later term of harvesting, that is used by participants and others more commonly today, implies a preceding act of planting a seed and monitoring a plant's growth. The moment of harvest describes how a full-grown plant or animal is taken as part of a cycle of consumption. In an online context, as outlined by van den Boomen, harvested user-generated data is used to make money (van den Boomen, 2014, p.165). The term harvest therefore conveys a predetermined moment in the migration of personal data in the cloud that users may or may not be aware of – personal data was never going to be private. In the use of harvesting, from the Germanic Frisian herfst, meaning autumn, a nature-based growth cycle is presented that includes an inevitable cycle of the seasons. A corresponding sense of inevitability was expressed repeatedly in participant comments, though noticeably less in response to the aspirational Noosphere artefact than in response to the Surveillance and Factory artefacts.

Cloud immersion

The idea of participants' immersion in the cloud arose in answer to a promotional image used by Amazon in 2017 to promote its APN Competency Program (W-systems, 2020). I included this image in the Stimulus Images in Phase 1 as an illustration by the industry of a user who appears to be part of the cloud. Due to the rotation of

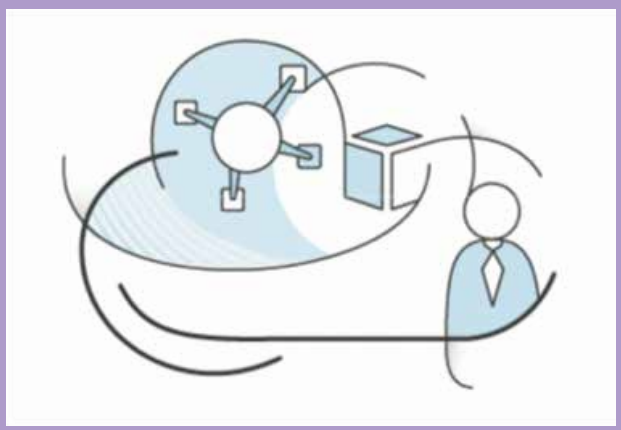


Figure 63: *APN Competency Programme*. https://www.w-systems.com/products/aws/solutions/

content on Amazon's website the image is no longer viewable on the current site. This is indicative of the fleeting nature of online content. The generic nature of the image is apparent in the current use of the image to symbolise Amazon's SaaS offerings (https://aws.amazon.com/partners/apn-portal/). In Phase 1 interviews, users were asked to respond to the image without explanation of the original context of the image. Most interpreted this image as an enclosed form, '*more like a bank vault*' [Z]. An ambivalent response came from one participant as they interpreted the person as part of the cloud: '*The person is in the cloud, I don't like the being in the cloud thing. That looks like it's encompassing people*' [AB]. Another participant initially stated: '*I am not in any way a part of the cloud*', later they concluded '*The cloud would require me or any person to function... so I guess in that way I am part of the cloud*' [O]. The resistance to being part of the cloud shows a distancing from the technology, and rejection of any implied dependency or intrusion. Others suggested in their interviews that they were a part of the cloud, expressing curiosity regarding duplicate identities that exist in the cloud:

> *'I'm in the cloud with devices ... part of me exists in the cloud.'* [E]

> *'When I think of it, I think of it as a cold, clinical version of my personality that exists in that cloud, that I don't necessarily relate to, but I witness by using these things'* [A].

Readiness to accept multiple identities aligns with Banks' proposal that the postmodern self is a network or assemblage of identities, exemplifying the fragmentation of modern life. The idea of a fluid network of identities fits with participant experiences of cloud computing: '*If you are your information, then you are the cloud also*' [P]. Banks' theoretical model further states that the fragmented, distributed nature of the self must rely on phenomenological work that limits generalisation and allows for complex definitions of self (Banks, 2017, p.433). This relates to my approach in my investigation of cloud computing, as I sought to integrate and understand users' fragmented identities through narratives of their subjective experience of cloud computing.

8.5 Empowering horizons

The narrative from [C] emphasised communication sent onwards through social networks over time. The narrative aligned with Steyerl's musings on the horizon as representing an expansive future.

> *'Earth is past, where we bury things, where entropy happens as part of transformation process, and sky for us is out there, it is the horizon, ambition, hope, progress and future'* [C].

I gave form to this temporal aspect through the horizontal composition of the artefact. I was inspired by Altmejd's construction in artworks such as Flux (2014), that contain series of morphing shapes made from acrylic forms in various sizes and connected by fibres (Figures 4 and 5). The threaded forms, representing objects transforming and changing over time, share a temporal quality with [C]'s narrative of data moving from one user to the next through devices, aided by the cloud. I first threaded laser cut sequential acrylic forms with fibre optic strands. Later I cut away the insides of the shapes to form a tunnelled interior space, similar to a crafted woven eel or fish trap. For the phone representations I experimented with incorporating actual phone components. When these proved to be unstable, I instead cut phone forms out of mirrored acrylic, including holes around the central frame for threading. The consistency of forms and material brought to life the negative space within the phone frames as a carrier of data from one device to the next, '*Phones are the gateways to other people*' [F]. These empty frames recall Alberti's Renaissance window, the tool that marked the invention of perspective in painting. Through the means of Alberti's frame, the artist's subject is contained and separate from three-dimensional space, as the frame places the three-dimensional depth inside a two-dimensional frame (van den Boomen, 2014, p.108-109). What does this mean for digital devices such as smartphones?

Frames and windows

David Bolter and Diane Gromola suggest that digital artefacts shift between the transparency of windows and the reflecting quality of mirrors (Bolter & Gromola, 2003, p.73). The transparent window is a device that disappears as the user is immersed while using the digital device, since the user looks only at what is represented within (van den Boomen, 2014, p.114). The mirror as a digital device reflects each user, so the view differs for each individual, as they are subject to the personalisation of Web 2.0. Although windows are material objects, van den Boomen reasons that windows hide their materiality, producing transparency, whereas the mirror, through reflection, affords a view of social mechanisms. She suggests that smartphones are best described as mirrors:

> When you look at them, you see yourself, your life, your diary, your contact, your mail, and your social network ... various apps that provide you with daily tools.
>
> van den Boomen, 2014, p.114

As the maker of the Noosphere drawing, [C] agreed on the mirroring function of digital devices as a reflection of their identity:

> *'It stores things in the past in a way that liberates me from the present. Like a journal. A way of tracing your roots and where you belong and what has shaped you. Only in the future can you really reflect on yourself. ... Taking a step back and getting a big picture'* [C].

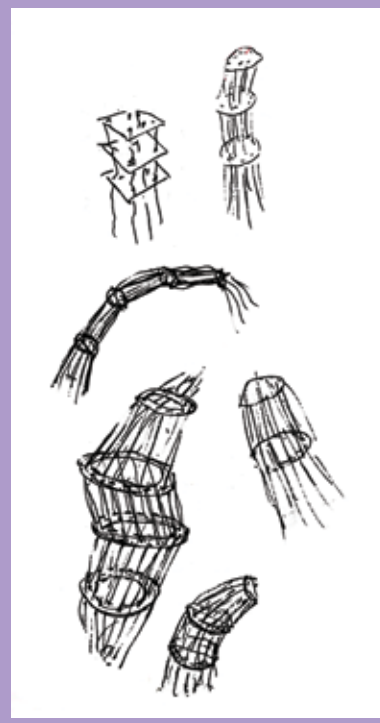


Figure 64: Studies for connecting forms

Figure 65: Phone frame testing

The reference by [C] to temporal aspects of online data in part drove my decision to adopt the horizontal composition. [C] contended that personal data online provides perspective after time, only then can they step back from the containment of Alberti's perspectival window and see the totality of themselves. I argue that the record created through digital devices is consistently framed in complex ways by the identities created within each app or platform a user participates in. Banks states that through maintaining different identities and devices the online self becomes a network in itself (Banks, 2017, p.419). Applying this thinking, the various identities in [C]'s online platforms are not directly representative of the singular identity of that person, but versions of the self, seen through the lens of each app, collectively making up one individual. I contend that digital engagement socially, through cloud computing, creates a form of mirror as users like [C] explore their identity over time. Van den Boomen states that there are only 'mirrors disguised as windows' (van den Boomen, 2014, p.114). Either way, the digital frame is always present, though it may seem to magically disappear (Bolter & Gromola, 2003, p.42). These qualities of mirrors and frames are relevant to the phone representations I made for Noosphere.

