GHOST IN THE MACHINE

Ben Speedy. Wellington. 2017.

Architecture (people) + Data

Ghost in the Machine

Ghost in the Machine

authored by

Benjamin Speedy

A 120-point thesis
submitted to the Victoria University
of Wellington in partial fulfillment of
the requirements for the degree of
Master of Architecture (Professional)

Victoria University of Wellington
School of Architecture

2017

I, Benjamin Speedy 300266587, am registered in the Master of Architecture (professional) course for the year 2016 at Vitcoria University of Wellington. I confirm that:

I have read and understood the University’s information on academic integrity and plagiarism contained at

[http: www.victoria.ac.nz/home/study/plagiarism](http://www.victoria.ac.nz/home/study/plagiarism) and outlined below:

I have read and understood the general principles of copyright law as set out below:

This project/assignment is entirely the result of my own work except where clearly acknowledged otherwise:

Any use of material created by someone else is permitted by the copyright owner.

Signed:

Date:

thank you.

To those who inspried it and will not read it.

There are so many people that I have to thank
for the crazy last 5 years. To everyone that
made it so memorable. Much love.

p.s Thanks Mum and Dad for all the help along the way.

Forever grateful.

FIG. i
Garden of Earthly Delights.
Painting by Hieronymus
Bosch, circa 1500

EPIC RAP I

Reality, at first glance, is a simple thing: the television speaking to you now is real. Your body sunk into that chair in the approach to midnight, a clock ticking at the threshold of awareness. All the endless detail of a solid and material world surrounding you. These things exist. They can be measured with a yardstick, a voltmeter, a weighing scale. These things are real. Then there's the mind, half-focused on the TV, the settee, the clock. This ghostly knot of memory, idea and feeling that we call ourself also exists, though not within the measurable world our science may describe.

Consciousness is unquantifiable, **a ghost in the machine**, barely considered real at all, though in a sense this flickering mosaic of awareness is the only true reality that we can ever know. The Here-and-Now demands attention, is more present

to us. We dismiss the inner world of our ideas as less important, although most of our immediate physical reality originated only in the mind. The TV, sofa, clock and room, the whole civilisation that contains them once were nothing save ideas. Material existence is entirely founded on a phantom realm of mind, whose nature and geography are unexplored. Before the Age of Reason was announced, humanity had polished strategies for interacting with the world of the imaginary and invisible: complicated magic-systems; sprawling pantheons of gods and spirits, images and names with which we labeled powerful inner forces so that we might better understand them. Intellect, Emotion and Unconscious thought were made divinities or demons so that we [like Faust] might better know them; deal with them; become them.

- Alan Moore

FIG. ii
Garden of Earthly Delights
Painting by Hieronymus
Bosch, circa 1500

The title for this thesis – The Ghost in the Machine – is drawn from the previous extract from an interview with Alan Moore. His description of consciousness as a phantom realm of mind resonated with how I felt society understood digital information. Data holds a presence within modern day existence, responsible for almost everything from communications to economies yet its lack of physicality results in it having this ghost like presence within the modern societal machine. This is where the substance for the Ghost in the Machine was found; driven by questions of architecture and its role in representing the intangible elements of human existence.

Painted by Hieronymus Bosch in the early 1500's – Garden of Earthly Delights – is shown opposite and previously along with Moore's quote. I saw this thesis as an opportunity for me to challenge my norms and chose to be more playful than I would normally attempt with my work. Grey-scale presentation had become a default response during my time at architecture school, so I decided to break tradition and used my favourite painting to set the scene from the beginning for bold colour and finer detail.

"Color does not add a pleasant quality to design - it reinforces it."

- Pierre Bonnard

PREFACE

In an age of electronic networks and digital communities, the ability to access the world's knowledge from anywhere, by anyone, at anytime is the **new reality**. With data growing at an exponential rate, questions of its **physical manifestation** in the socio-environment become inescapable. As digital networks grow and develop a mounting influence on our urban and social condition, it becomes critical to develop a platform from which a **tangible** relationship with data in the public realm can be accomplished.