The phone frames provide both reflection through the materiality of mirrored acrylic, and transparency through the empty frames. The viewer is made aware of the continuing transmission of digital messages and posts flowing through time, while the content of the messages is downplayed in the empty frame, particularly when exhibited in the dark. This reverses the usual experience of online interfaces in which the frame disappears, while the screen immerses the user. During the critical making process, I observed how phone design had evolved to become increasingly complex technologically, while correspondingly, processes of translation and mediation have become more transparent. An example of this is the display of the iPhone 6, which includes a one-millimetre frame that, when switched on includes a black frame covering around 10% of the glass surface. Whereas the latest iPhone 11, similar to many other smartphones, contains a barely perceptible two-millimetre black frame of visible area, as the home button has followed the previously separate keyboard and been absorbed into the touchscreen. This foregrounds a striving to remove any reminder of a frame, instead emphasising transparency. Many participants viewed the linked phone shapes as creations going out into the world over time, living their own life:

> *'When it gets filtered out to a certain extent, it changes, I don't have any recourse, it becomes a living document'* [F]

> *'So it's different thoughts, feelings, ideas, memes that will just keep being reposted'* [A].

Participants interpreted the fibre optic cable connected phones as fluid and communication driven:

> *'A genuine cloud because it is moving without any support or structure, a spontaneous network between people and technology'* [Q].

This participant saw the Noosphere cloud as comprising both a social network and a technological network (van den Boomen, 2014, p.171).

Layer stacks

The merging of mystery and analysis related respectively to the poetic and analytical aspects of the cloud. I had these polarities in mind when constructing the leading bust.

Layering is a repeating theme that arose in investigations of cloud computing both in the infrastructural IT terms and in relation to the hidden aspects of the

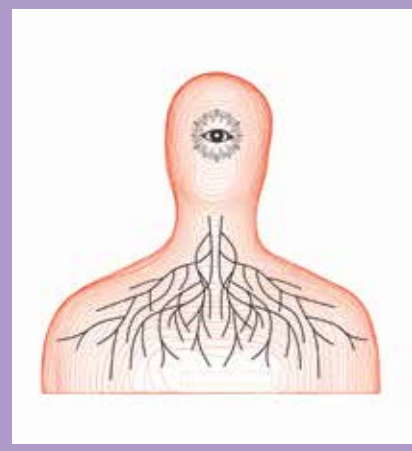


Figure 66: Digital working file for layered leading bust

Figure 67: Noosphere in progress

Figure 68: Collating the layers for the leading bust

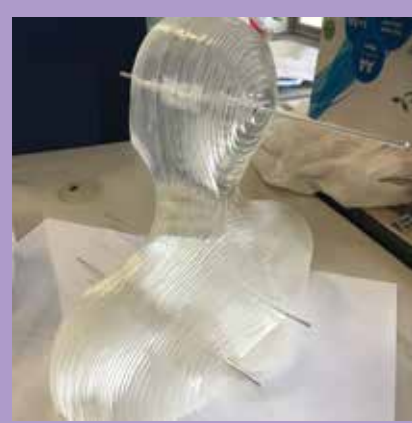


Figure 69: Completed form for the leading bust

technology. Layering occurs in relation to the infrastructure of cloud computing in the use of the term 'layers of abstraction' and in the computer stack, as discussed in the Surveillance chapter (Bratton, 2016). In the processing of user data through data analytics, nuanced human behaviour is effectively dissected and analysed, breaking down complexity. The process of analysis is represented in the transparent slices of acrylic that collectively evoke a three-dimensional image through layers and shadows. The effect is that of an object emerging from a thick mist, or a cross section of a medical specimen captured on layers of milky glass. From the side view the ephemeral image disappears as it fragments into multiple opaque transparent sheets.

My aim to incorporate a user-controlled light source within the bust was to empower the viewer to feel in control and to evoke flowing communication. The interactive drawer gave participants a sense of sending messages: '*It feels like you're taking parts of you and sending them outwards in the way that you physically can't do*' [G]. Although there was some uncertainty about what was being sent:

> *'That's the person's ideas going through. ... or that person's parts of them that have gone out into the world, could be parts of my identity'* [W].

> *'How the mind has become almost fragments of an iPhone. Or a person has become parts of an iPhone'* [G].

A merging of technology and flesh is evident both in the immersion of the phone drawer in the base of the head, and [G]'s observation about immersing parts of the person within the phone.

Figure 70: Flashlight drawer

Figure 71: Internal and external lighting in place

At the time of making it was uncertain whether my ideas were workable, and whether the outcome would be effective in the final artefact. The extent to which the lights would radiate along 270 mm high stacked sheets of acrylic was uncertain, as was the stability of the bust, and whether the artefact as a whole would be convincing or simply strange. The process of making something that I had not seen before involved risk, iteration and uncertainty. Once I had fitted the pieces together however, I was pleased to see each section light up and fade in turn, creating a twinkling effect as light moved across the etched lines. In the final exhibition the light dispersed along the surface of the acrylic, illuminating the outer edges of the acrylic and the etched lines, and reaching the eye at the top of the head.

8.6 Summary

In response to the Noosphere artefact the overwhelming majority of participants identified themselves with the leading bust, and phones and fibre optics strands with social networking. The fibre optics coiled from the leading bust through the phone frames, to the end of the cabinet where they terminated in dots of light. I envisaged this termination as a figurative end of the head strands due to physical constraints of the cabinet, comparable to a cross section in a graphic visualisation. Interestingly, as with many aspects of the artefacts, participants projected meaning onto the thread ends:

> '*With this one it just ends abruptly and that is more representative of social media where the info isn't being stored in a place, it is just being sent to different people, there is no aggregated part of it*' [Q].

Freely interpreting the ending lines, this participant perceived the illuminated strands as symbolic of social media content that is not stored, only sent to others. Others saw the fragmented ends as self-contained, while yet another saw the bits ending as a trap. The slices of acrylic that made up the head, and the multiple figures and phones were readily interpreted by several participants as fragmentation of identity. This is typified by one participant who called the Noosphere: '*The dispersion of identity*' [X].

The dispersion and lack of control over posts that go out into the world is a concern for participants. Responses to the Noosphere established that participants were uncertain about what data surveillance is, as many described a process of other people looking at their files rather than the automated collection of behavioural surplus in the form of browsing history, clicks and dwell times, for example. Users' social media data is stored and shared without explicit permission, although users do sign away their privacy in the small print (Zuboff, 2019, p.48). In addition to this, social media posts can be circulated on a much larger scale in politically motivated circumstances. For example, in the lead up to the 2016 U.S. election, journalist Catherine Cadwalladr documented politically targeted social media posts that appeared and disappeared without a trace. Cadwalladr identified Facebook posts designed to influence political views through persuasion as psychological operations, or psyops – changing people's minds through informational dominance (Cadwalladr, 2018). Increasingly sophisticated psychological profiling online over recent years has made social media a more valuable and powerful influencer than ever.

Partial, de-contextualised online data can appear and reappear and be used for other purposes, across private and public divides. '*It goes outwards, upwards, out of my control*' [F]. This can be likened to a palimpsest – an inscription or surface that contains layers of past inscriptions. Through studying medieval vellum inscriptions

scholars discovered that monks in scriptoriums would re-use old vellum by scraping it clean. Through the use of technology, it was found that the underlying original text could be reconstructed (Harbin & O'Callaghan, 2016). The digital equivalent of this is inscription on a hard drive, from which data can similarly be retrieved despite the hard drive registering its disappearance when accessed through an interface (Kirschenbaum, 2008, p.103). Sarah Dillon, in conversation with Matt Parker, compared the cloud to a palimpsest. Dillon argued that the traceability of the palimpsest demonstrates that we need to be more aware of the use of the cloud data storage. As if to demonstrate the validity of the dematerialising cloud, this conversation has characteristically disappeared from the Internet. More could be written about what van den Boomen calls 'media as inscription', as inscription on computer drives is ultimately how data is stored (van den Boomen, p.99). However, because participants experience the cloud as impermanent storage, I have focused on the cloud as container metaphor. This compares the cloud to storage methods such as a palimpsest (Tuite, 2015, p.13). Returning to users' experience of social media and stored data, I argue that the cloud is an unreliable palimpsest, occasionally comparable to vellum written on with invisible ink, at other times able to reveal much more than the data originally inscribed. Participants also felt that the cloud was unreliable and not entirely trustworthy:

> *'I throw money into a traditional big establishment of some kind ... they rely on cloud services for a lot of what they do, so we may not even see that what we're giving them is spreading further out, but it can, and it does'* [I].

This contradicts Peters' framing of clouds as elemental media, a naturally occurring element that we have begun to control through cloud seeding (Peters, 2015, p.255). The inherent vagueness of clouds clearly influenced the imaginary of the following participant in Phase 1 of the project:

> *'It's the permeability, you can think of our control over our perception of our self, before this massive social integrated scattering of cloud services and social media we would probably have thought of ourselves in a wall around us, or a bubble, and we would invite people in and those people would know and understand, and people who were outside the bubble wouldn't. But that's not how it is now, we don't have a wall, we don't have a bubble, we just sort of have this misty shroud around us and the things that we perceive of ourselves are leaking through this. ... When I think of cloud computing, it's one of the first things that comes to mind – clouds – I think of cloud computing and shifting and impermanent and permeable, rather than solid and reliable'* [I].

While [I] sees boundaries online as a misty, leaky shroud, James Bridle suggests that we all live inside a computer that expands into space, while Geert Lovink takes this one step further, describing the boundary of panoptic vision as walls inside the self (Bridle, 2019; Lovink, 2018, p.115). This aligns with the Noosphere artefact, in which the leading bust merges with technology as the bodily boundaries are shifted.

9 Artefact exhibitions

Each medium leaves behind qualities of the last, reinterpreting the content and function of the previous medium, using the strengths and particular qualities of the new format. Digital storage replaces physical storage, and digital communications in part replace in-person communication. Sequential steps in my project follow a comparable path of remediation (Bolter & Grusin, 1999, p.45). Findings from the Cloud Drawings were reinterpreted, abstracted and transcoded into the physical artefacts, the artefact exhibitions were newly presented in three separate installations, exhibitions were captured through video and photography, and this book artefact gathers the learning, while reinterpreting the themes. Each artefact is a subjective interpretation of the previous stage, each interpretation loses something of the last artefact, and adds another layer.

The cloud is experienced as an abstract technology by most people. In the process of materialising participant imaginaries in Phase 1 Cloud Drawings, information was revealed that was not apparent before. By the same token, the Cloud Drawings inspired me in the critical making of the physical artefacts, abstracting the drawings from the two-dimensional page to three-dimensional physical artefacts. The particularities of the phenomenological installation illuminated the subtleties of the low lighting, smoke, video projections and the light from the leading bust, factors that proved demanding to record. Each exhibition location, and each artefact brought its own challenges and further developed my critical making process. I created a permanent photographic and video archive of the exhibition with consideration for the ultimate destruction of the artefacts. The transcoding from the photography to the book artefact echoes a similar process of loss through another reinterpretation.

9.1 Cloud forms exhibition

The first Cloud forms exhibition was staged to gather responses to the artefacts from Phase 2 participants. Situated in a photographic studio, the windowless space contained a lighting rig and photo studio furnishings, within a black interior. Air conditioning pipes, incidental building sounds, and an unintentionally triggered security alarm fittingly evoked an industrial atmosphere. Positioning the three artefacts across the space next to each other, enough room was left for visitors to walk around the artefacts. Subtle lights from the fibre optics and the videos, the sound and experience of smoke releasing from the smoke machine housed within the centre cabinet added to the phenomenological experience of the exhibition. Fog from the central artefact drifted across to the other artefacts.

On entering the space, participants entered the cloud – moving from a lit corridor to a darkened room with few spatial references. The contrast in lighting emphasised the only source of light within the space as the three two-metre high cabinets with illuminated contents. With no ambient lighting and no visible distractions, attention was drawn to the artefacts and their meaning as objects. The invisible

cloud was made visible, illuminating that which is normally unseen, revealing a layer, or stack, that explores the mechanism of the cloud metaphor. Within the exhibition space, different viewing possibilities offered diverse realisations for participants. The eye was drawn to the lit elements of the artefacts, while the black steel structure of the server cabinets receded into the dark. For me, this triggered thoughts about the foregrounding of the poetic cloud metaphor and the ways that 'cloud' detracts from the environment and infrastructure of the industry. Emphasis on poetic aspects paralleled the industry-curated prioritising of the metaphorical and iconic cloud, over the cloud computing infrastructure. Through a trojan horse effect, the poetic phenomenological aspect and themes mirrored the environmental, identity and surveillance issues within.

When introducing participants to the space I guided them in a way that accommodated a tour of the artefacts without specifically favouring any of the three artefacts. After encouraging viewers to look around the room for several minutes, I invited them to sit and fill out the required ethics forms, allowing them time to adjust to the lighting and atmosphere. Once the participant had completed the ethics requirements, I led them through the interview process.

On presenting participants with the *Cloud Cabinets* exhibition, almost all related actively to the narratives they depicted, commenting in various ways on specific details. During the critical making stages I indulged in designing polarising aspects of cloud narratives, with the intention of provoking participants to respond with clear perspectives on cloud computing. I was curious how participants might respond to what I felt were challenging aspects. Surprisingly, most participants responded positively to what I considered to be the most provocative elements, such as the tethered users in Factory, and the leading bust in Noosphere, within which a phone is inserted. For participants, the poetic aspects of the artefacts attracted attention, while the steel server cabinets were secondary, and often went unnoticed. Participants' responses reflected how the artefacts were presented through the setting and the lighting. Most participants described the artefacts as beautiful, one participant comparing the Factory to a waterfall. Seeing three different manifestations of the cloud reinforced my earlier realisation that the cloud is conventionally presented as a singular entity, when in fact there are multiple cloud services and forms. During the critical making I observed how the themes and materials from each artefact interacted with one another. While perusing the artefacts, participants likewise commented on their own connections and associations regarding the artefacts.

Surveillance presented a somewhat paranoid narrative. This impression was more distinct when placed alongside the more clinical, systemic representation of Factory. When viewed in relation to Factory, Noosphere zoomed in to the individual 'I' figure. The Noosphere drawer embodied the possibilities of interaction to engage and empower users. I reflected on the haptic nature of smart devices and how digital industries design products that include interactive features, so as to engage users and transcend the limits of the flat boundaries of the screen. For participants, the scope of these physical narratives presented choice in a way that the digital experience of cloud computing does not. Comparing the artefacts to a digital experience of the cloud through digital interfaces, the artefact exhibition empowered visitors to freely navigate the artefacts and exhibition from multiple perspectives, traversing the space on their own terms.

The temporal experience of the acrylic material interacted differently in response to the light, depending on the viewers' vantage point, whereas the digital cloud is experienced through a flat, minimal interface. I learnt also that the collective exhibition experience of all three artefacts invited exploration from all four sides of the cabinets. The rich experience of the physical installation was evident in participants'

Figure 72: Completed artefacts before exhibition

Figure 73: Interaction with exhibition artefacts, including lighting and smoke

Figure 74: Exhibition interview in progress

Figure 75: CAADRIA *Cloud cabinets* exhibition, additional exhibiton of drawings

speculations about how the elements within each artefact related to one another, and how the artefacts themselves compared to one another. For example, in the Noosphere one participant's view of the artefact from behind specifically triggered them to comment that the leading bust was a victim of the cloud.