The **Data Centre** is an architectural typology that has recently emerged in response to the rapid consumption and production of digital information. While these data centers serve in driving global communication and economies, they operate as impenetrable objects without a common physical expression away from red and blue wires. Many adapt existing buildings and bunkers, occupy nondescript warehouses and are placed in remote sites for reasons of energy consumption and security. The current data centre typology blends in to urban contexts, sometimes disregarding humanised space entirely, justified as a response to operational constraints. The illegibility of this architectural strategy camouflages the physicalness of rapid digital data production and consumption. Giving data this 'ghost' like presence within the mechanisms of the modern world.

This thesis proposes the need for an architectural response aware of the changing knowledge landscape, one that recognizes that the human condition in the digital environment requires more than just a sign to Silicon Valley. Calling for an architectural restructuring of the data centre, enacting a tangible interface in the pursuit to locate the **human condition** within the digital expanse.

THE S I S L A Y O U T

PART .01

Theoretical positioning
p10. The Data Centre
p20. Space of Flows
-

PART .02

A look at the successes and failings of projects
concerned with the relationship between people and
information.
p22.
-

PART .03

Applied architectural design.
p44.
-

PART.01

INITIATIVE

Focused through an architectural lens, PART 01 is a literature positioning that situates the basic constructs and aims of this thesis.

Declaration
A Big Thanks
Epigraph
Preface
Abstract
Thesis Layout

xvii PART 1.0

xviii	Contents
01	Introduction
04	What this thesis is.
07	What this thesis will do.
09	Terminology
10	The Data Centre
20	Space of Flows

22 PART 2.0

24	OMA - Seattle Library
30	AT&T - Long lines Building
36	DEAD DROP - Reaction to digital space
42	Project Influence

44 PART 3.0

46	Introduction
48	Site Proposal
60	Macro and Micro Analysis
72	S.W.O.T
74	Programme
84	Form Making
104	Form Refining
122	Circulation
130	A Digital Touch
144	Ministry of Digital Information
180	Conclusion
183	Bibliography & Figure list

INTRODUCTION

FIG. 01
Interior of New York Public
Library. Google images

Digital information is a means of controlling and representing human expressions and actions. It is the contemporary authority on everything; a way of communication that modern-day interactions and societal functions demand. Digital information or data as it is commonly referred, has evolved from the pen and paper as another way of storing, creating and distributing knowledge. However Data, unlike the book, does not have the capacity to hold and require a common physical presence. This lack of physicality and its reliance on digital channels now pose potential threats to the further development of a humanized society.

The 'book' was the culmination of human expertise. It held all that collective humankind knew about the world and their place in it. The library is the home of the book, the place of learning and knowledge distribution, where groups or individuals could visit and develop their intellect together. Furthermore the symbol of the civic library was a pledge to freedom of knowledge, an image firmly anchored by its trademark as an establishment for a progressive society. The architecture of the library became the physical manifestation of

mans collective stride towards the betterment of humanity, a physical entity that performs a sense of civic loyalty and ownership.

Data is the now the contemporary equivalent to the book. Enduring all the same proficiencies a book provided in a much more modern condition. Providing access to knowledge with the added facilities that our digital society encompass; speed and flexibility with a seemingly limitless capacity. The ability to store and access information remotely has removed the need for a 'library' or a public place of assembly. Now you can swipe through the knowledge of the world from your couch at home. As a result, humankind lost the empirical value a civic library once provided and what was a public place of celebration had been reduced to that of a placeless hand-held digitized screen.

"In our lifetime we are going from not everyone being able to communicate to almost everyone being able to, from not everyone having access to a library to almost everyone having access to the worlds knowledge"

- Eric Schmidt, Executive Chairman of Alphabet.

FIG 02 Opposite.
Interior of a Google Data
Centre. Sourced from Google

1. Silicon Valley, an area
located in the USA, is widely
considered the Global hub
of technological and digital
innovation.

2009
BUT WHAT ABOUT THE DATA CENTRES?

Data centres and libraries are both repositories of information. But while data centres serve in driving global communication and economies, they operate as impenetrable objects without a common physical expression away from red and blue wires. Many data centres blend into urban contexts by adapting existing buildings and bunkers or occupying nondescript warehouses. Others are placed in remote sites for reasons of energy consumption and security. The illegibility of this architectural 'box' camouflages what the architecture of the library celebrated: the physicality of knowledge production and consumption.

What does this change in our knowledge-setting mean for architecture? What place

does architecture have in locating the human condition within our digitally saturated society?

This thesis proposes the need for an architectural response aware of the changing knowledge landscape, one that recognizes that the human condition in the digital environment requires more than just a sign to Silicon Valley . Through the linking of digital information technology to new spatial programs, experiences, and public functions, architectural **space** can offer an interface between the physical and digital environments. Over time this space can become a **place** that offers man something tangible in the pursuit to better understand digital channels; striving for a contemporary revitalization of the public emotions of grandeur, loyalty and ownership once instilled by the civic library.

“Architecture never derived
its force from stability of
culture, but rather from
the expression of those
moments when that sense
of stability slipped.”

Mark Wigley

The modern world is undergoing digital change at an exponential rate. Because of this global economic and communication channels have experienced unprecedented growth and development. Yet the time sensitive endeavours such as democracy have been less able to keep up. This widening gap between governing systems and social progression is bringing attention to concerns around digital identity, privacy and ownership. This thesis explores these elements of social influence and proposes the programmatic restructuring of the data centre in order to better serve a humanised civic condition. This profound change in information accessibility has brought the library's civic role in the digital age to question. However this thesis appreciates the civic value of the library as more than just a place to shelve books. It is understood as a place of social and political importance that has its own architectural significance, one that will not cease to endure and evolve through time. Instead of advocating for the replacement of the library, this thesis uses the past sentiment of the civic library as a precedent, one that contextualises humanity's physical relationship with information and knowledge.

The Data Centre is an architectural typology that has recently emerged in response to the rapid

uptake of digital information technology. This thesis is concerned with the relationship between humankind and our present digital environment, using the data centre as the basis from which to evolve from. The architectural research aims to create space where the intangible nature of digital information is re-imagined in a physical setting. Giving data a physical presence that invites an emotive and quantifiable human response. This is not to be confused with a singular focus towards finding an aesthetically centred 'digital vernacular', these formally driven aspects of the design process share in a wider programmatic and spatially motivated approach.

The following outlines the more general focuses relevant to the wider generation of this project:

1. This thesis explores an architectural response set in the present-day.
2. This thesis understands that all architecture needs to be site responsive, ensuring a transition from a space to a place over time.
3. This thesis aims to develop an energy efficient proposal. Architecture without a sustainable focus has no place in our delicate environment and its future.

WHAT THIS THESIS IS.

FIG. 03

Sculpture work by Fred
Graham. Project Site.
Authors own photo.

WHAT THIS THESIS WILL DO.

PART 01: THEORETICAL SETTING

First a broad analysis of data centres mechanisms is engaged along with a look into its brief history. This allows for an understanding of data centres current design treatment and contextualises the apparent social neglect. To locate the role for architecture an introduction of key urban and social theories concerned with the advent of digital information are explored. These findings helped direct and focus the project, something that has been a difficult task in such an information-saturated topic.

PART 02: CASE STUDIES

Case studies of both existing data centres and projects concerned with humankind's relationship to the digital environment are explored. These are then used to contextualise the theoretical arguments previously set and reveal the architectural imperatives and challenges that define the final scope of the project.

PART 03: DESIGN

A methodological design process can now be actioned. Influenced by the research and a robust variety of case studies, the design process focuses on developing an architecture driven by qualities of site, space and program. Aiming to re-present digital information to the public through tangible space.

Starting with site setting and analysis, the process then begins to define formal drivers influenced by existing site conditions and the development of ambient space. The design aims to create spaces that materialise an interface between digital channels and the physical environment through the application of specific forms and functions. All in hope of generating spatial opportunities for the inhabitants to physically experience the presence of digital information in a public and inclusive situation, one that is not currently associated with data use.

FIG 04 Opposite.
ENIAC, the worlds first digital
computer. Web.

TERMINOLOGY

Digital Information: A type of information that is stored using a series of ones and zeros. It requires a computer to translate this digital code into a legible analog form for man to understand.

Data: A conversational term for digital information. Although data is accurately the definition of all unorganised information, not just digital, it has become a colloquial reference to digital ethers and systems.

Data Centre: This term is used to describe a built-form concerned with housing the physical technology responsible for the generation, maintenance and storage of digital information. It is not used to define a particular architectural typology.

Cloud: A metaphor for the offsite storage and remote access to digital information. An Internet based computing that companies such as Facebook are built upon. Essentially the network services are invisible to the user, as if obscured by a cloud.