Until I experienced the artefacts in one space, with controlled lighting and smoke I was unsure of the exhibition experience as a singular installation. I was relieved to see that the smoke floated across the space, and I welcomed the industrial sound of the smoke machine into the experience of the space. The fibre optic strands from Factory glowed outwards over the artefact with enough luminescence. Noosphere functioned as an integral artefact – the light from the interactive drawer travelled upwards through the leading bust, emulating network connections aptly, as light flowed outward horizontally from the leading bust. An unexpected element that resonated was the portrayal of themes of social connection through the light that reflected off the phone frames in Noosphere. The hanging fibre optics moved slightly in response to the movement of the drawer, causing changes in the lighting as the light reflected off the phone frames. Viewing the phone frames in the dark emphasised the devices, while the space within the phone frames remained as an empty black rectangle. This called attention to the way in which the reverse occurs in everyday interactions with screens as we view the content displayed on the screens of our devices, and ignore the frame.

9.2 Cloud cabinets

Several months after the initial exhibition I received an invitation to exhibit at *CAADRIA 2019 Intelligent & Informed Conference* (24th Annual Conference of the Association for Computer-Aided Architectural Design Research in Asia) at the School of Architecture and Design. I took the opportunity to depart from my initial exhibition format, and tell more of the whole story by including the participant drawings that were the inspiration for the artefacts. These were displayed on a wall just outside of the same photo studio space used for the original exhibition. As visitors entered the space, I explained the context and intention of the artefacts on display. The project was easily understood, and visitors responded positively, with much interest, and at times astonishment. My own fascination with the narratives depicted in the drawings was, surprisingly, not noticeable amongst visitors. I had actually expected the reverse – that the drawings would be of interest, but the artefacts would puzzle people and seem incongruous. In this case I misjudged the impact of the physical artefacts and the ease with which people appreciated the work, without an explanation of the context or motivation.

In both the *Cloud forms* and the *Cloud cabinets* exhibitions it was reassuring and inspiring to interview and gather a myriad of associations and responses from participants. One factor that surprised me was the confusion from some participants about the meaning of the smoke. What to me was a most obvious, and somewhat blatant link to clouds went unrecognised by most. I was impressed how charmed and immersed people were when experiencing the empowerment of the Noosphere drawer. My suspicion that participants and other visitors would be confused about the context and meaning of the artefacts was unfounded. Most participants asked about the context and inspiration for the exhibition after the interview. Incidental visitors without prior knowledge and only a small poster announcing a *Cloud Cabinets* exhibition were not concerned about the content, intention, or meaning of the artefacts, but were content to experience them as independent exhibition artefacts. This stands in contrast to the intended purpose of critical making – to create made artefacts that perform as outcomes of research, rather than standalone objects (Ravelli, Paltridge, & Starfield, 2014, p.310; Ratto, n.d.).

9.3 Unpacking the Black Box

The most publicly visible exhibition of the three, *Unpacking the Black Box* was staged at Te Herenga Waka Victoria University of Wellington's School of Design Innovation's Faculty Gallery, a large window display space at the entry to the school building. The exhibition delved into and emphasised themes of visibility and invisibility, and the characteristics of black-boxing. The complete spatial reconfiguration in a closed window vitrine challenged me to find a divergent way to tell the story of the artefacts. Only by viewing in the black-boxed environment at night did the hidden aspects of data surveillance, identity and the network system appear. During the day the artefacts stood exposed to full daylight, the infrastructure of the steel cabinets and the cords and wires visible from the street below. Although the phenomenological aspects of the work were not visible, the infrastructure of the artefacts in the form of the wiring and cabinet structure were now emphasised. Day time viewing stripped the exhibition of the amorphous aspects of the smoke and video that were present in the previous exhibitions. The exposure of the construction aligned with Eliasson's *The weather project* (2003), because the workings of the artefacts demonstrated transparency regarding the wires and the infrastructure. Because the exhibition was open to daylight and was best seen at night, the gallery appeared closed, inactive, and hidden during the day, while at night it appeared to unpack. My signage and exhibition text on the front window noted that. After dusk the fibre optic lights, LEDs, and the video projections within Surveillance were visible. A projection of each of the Cloud Drawings was perceptible on a large portion of the front glass vitrine, alongside the artefacts.

The different view offered by the vitrine location created a thought-provoking reflection of the project's themes as the exhibition was placed in the public view. *Unpacking the Black Box* was viewed by passers-by from 1.5 metres below the exhibition space, at street level. The physical inaccessibility recreated the challenges of communicating through screen interfaces of black-boxed technologies. The phenomenological experience of the earlier exhibition was hampered and changed by the containment behind glass. This was a reminder of the limitations of interactive engagement through devices and the ways that haptic responses compensate for the constraints of communicating digitally.

As the gallery space was long and narrow, I positioned the artefacts at one end, and projected a looped presentation of the participant drawings at the other end. Factory was the least affected by this change of perspective, though one difference was the enhanced visibility of the cloud forms positioned at the top of Factory. Surveillance did not contain smoke, except during the exhibition opening, due to building regulations. The Surveillance eye was more easily discernable and appeared incongruous and more imposing, from its position high above the public street below. Placement of the eye in the vitrine seemed more shocking as it re-enacted the surveillance of a private citizen from within a hidden black box of the exhibition window. The video of the three figures that were otherwise viewable when standing in front of Surveillance, were inaccessible to the viewer standing below. I was challenged to rework Noosphere for the new location because the interactive sliding drawer was not operable. To remedy this I embedded a sequence of LEDs into the bust to emulate the back and forth movement of the phone drawer. The LEDs lit up in sequence, illuminating in turn the etched pattern on each layer of acrylic. The drawings at the end of the exhibition space appeared in sequence, for around 25 seconds each, on a matt, opaque, vinyl surface measuring approximately 2.5 x 1.5 metres.