HISTORY + ANALYSIS

FIG 05. Hermann Hollerith moved his fledgling tabulating machine business from downtown Washington, D.C., to a former cooper's shop. Image IBM. Web.

1. IBM, Chronological History of IBM.

2. Ibid.

INTRODUCTION

The history of the data centre is aligned with the history of computing; as computing technologies expanded and grew so did the existence of the data centre. During the 1980s, the computer industry experienced the boom of the microcomputer era thanks to the birth of the IBM Personal Computer (PC)¹. Computers now could be installed everywhere with little thought being given to the specific environmental and operating requirements of the machines, let alone concerning their relationship with humankind.

The need for data centres became more apparent as technology was improved and the spatial needs became more specific. With the rise of the Internet and network computing in the 90's,

microcomputers² (now called "servers") started to find their places in the old computer rooms and were being called data centres. With the boom of the Internet (dot-com era) and the wide spread use of virtualisation, easily accessed offsite information became desired. The existing localized data rooms shifted offsite to become known as 'mega data centres', with the sole purpose of providing a perfect environment for efficient operation of digital information storage and management.

As a result, data centres are likened to a "big computer" more so than a built space. Essentially the data centre holds no social recognition further than that of the digital hardware it is charged with containing. The dismissal of a significant social residence can be attributed to the rapid development and inherent complexities of digital technology. In the early days of computing, things were much bigger, required some form of mechanical operation and as a result it was easier to have a general overview of the development. Computers today are so

NOTE. IBM is the largest occupier of data centre space in the world and currently owns or occupies approximately one million square metres globally.

FIG 06. Photograph of Server racks at Googles Douglas County Data centre in Georgia USA. Image from Google.

- 1. The Data Centre as a Computer. Barroso, Clidaras and Holzle 2013.
- 2. Ibid. p 6-7
- 3. Ibid. p 47
- 4. Ibid. p 53

complex that even specialists are only familiar with partial aspects, with computers requiring a team of specialists to master. The nature of complexity and its role in social acceptance are explored later, first it is important to understand the technical requirements of data centres and how this has attributed to its social retreat.

The following has been split in three sections: Space, Energy and Access. Each of sections covers the three major aspects of data centre design that play major roles in the function, aesthetic and location of data centres today.

SPACE

The spatial requirements of a data centre are summarized in the block diagram opposite (Fig.07). As you can see from the diagram, a majority of the spatial requirements of a data centre are taken up by the IT equipment and environmental control systems.¹

IT Equipment: The main components of a data centre are the servers that are responsible for the access, storage and distribution of

digital information. Stored on racks within server cabinets of varying sizes² (dependent on the storage requirements or availability of technology) these server cabinets are then stored within the data centre shown below (Fig.06).

Environmental Control: IT equipment needs a maintained cool environment to prevent overheating and consequent failure³. Data centres employ various different methods of environment control ranging from fresh-air cooling (economization) to water-cooled systems. Economization uses the existing external environment to provide the required temperatures, a system than can only be employed when the data centre is sited in cold

PROGRAMME

- 1.Environmental Control
- 2.Power Distrubution
- 3.Server Cabinet
- 4.Back up Storage
- 5.Admin
- 6.Pump Room
- 7.Generators

FIG. 07
Basic spatial makeup of a Data centre. From the book *The Data Centre as a Computer*

environments⁴. Although this reduces energy costs dramatically, it is a major factor is modern data centres being placed in remote inaccessible locations. A water cooled system as the name suggests, cools the servers with water.

The two systems previously explained are examples of environment systems focused around controlling the temperature of an entire room. The next environmental control system is one that is concerned with only cooling the racks and servers themselves. This system is known as

in rack cooling and has a few different methods of implementation.

The first option is to take the big bulky systems required to cool an entire server room and attach much smaller units to the back of each server cabinet. Providing space saving benefits and also a more efficient model of environment control, as the system is only concerned with the server temperature and not the entire space. The next option is the use of cold plates, i.e. liquid cooled heat sink. Which through the direction of

1. *The Data Centre as a Computer*. Barroso, Clidaras and Holzle 2013.
2. *Ibid.* p
3. *US department of Energy*. 2016

cold water through metal plates removes heat from the server racks. Cold plates¹ are also a safer example of water cooled systems as the likelihood of leaks is much less when compared with water cooling systems using conventional plumbing methods.

Administration and Security: Because data centres are digitally based the need for onsite human occupation is relatively limited when compared to the scale of many of these facilities. The number of people needed to run a data centre is proportional to the number of servers on site, a rough figure is 1 technician per 1000 servers². As the number of servers increases so will the need for technicians, and subsequently the need for sufficient living and working conditions (bathrooms, social spaces etc). Other than the technical systems, the next job requiring a physical presence is security, although advancements in this field have also reduced the need for people being on site. Because of this many data centres have the necessary people on call resulting in these empty, cold and generally inaccessible facilities.

ENERGY

Data centres consume an immense amount of electrical energy. In the United States a 2007 report found that the data centre sector accounted for 1.5% of all US electricity consumption in 2006 (61 billion kWh) totaling a cost of \$4.5 billion.

These huge numbers are the reason why data centres and their design is focused heavily around being energy efficient. The two major consumers of energy are the servers and the environment systems. The server energy use is a closed system, meaning advancements in server technology are needed to reduce their energy use. Maintaining a controlled environment however is affected by the design and location of the building. This relationship between built form and a controlled environment leads to various design outcomes, with a few outlined below:

a.) Little to no fenestration. Allows for spaces

FIG. 08
Energy use percentages by function in a US data centre. Source: EPA 2007 report to congress on server & data centre energy and efficiency.

temperature to be more easily maintained.

b.) Remote locations in cold climates. Allows for efficient fresh air cooling (far cheaper and greener than mechanical systems)
c.) If cold location unavailable. Large amounts of space dedicated to the mechanical cooling systems required.

ACCESS

With the successful operation of companies relying on the operation of its data services along with many data centres holding

sensitive personal, corporate and government information, the secureness of these data centres is important. Much like environmental considerations, the need to secure data centres and their holdings plays a significant role in the site selection and design of a data centres structure and its spaces.

Security of a Data centre involves more than just limited access to the facilities internal spaces. Considerations around natural disaster responses, fire protection, and data recovery/

ARCHITECTURE OF THE DATA CENTRE.

The current focus of data centre design is on developing the most efficient and effective model of storage and distribution. This has lead to the architecture language of the data centre being driven by the functional constraints and programme requirements outlined previously. All with the purpose of getting the information from the server racks to the individual as quick and cheap as possible (both in terms of monetary and physical resource value). The following is an outline of the key factors that contribute to the design of todays data centre. Site and Form collapse the architectural language of the data centre into direct relationships between required functions and the consequent effects. This is explored in finer detail in part 02 of this thesis (case studies).

SITE

Three major factors contribute to the site location of a data centre:

1.) Availability/price of land: The need for large amounts of floor space drives many data centres out of populous urban areas where land price is high and space is limited.

2.) Securitization: The sensitive information that data centres hold is another factor for wanting to distance their location from large populations of people, in hopes of reducing security threats.

3.) Favourable climate conditions: Cold climates are considered ideal for data centre locations as it reduces the need for artificial cooling systems and brings the energy consumption down significantly.

FORM

Three major factors contribute to the form of a data centre:

1.) Environment control: The strict cooling requirements for internal space mean fenestration is undesirable, as a fully closed and insulated room is the most efficient space for maintaining a constant temperature.

2.) Securitization: The sensitive information that data centres hold means not only security threats from individuals are considered, but also larger threats such as terrorism and natural disasters¹. This leads to many data centres becoming strengthened structurally, resulting in bunker like forms and construction methods.

FIG 09. The Newest Addition to the Facebook Data Center Fleet. Visualisation. Image from FB newsroom.

FIG 10. Mokai Geothermal electrictal power plant. 20km north of Taupo. Image from Tuaropaki.com

1. Cushman & Wakefield LLP. Data Centre Risk index. 2016. pg 3

2. Ibid.

3.) Size: The amount of information needing to be housed within the development plays a significant role in the form of a data centre. With the existing server racks and cabinets layout a large area of column free space is required. This leads to data centres sprawling outward becoming large non-descript factories or tall extrusions on concrete (see AT&T case study).