Figure 76: *Unpacking the Black Box* signage and vitrine

Figure 77: Exhibition view with projected drawing

Figure 78: View of the artefacts from street level

Figure 79: Noosphere, seen from within the vitrine

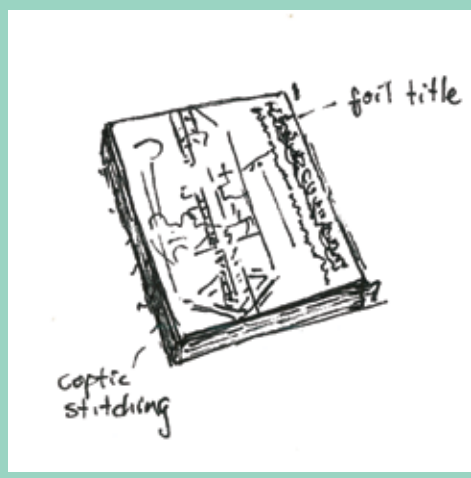


Figure 80: Sketch of finished book with exposed binding

Figure 81: Front and back cover concept, with foil title and coptic stitching

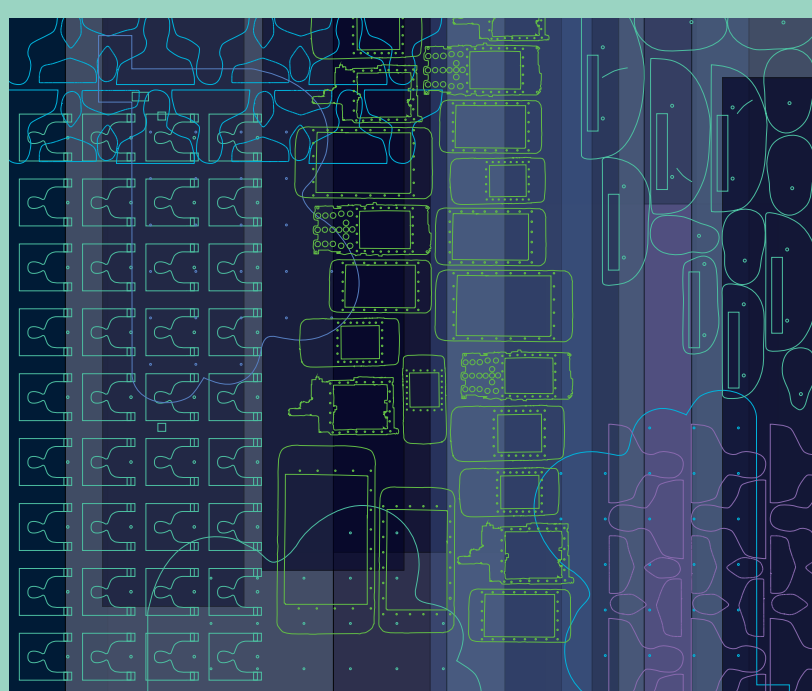


Figure 82: Image for book flyleaves

9.4 Video and photographic archive

In the video and photographic archive of the project, my aim was to capture the essence of the phenomenological experience of the artefact exhibitions. Footage was captured at each exhibition, consequently I reflected on the research and the findings at the time of each photo shoot. For the video I recreated a visitor's encounter of walking through the exhibition, including seeing the artefacts juxtaposed alongside one another. Poetic and spiritualist associations of the phenomenological exhibition were conveyed through capturing the smoke, and incorporating slow video transitions. For the photography I referenced the ambiguous nature of perceiving the cloud by including manual multiple exposures to capture movement. Including audience interaction demonstrated the scale of the artefacts. I art-directed the photographer as he moved around the space. Challenging lighting conditions led to much experimentation. I manipulated lighting and experimented with smoke both in the photo studio exhibitions and in the *Unpacking the Black Box* vitrine exhibition. Several photos taken within the vitrine provided a reversed perspective in the form of a view from inside the black box looking out to the street (Figure 79).

9.5 Thesis as book artefact

In the context of doctoral research, a bound book conventionally documents a project and functions as a final repository for knowledge. As a lasting record that tells a linear story, the book form is the culminating artefact for my thesis.

Rather than simply a record of the content of this project, I have chosen to design a thesis document that visually references both the content and the perspective of the study, in a manner that is in keeping with my methodology. My book artefact is positioned as a designed document that is both an informative and visual record of the research. The book contains the written component, the critical making artefacts, the photographic archive, and my critical making response at each stage to the preceding artefacts. In my discussion of my hermeneutical phenomenological approach I stated that true objectivity is not possible (see 4.2) I also discussed the impossibility of subjectivity in relation to Google's vision (see 8.2). Because artefacts are an integral component of the project, I incorporate creative and critical making into the book's design to reflect on the work that has gone before. By compiling and presenting this document as a visual designed artefact, rather than simply a written record of the process, I continue to translate the project data into a permanent record that captures all stages of the research in one physical artefact.

Instead of standing outside of the process and documenting it clinically, stripped of any design devices that speak with another voice, perhaps deceptively, I incorporate subjectivity in my critical making. I have investigated the metaphorical layers of the cloud through user imaginaries, the data surveillance economy, the environmental impact. Things are not as they might seem – users are not the clients, they are the source of the data; the cloud is not immaterial, it is a billion-dollar industry; personal search returns and social media feeds are personalised – we are each in our own cloud. The subjective packaging of content influences how content is absorbed and experienced. The cloud is not neutral in the way that a traditional written thesis might be intended – a faux leather, double line-spaced, bound book. My book artefact responds to this by incorporating a layer of abstraction in its design, employing visual strategies that create a layer around the words and visuals. In the cloud it is not only content that communicates, but the media itself, and the interfaces that users engage with. Importantly, the layer of design in my book artefact is intended to enhance and

reinforce, rather than obfuscate. My aims in the making of the book are aligned with the project's themes of materiality and immateriality. Inevitably, through my own curation throughout the project, some aspects of the data created along the way are lost, or altered. The phenomenological experience of the artefact exhibitions, and the artefacts themselves are part of the project that will, after the close of the project, be lost. The ultimate depository for the project remains in the lasting artefact of the book. However, making the book itself has uncovered issues of decay and maintenance of all media.

While any physical artefact is subject to degradation over time, digital formats also require their own means of preservation and maintenance. As a consequence of my design decisions, materials chosen for the book will themselves be subject to decay and discolouration. The making of the physical document also continues my approach of transcoding across the digital and physical formats. Ratto states that critical making brings together tacit, materially engaged activities with abstract critical thinking. My continuing critical thinking leading to the completion of the project uses both text-based content and the iterative reflective process of transcoding from digital, written content, video and photography, into material form. Particular considerations that arose in the project and that speak in the format of a printed book guided my design. My brief for the book reinterprets the aims outlined in section 4.3. Other aspects that encompass the outcome of the critical making process guided my brief for the printed book. These are:

- **Modularity** The modularity of the cloud server system, with its capacity for multiple physical drives within a single server cabinet translates into a bound book with exposed stitching that holds together the signatures, or sections, at the spine.
- **Colour** Use of colour was an opportunity to reinforce the palette of the artefacts and to reference the wider industry aesthetic of the data centre environment.
- **Modernity / Wunderkammer aesthetic** The formality and sparse modernity of the data centre contrasts with the poetic metaphor of the cloud. Poetic qualities of the cloud are inherent in the aesthetic of Surveillance in particular, through the incorporation of smoke, Pepper's Ghost, and the eye. These qualities are present in the choice of font and traditional detailing, and the clean, modern layout.
- **Spatial, geopolitical aspects** I reference the aesthetic of maps and geopolitical space through linear detailing, and blocks of colour that sit behind images. This aligns with the discussion of geopolitical space and writing on the early Internet as a space.
- **Materiality** In keeping with my voice and approach, I make use of tactile materials in the binding, foil and uncoated paper stock.
- **The network aesthetic** Networked lines are present in the participant drawings, graphic visualisations of participant comments, and the fly leaf design composed of the digital files for laser printing the acrylic.
- **Obsolescence** The finite nature of any media form, whether digital or physical is relevant to the research. Digital file formats become obsolete, cloud data is lost, and ultimately, the laser printed paper of this book has a limited life.

10 Conclusion

My original research question for this project began with a fascination with ways that the cloud metaphor influenced users' perception of cloud computing. As the project developed, this direction evolved into an investigation of a network of imaginaries, and how these imaginaries function and affect one another. Subjects included imaginaries of the early Internet, the cloud computing industry, the data surveillance economy, cloud computing infrastructure, and the impact on the environment. I investigated how these relate to understanding, perception and experiences of the cloud. Preliminary investigations sought to establish users' understanding of cloud computing.

How do users experience, perceive and imagine the cloud?

Images and information that look beyond the layer of the cloud metaphor as black-boxed technology can lead to a more informed awareness and engagement with cloud technology. The poetic cloud metaphor describes the convenience of cloud computing effectively, yet participants' understanding is varied, ranging from IT professionals with a high level of knowledge, to users who expressed uncertainty about what and where the cloud is.

Participants feel connected and validated through cloud computing, better able to share ideas, and more empowered through mapping their environment and social networks, yet they cannot opt out of data surveillance. Understanding of data surveillance was diverse, as most participants showed some awareness of targeted advertising. Yet none of the participants, including those working in cloud computing and IT, were confident of the precise parameters of data surveillance online. Images depicting cloud computing data centres drew comments on the materiality of the industry.

Very few participants considered the environmental consequences of using cloud computing. Although once participants viewed images of industry infrastructure, and advertising, they wondered aloud about the environmental impact of cloud computing. This brought the ethereal cloud down to earth: the cloud was fallible. Participant responses illustrate that the perception and imaginaries that they have about cloud computing reflect an imaginary of clouds as immaterial. Citing images of infrastructure invited participants to move beyond immateriality to cloud computing as a material industry, with consequences and costs.