Considering how a data centres architecture could add something of value to society has been pushed aside in the pursuit for the most efficient model. From this research it is clear to see that data centre design considers all but one aspect of a typical architectural project; the Human. Site, environment, security, resiliency, adaptability and energy use are all major factors

when implementing a new data centre². Instead of the focus being around how the design can benefit man, it is concerned purely with the computer. Essentially data centres are treated like any other piece of critical infrastructure, there to serve a wider purpose. Comparable existing examples of infrastructure include telecommunications or electrical distribution systems, each with specialized components **that invariably inform a formal and spatial consequence**. These examples of infrastructure have an architectural language, which, unsurprisingly is almost indistinguishable from that of a data centre (Fig 9&10). However these existing infrastructural systems have defined interactions with society and the space it occupies, with the most obvious example being

electricity and its distribution. Through a network of physical installations (power poles & lines) electrical infrastructure has a presence that is visually and tactilely accessible in every modern urban context, giving place to consumption of energy. Conversely, data centres interact with the world through personal computerized devices that support no public presence and begin to breakdown the relationship between consumption and place, which once were inherently linked.

Upon review it is clear that there has been an unintentional abandonment of digital information’s physical representation within the civic and social domains. Unlike electrical infrastructure, that through no direct attempt of its own; requires a physical place in modern populated areas (power lines and alike). As

a result delivers a civic sense of achievement and progress. Data centres do not require this physical presence, and therefore cannot physically contribute to a larger social and civic audience.

As the data centre is just a cog in the workings of the most significant influencer of our time, the Internet, it is not difficult to understand how this neglect manifested. The complexity of digital infrastructure in combination with the uptake of personal devices led to the receipt of a social ignorance. Because digital information serves a global social, political and economic need, the people of world have become unconcerned with how it works or where it comes from, only with having uninterrupted access to ‘everything’ at the swipe of a finger.

SPACE OF FLOWS

Manuel Castells’ ‘The Information Age: Economy, Society and Culture’, is an analysis of contemporary capitalism, presenting a theory of urbanism positioned in the information age that has resounding implications for architecture. Castells explores how the presence of digital ethers and the capitalist consumption of electronic information have implications for the development of a humanised society. Castells’ theory of urbanism supports the employment of architecture to develop a tangible relationship between digital information and society.

This theory of urbanism is based on the distinction between two key spatial characterisations of the information age, the “space of flows”, and the “space of places”¹. Castells describes the space of flows as the “material support of simultaneous social practices communicated at a distance,

[involving] the production, transmission and processing of flows of information.”² The space of flows is the dominant spatial manifestation of power and function in our societies³; meaning the way in which society places itself within the information age is of direct response to the use and application of this digital information and technology. This thesis recognizes the ‘space of flows’ as the consumption and production of digital information.

Castells does make mention that although the space of flows is the spatial model where power and social functions are currently organized, people continue to live in the ‘space of places’⁴, reminding us that we move physically (space of places) while staying put in our electronic connection (space of flows). Emphasizing that we carry ‘flows’ while we move across ‘places’.

1. Manuel Castells. *The Information Age: Economy, Society and Culture*. pg 409
2. Ibid. pg 443
3. Ibid. pg 409
4. Ibid. pg 453
5. Ibid. pg 458
6. Ibid. pg 459

Furthermore, Castells suggests because function and power in our societies are organized in the space of flows, the domination of its logic alters the experience of places, becoming abstracted by power and increasingly separated from knowledge⁵. This meaning that not only is digital information defining the how our society works, but as a result it is also beginning to shape it.

The final chapter highlights information technology's influence in shaping the urban condition, warning that the contradiction between the two opposing methods of spatial organisation threaten to break down communicative channels in society. “Unless cultural, political, and physical bridges are deliberately built between these two forms of space, we may be heading toward life in parallel universes whose times cannot meet because they are warped into

different dimensions of a social hyperspace.”⁶ Castells analysis of the urban condition in the information age has reinforced the need to develop a tangible relationship between digital networks and society, between the space of flows and the space of places. Giving people an opportunity to experience a physical connection with digital information, outside their Facebook pages and off their electronic devices, in the pursuit to better understand digital channels and its influence on the development of a humanised society.

PART.02

CASE STUDIES
Focusing the research through analysis
of existing projects concerned with
the relationship between people and
information.

- 2.01
SEATTLE PUBLIC LIBRARY
- 2.02
AT&T LONG LINES BUILDING
- 2.03
DEAD DROP
- 2.04
PROJECT INFLUENCE

SEATTLE PUBLIC LIBRARY

2.01

FIG 11 Opposite.
The Seattle Public Library.
Image source ArchDaily
FIG 12 Left Below.
The Seattle Public Library.
Atrium Image source Arch-
Daily
FIG 13 Right Below.
The Seattle Public Library
programme model. Image
source ArchDaily

With the advent of digital information, the role of the library in our digitally saturated society has been brought to question. A built example that addressed this change in our knowledge landscape is OMA's Seattle public library, designed within the concept of 'Urban consolidation'. In this concept OMA reinterpreted infrastructural elements typical of the city as spatial components of the building, thus suggesting a continuation of the public realm. In this design, the classic program of the library consisting of information storage and transfer is extrapolated into an urban event space, offering the reader many spaces, places and information mediums to interact with.

This approach to defining programme has lead to its expressive exterior facade. The rigid structuring of spatial elements and defined use spaces resulted in a strong geometrical form that was accentuated by its blatant wrapping of form. The diamond structural grid encasing the interior is angular and sharp, expressing the stacked and cantilevered spaces within. This honesty of form develops an intriguing aesthetic driven by its simplistic shape that is then complicated by the intricacy of the structural detail. Structure is important in the over all appeal of this work of architecture, especially in terms of it making a public work that instills a sense of civic pride and ownership.

FIG 14 Opposite.
The Seattle Skyline. Image from flickr.com

FIG 15 Left.
The Seattle Public Library. Programme diagram. Sourced from Archdaily.com

FIG 16.
OMA's Seattle public library.
Image highlighting the
expressive structural system
that wraps the entire exterior.
Source Archdaily

LONG LINES BUILDING

2.02

FIG 17 Opposite.
AT&T Long lines Building.
Drawing. Socks-studio.com

This case study is an example of how the buildings infrastructural utility informs the articulation of shape and materials. In fact, given the rarity of human inhabitation, utility has become the sole parameter in the design of the data centre. This brutalist piece of architecture remains an enigma to many New Yorkers, without any fenestration of any kind the only exterior protrusions are for air ventilation. Due to the building's technical nature, the height of each floor is 6 m, almost double that of the normal office building, and there is thus only 29

floors altogether which one can only begin to understand once inside the building.

I have mixed feelings towards this work of architecture. On one hand I despise this building for its total blockade of the outside world. As a result long lines has single handedly defined digital information as a 'divine power' that we are not worthy to greet or know. Treating digital information as a utility not worthy of understanding, only use. A prime example of how data centres refuse to address a civic need

Name: AT & T Long lines building
Location: 33 Thomas St, Manhattan, New York
Date Built: 1974
Architectural Style: Brutalist
Architect: John Carl Warnecke
Height: 167.5m
Use: Secure data storage facility.

FIG. 18
NY.Skyline. Photograph
Flickr.com

and instead become a physical expression that reinforce the separation between digital information and man. On the other hand I am intrigued and attracted to its fierce architectural honesty. The Long Lines Building's consistency of function (bar the intake and exhaust of air) is translated into the severity of its uniform granite facade. The irony found in the designs total rejection to interaction with the outside world in contrast to its site in the middle of one of the busiest cities in the world is humorous. Stubbornly devoted to the rule of its era: Form follows Function.

FIG 19 left.
AT&T Long lines Building.
Photograph. Socks-studio.com

FIG 20 Right.
The lack of fenestration
creatings an imposing
aesthetic. AT&T Long lines
Building. Photograph. Socks-
studio.com

FIG. 21
AT&T Long Lines Building.
socks-studio.com

2.03

- 1.Eyebcam is a nonprofit studio for collaborative experiments with technology toward a more imaginative and just world. <https://eyebcam.org>
- 2. Aram Bartholl. <https://deaddrops.com>
- 3. Ibid

This case study looks at an art movement that began in NYC in 2010. It is the work of conceptual artist Aram Bartholl, who conceived the idea during his stay at Eyebcam¹ as the artist in residence. He has a website² which provides a manifesto as follows:

Dead Drops is an anonymous, offline, peer to peer file-sharing network in public space. Anyone can access a Dead Drop and everyone may install a Dead Drop in their neighborhood/ city. A Dead Drop must be public accessible. A Dead Drop inside closed buildings or private places with limited or temporary access is not a Dead Drop. A real Dead Drop mounts as read and writeable mass storage drive without any custom software. Dead Drops don't need to be

synced or connected to each other. Each Dead Drop is singular in its existence. A very beautiful Dead Drop shows only the metal sheath enclosed type-A USB plug and is cemented into walls. You would hardly notice it. Dead Drops don't need any cables or wireless technology. Your knees on the ground or a dirty jacket on the wall is what it takes share files offline. A Dead Drop is a naked piece of passively powered Universal Serial Bus technology embedded into the city, the only true public space. In an era of growing clouds and fancy new devices without access to local files we need to rethink the freedom and distribution of data.