Industry perpetuates an imaginary of poetic, immaterial, natural clouds in the visions of sublime hyperscale data centres with sterile interiors, immersed in natural surroundings. Data centres photographed within these natural settings curate an image of the virtual computing cloud as a natural phenomenon. These associations obscure the environmental impact of the industry, the data surveillance economy, and the wider impact of the production of digital devices. Through the mechanism of the cloud metaphor the impacts of cloud technologies are avoided – privacy issues, data surveillance, social disconnection, and effects on the environment. For users images of infrastructure are minimal, creating an imaginary of an immaterial, fleeting cloud.

To what extent do industry imaginaries, and collective, cultural associations with clouds influence users' imaginaries?

Representations of clouds in art, meteorology and culture function as an anchor and a mirror to the imaginaries of virtual data storage today. Responses to Stimulus Images showed the continuing relevance of diverse cultural associations with clouds as poetic, heavenly and all-seeing. Participants readily associated images with characteristics of cloud computing. Past aesthetics of the Internet proved to be relevant to participants' imaginaries of the cloud, often irrespective of age, as this included digital natives.

Industry perpetuates an imaginary of poetic, immaterial, natural clouds in the visions of sublime hyperscale data centres with sterile interiors, immersed in natural surroundings. Data centres photographed within these natural settings curate an image of the virtual computing cloud as a natural phenomenon. These associations obscure the environmental impact of the industry, the data surveillance economy, and the wider impact of the production of digital devices.

Without associations to nature, religion, ephemerality, and immateriality, virtual data storage might have developed quite differently. This suggests that, if the cloud had been consistently named differently from the outset – for example as a brand name server such as Google Drive only – an entirely different industry and user imaginary might have evolved.

How does the immaterial nature of cloud computing impact on users?

Critical making was a valuable opportunity to engage in critical thinking, and reflect on the making, while producing physical artefacts of the cloud for participants to respond to. Rather than a cloud icon in one's browser, users were offered diverse imaginaries of cloud computing that highlighted differences between digital clouds and material clouds. The antithesis of seamless digital experience, each artefact provoked participants to think about the seams, outcomes and impacts of computing in the cloud. Concern was expressed at the lack of social interaction of the user representations in Surveillance, depictions of users in Factory disturbed participants, and participants were inspired by the aspirational empowerment of Noosphere. The process drew out specific realisations about the immateriality of the cloud. I learnt that the vertical perspective of the cloud above in the construction of Surveillance and Factory determined users' experience of cloud computing. This prompted me to diverge from the composition of the first two artefacts by making the third artefact with a horizontal emphasis. In reply to this change of direction, participants reported a positive sense of empowerment. This shows that the inherent vertical emphasis implied through the cloud metaphor influences how people experience the cloud.

As the project progressed, participants engaged more with the entirety of cloud computing in each stage – through visualising the cloud, giving feedback in interviews, responding to Stimulus Images, and viewing the physical artefacts – more nuanced and in-depth participant data was gathered. The beginning stages of the project showed a low proportion of participants with concerns about cloud computing. Four Phase 1 participants said that people were in control of the cloud, while after viewing the cloud artefacts just one person said that people were in charge of the cloud. The remainder stated that corporations were in control of the cloud. Increased concerns about privacy, identity and social networking arose in response to the Stimulus cloud images, and even more so in feedback on the critical making artefacts. Concerns about trust, privacy and identity in the cloud did not correlate with lack of knowledge or paranoid fears about cloud computing. This was apparent in comments from participants who were IT professionals. Predictably for a study about cloud computing, a number of IT professionals responded to requests for participants on the topic. I

had anticipated conservative, pro-cloud computing industry feedback. However, the IT professionals were the most critical of the current practices of the cloud computing industry, and they provided the most imaginative and thoughtful responses.

Research subjectivity

Because my own subjective perspective is an integral part of my approach, as stated in 4.2, it could be said at this point that I led participants to respond in certain ways through my design choices in my interpretation of the cloud narratives. However, the artefacts were visual, sculptural provocations, that participants could freely respond to. Open-ended questions allowed users to register their affinity or disagreement with various aspects of each cloud model, which they did. Diversity was implicit in the narratives the artefacts represented, ranging from panoptical, to systemic, to empowered. Ultimately, participants demonstrated sometimes contradictory, but clear opinions on the artefacts and on cloud computing. Participants positively engaged with the Noosphere leading bust, and felt this narrative was the most empowered, but when asked which artefact was the most accurate for their experience now, almost all declared that Surveillance was. Although participants aspired to Noosphere, they identified their current experience of cloud computing with Surveillance.

10.1 Further research

Future plans for continuing this research could involve building cloud artefacts based on industry imaginaries in particular, as these would contrast with the artefacts based on user input. Applying critical making to an artefact inspired by industry imaginaries could start a conversation with the existing artefacts. Displaying user narratives alongside industry narratives, in the form of artefacts could reveal gaps between these different imaginaries, offering new perspectives on both.

User representation

Investigation into the design of user icons aligns with my interest in digital aesthetics. In section 8.6 the creative making of the user figurines led me to investigate the origin of the user icon and the visual representation of the user in the form of user icons. The early development of interface icons for Apple, Hewlett Packard and General Magic led to the first functional icons – trash cans, folders and documents. User figures developed after this, which connects to Chun's statement that software produces users (Chun, 2006, p.21).

Video and sound

Further study of the cloud could delve into the sounds and visuals that contribute to the experience of cloud computing. I envision filming meteorological clouds to emulate the aesthetic of CCTV surveillance screens, suggesting a turning of the cameras to watch the watcher. The subject of the cloud would be framed as decontextualised clouds in the manner of Stieglitz' *Equivalents*. This would invite reflection on the process of surveillance. The fascination of observing human behaviour is substituted for the fascination of Nephelococcygia, or cloud watching.

The image users have of data sent through the air to the cloud above is maintained by sounds like the Apple Mac whoosh that signals the transmission of data. Incorporating sounds that more accurately represent physical, infrastructural aspects of data transmission would subvert the existing industry imaginary. Technological and earthy sounds that evoked data moving through subterranean and subaquatic cables, or the technological noise and hum of data server farms, could more accurately

represent the movement of data through the cloud, rather than the airy, magical sounds produced by industry.

Cloud to IoT

Like cloud computing, the infrastructure of the Internet of Things (IoT) is not visible to the user. The ways in which the thing-ness of IoT is perceived and imagined by the user perspective may be similarly susceptible to imaginaries about its nature, its physical manifestation and use. Ubiquitous digital technologies such as cloud computing and IoT require a better understanding of how users experience and perceive these technologies, as this can lead to more empowered engagement with these technologies. Exploring the cloud has provided insight into a moment in time at which users have a limited appreciation of the layers of abstraction that make up cloud computing.

10.2 Final observations

This project records how people experienced cloud computing at this moment in time. I do this through building on existing literature that documented users' responses to new forms of media and the imaginaries associated with them, such as Marvin's record of 1890s technologies, Flichy's record of Internet imaginaries, and Mosco's writing on the digital sublime. In a fast moving digital space, cloud computing is constantly evolving. Just as cloud technologies have changed over recent years, they will continue to evolve rapidly in the coming years, impacting on the relevance of this research. However, the increasing use of seamless digital technologies that are invisible to users, points to a need for users to be better informed about how these technologies work, and for systems that are ethically designed.

Designing the cloud

My critical making artefacts were the means to developing the new knowledge documented in this project, as well as an artefactual record of the project. As stated by Ratto, the value of artefacts that result from critical making lies in their purpose as outcomes of research that lead to new knowledge, rather than standalone objects (Ravelli, Paltridge & Starfield, 2014, p.310; Ratto, n.d.). The new knowledge that is the outcome of the project can inform better engagement with the challenges of cloud computing for those designing cloud systems. To frame this new knowledge, I reflect on the principles of values in design.

My project sought to investigate the meaning of cloud computing through focused enquiry into users' imaginaries, experience and perceptions of the cloud. Employing user input aligns with Nissenbaum et al's suggested strategy of exploring nuanced notions of how users think, feel and act as a way to develop ethical computer systems (Nissenbaum, Stark & Ziewitz, 2013). The outcome of this project begs the question, how might a cloud service work that functioned as the Noosphere, for example? The new knowledge in this project is a first step towards exploring other models.

The knowledge resulting from this project offers insights that could drive the development of alternatives to the current cloud computing systems, alternatives that offer empowerment, transparency, and moral and ethical solutions. My artefacts and the documentation of this project perform what Nissenbaum terms the discovery task of analysis that could inform a brief for more ethical systems design, and therefore better user experiences in the cloud. The outcome of this project suggests that using descriptive rather than metaphorical terms could prompt more ethical cloud computing solutions. An industry that fully disclosed the impact of the industry on the environment could lead to a more informed use and more ethical cloud computing

technologies. Strategies involving design thinking in systems design could also result in less confusing cloud experiences.

Cloud computing is a computing system that fails to engender trust and user autonomy. I argue for a bridging of this failure by employing design thinking into computer systems. My initial curiosity about users' confusing cloud experience may in part be due to systems development that is engineered without consideration of values, simply because they are built by engineers for machines, and not designed with a consideration for human experience.

I propose that design thinking is needed to bridge the gap between computer science and the philosophical values in design approach. Nissenbaum et al's use of the phrase 'designers and builders of systems – scientists and engineers' illustrates a repeated interchangeable use of 'designers' and 'computer scientists' or 'engineers' (Nissenbaum, 1998). This points to a trend of co-opting design terminology into IT processes and role descriptions. While Nissenbaum's suggestion that designers cannot be expected to grapple directly with abstract conceptions of value may be applicable to systems designers, I argue that dealing with abstract conceptions of value is precisely the role of contemporary designers (Nissenbaum, 2005, p.Lxvi). As stated by Muratovski, contemporary designers should 'understand human needs and behaviour, and create systems for living' (Muratovski, 2016, p.378). Therefore designers and design thinking are ideally equipped to tackle abstract ideas, and to contribute to better designed cloud computing systems with a focus on human values, such as privacy and trust, while prioritising transparent industry practices that account for the industry's impact on the environmental impact.

Using the cloud

Through my critical making of the cloud artefacts, I sought to learn more about participants' understanding, and to draw out participant's responses, both positive and negative. Gathering feedback was a fascinating process with many surprises. Participants tended to first respond with enthusiasm to the imaginaries presented in the artefacts, denying any negative outcomes from social media, yet later showing concerns and confusion. Interacting with the artefacts lifted participants out of their usual interactions in the cloud, stimulating wider perspectives on the technology that were not seen or accessible otherwise.

Lack of understanding, confusion, and lack of trust are characteristic of users' experience of cloud computing at this moment in time. While this project raised awareness about cloud computing, further consciousness raising is needed to resolve misconceptions about the nature of cloud computing and data surveillance. Issues of seeing and scanning that are addressed in the artefacts, reference users' misconceptions about surveillance as panoptical observation.

What these invisible technologies require of us is an understanding of different ways of seeing, observing and being seen. The situation calls for a shift in awareness to understand the nature of data surveillance as technological, rather than human, visual observation. Unlike users' imaginaries of being watched by an all-seeing eye, cloud surveillance is about subtle data surveillance through clicks, views and pauses – not people listening in on smartphone conversations.

As part of the critical making process my aim was to find ways for users to stop avoiding the problem of the cloud, to instead accept and own that they are part of the cloud. Participants tended to be complacent and passive about the inevitability of immersing themselves with the services provided by a small number of tech giants. Disempowerment was expressed by participants in their interactions with services run by the largest, and most powerful corporations in the world today. Yet user data is what makes the cloud such a valuable, seemingly infinite, resource, because users'

music and video streaming are the biggest drivers for cloud computing, and therefore the cause of significant impact on the environment (Cook, 2017, p.7). My hope is that better informed users could lead to better cloud services, and more empowered choices. The shift in thinking requires similar re-thinking as climate change does – consideration for finite resources although these are not visible, an understanding of the impact of one's actions, and a prioritising of transparency.

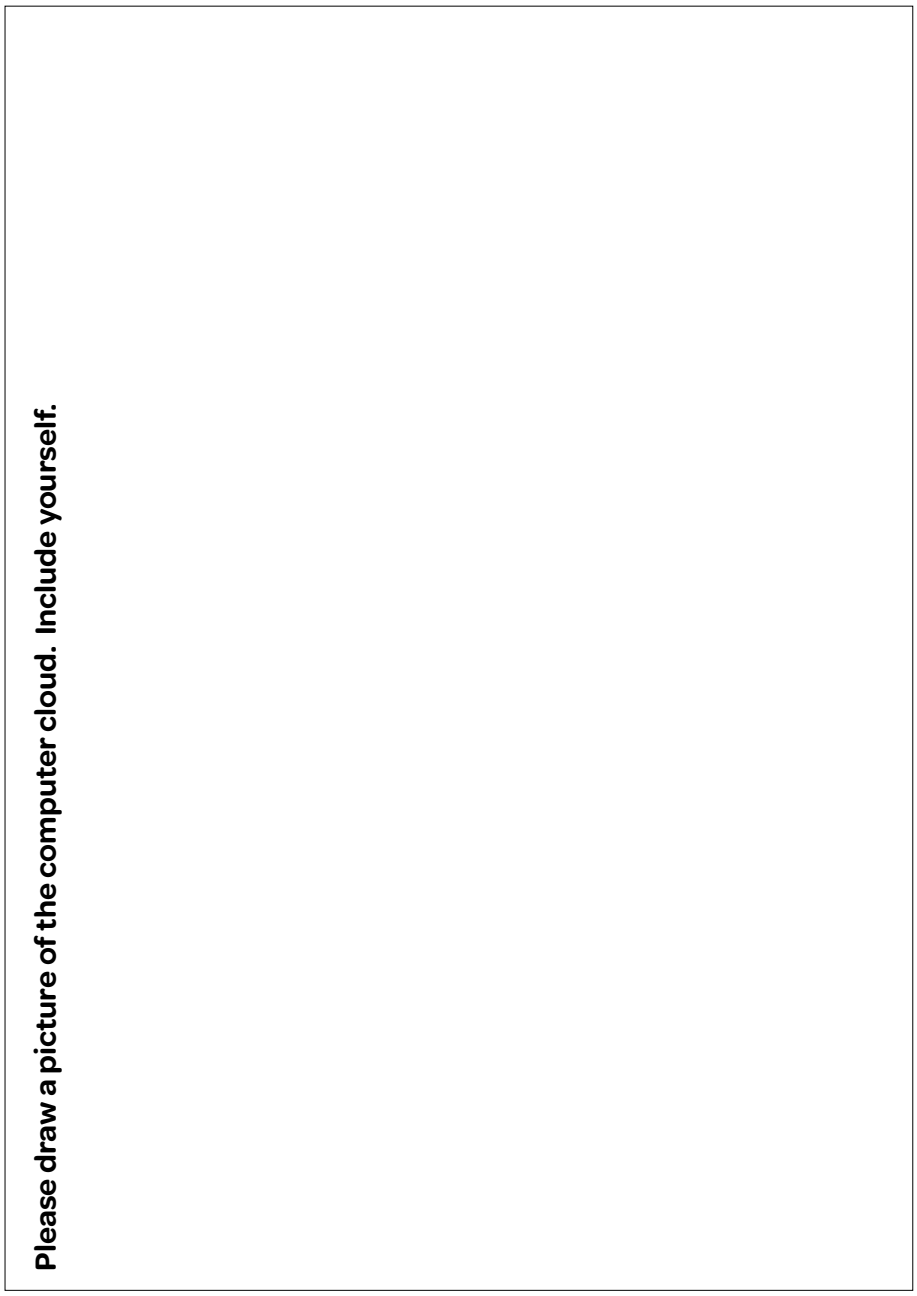
This project is an investigation of a moment in time in which cloud computing data storage was prevalent, but unquantified in scope, and not clearly understood by users. Moments at which new media were introduced have been documented previously. These moments in time record the human meaning-making of technological changes, documenting individual imaginaries. Over five or 10 years, some aspects of the imaginaries captured in this project will have changed and seem absurd, while others may be retained, and new imaginaries will be conveyed by those producing the tools, and by users.

Appendices

Ethics

Ethics approval was arranged for the Cloud Drawing exercise and all interviews in Phase 1 and 2 (see HEC, Approval nr 0000024389). Participants were sought both within the university and externally. Digital natives were approached as well as non-digital natives, a range of respondents were found in relation to age, gender and belief systems. Participant involvement was confidential, participants were anonymous in all documentation. Only the age range, gender and belief system of the participant was noted on the activity. The drawing element of the activity took place over 20-30 minutes, the interview took approximately 20-30 minutes.

Appendix 1 – Cloud Drawing exercise form



Name: ______________________________

Contact details. *Email:* ______________________________

Phone: ______________________________

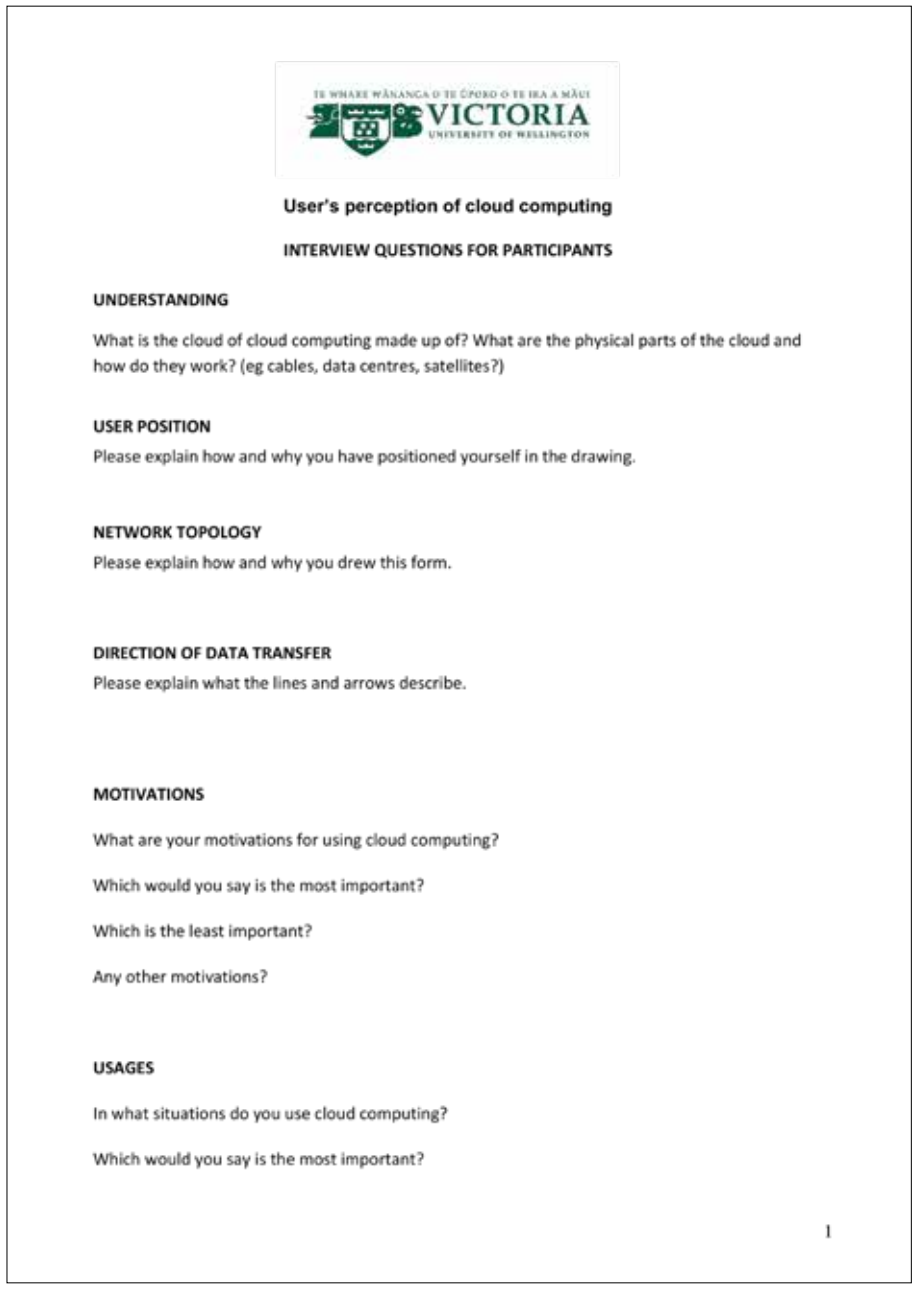
Age: ______________________________

Gender: ______________________________

Religion or belief system: ______________________________

Ethnic origin or identity: ______________________________

Appendix 2 – Phase 1 interview form



TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

User's perception of cloud computing

INTERVIEW QUESTIONS FOR PARTICIPANTS

UNDERSTANDING

What is the cloud of cloud computing made up of? What are the physical parts of the cloud and how do they work? (eg cables, data centres, satellites?)

USER POSITION

Please explain how and why you have positioned yourself in the drawing.

NETWORK TOPOLOGY

Please explain how and why you drew this form.

DIRECTION OF DATA TRANSFER

Please explain what the lines and arrows describe.

MOTIVATIONS

What are your motivations for using cloud computing?

Which would you say is the most important?

Which is the least important?

Any other motivations?

USAGES

In what situations do you use cloud computing?

Which would you say is the most important?

1

Which is the least important?

Any other uses?

PROBLEMS

Have you experienced any problems with cloud computing? Can you describe these.

Which would you say is the most important?

Which is the least important?

Any other problems?

IMAGES AND REPRESENTATION

I am going to show you some images of cloud computing. Can you tell me if any of these resonate with your experience of cloud computing?

(When discussing the participant's Cloud map I will share comparable representations of cloud computing from advertising and technical publicity from cloud companies / meteorology / art history. These will act as a focus to discuss possible influences on how the participant experiences and imagines their cloud and generate useful language for describing their own experiences.)

Appendix 3 – Phase 2 interview form

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

User's perception of cloud computing

INTERVIEW QUESTIONS FOR PARTICIPANTS

Name:
Age range:
Religion or belief system:

Contact details:
Gender:
Ethnic origin or identity:

What do you think the exhibition was about?

Box 1 [surveillance/spirituality]

What do you think this is about?

What is happening?

What do the various parts represent? How does it work?

What did you feel about the music that played?

How does the installation make you feel?

Generic questions about use of cloud computing

What do you think about cloud computing?

How do you use cloud computing?

Do you have any problems with cloud computing?

How do you use cloud computing now compared to how you did in the past?

Questions particular to this box

What do you think about tracking and surveillance of your data in the cloud?

Is privacy important to you?

Who is in control of the cloud?

Return to installation to view Box 1

How does this installation relate to your experience of cloud computing?

How does the piece work in relation to cloud computing? How does data move?

Where do you see yourself in this piece?

1

Box 2 [factory]

What do you think this is about?

What is happening?

What do the various parts represent? How does it work?

How does the installation make you feel?

Questions particular to this box

Who or what is in control in the cloud?

What do you think happens to your data in the cloud?

Do you think cloud computing works well?

Return to installation to view Box 2

How does this installation relate to your experience of cloud computing?

How does the piece work in relation to cloud computing? How does the data move?

Where do you see yourself in this piece?

Box 3 [social noosphere]

What do you think this is about?

What is happening?

What do the various parts represent? How does it work?

What did you feel about the music that played?

How does the installation make you feel?

Questions particular to this box

How does cloud computing affect your sense of social connection?

What information do you share through social networking in the cloud?

How have your ideas about cloud computing changed over time?

How do you use cloud computing now compared to how you did in the past?

Return to installation to view Box 3

How does this installation relate to your experience of cloud computing?

How does the piece work in relation to cloud computing? How does the data move?

Where do you see yourself in this piece?

If you were to give this exhibition a title what would it be?

3

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