The Dead Drops movement is on its way for change! - Aram Bartholl, Dead Drop manifesto.

1. A hole is drilled into the wall, floor, roof or anything you can find that will support a USB (pretty much anywhere..)

2. After placing the digital content on the USB, insert it into the wall so that only the 'tongue' is visible.

3. Fix the USB in place using quick cement or other appropriate fasteners. Making the usb look like it is as much apart of the built form as possible.

4. Touch.. Plug.. Pause..
INTERACT! The dead drop is now active and ready for some old fashioned physical interaction. Upload the Dead drops location at Deaddrops.com`

Authors own sketches.

Figures Below. Authors sketches depicting how the dead drops cause a physical interaction between people, architecture and data.
1. Aram Bartholl. <https://deaddrops.com>

Along with this manifesto there are instructional videos, a FAQ board and a locations map, where interested members of the public can geo-locate their own dead drops they have implemented around the world. Currently there are **1,858** dead drops counted for around the world, totaling **25,081 Gigabytes** of physical public USB storage space¹.

The dead drop movement was born out of the growing concerns around data ownership and censorship in the digital environment, both topics that have become mainstream news in the wake of affairs such as Edward Snowden with Wiki Leaks. Along with providing a system

of digital storage that is free from political and social censorship, the dead drop movement also delivers a situation to the user that is unlike any other digitally focused condition. Through forcing the digital consumer to get their "knees on the ground", or put their "jacket against a wall"² in retrieval of the digital information, a dead drop challenges the lack of physical interaction between digital information and man.

The cementing of a USB stick into built form shifts the data held within the USB into the physical world. Access and use now being influenced by time and space, both of which digital information

FIG. 22
Close up of a Dead Drop
embedded in a brick wall.
Image from deaddrops.
com

“I fear the day that technology will surpass our human interaction. The world will have a generation of idiots. ”

- Albert Einstein

by design is inherently uninhibited by. Regardless of whether or not a user physically downloads/uploads information to that USB or just notices it in passing, the presence is enough to incite thought patterns that beg the user to question their physical relationship with digital information. Architecture is used as a vessel, bridging a connection between the physical world and digital information, allowing for a moment of pause in the boundless and persistently impatient domain of digital access. Although the placing of USB devices in public space as a viable means of digital information access and distribution is questionable and fundamentally flawed (USB sticks in themselves will most likely be swallowed up by technological advancements and rendered useless within the next decade) the proposition of facilitating a physical interaction between digital information and humankind is hugely important to the development of this thesis. Not only does it force a physical relationship between data and humankind, it uses architecture to do so. Creating a trio of interactivity that develops emotions and understandings around the physicalness of digital information.

PROJECT INFLUENCE

2.04

From the previous case studies there have been three major lines of influence taken into the continuation and design of this thesis project. They have been defined below in two categories: Form and Programme.

Form:

When looking at both the Seattle library and Long lines AT&T it was obvious to note that both projects had a very strong structural aesthetic. Long lines building holding this within its homogenous solid façade and strength of stone, and conversely in the Seattle library whose façade is made up of many glass panels but

framed within a continuous deep structural grid.

Programme:

Coming across the dead drop movement presented interesting opportunities for the programmatic function of the new data centre. Not by implementing it as a viable means of digital storage and access, but instead by positioning it as a sculptural element throughout the design, becoming an ornament that celebrates and expresses the physicality of digital information production and consumption. (developed in part 3)

Part 3

3.01

Introduction

Project focus

Site Proposal + Analysis

3.02

Defining Programme

3.03

Form Making

3.04

Form Refining

3.05

Circulation

3.06

A Digital Touch

3.07

Ministry of Digital Information

- Plans, sections & perspectives.

3.08

Conclusion

DESIGN

A full architectural design process is engaged. From site analysis to rendered visualisations. Humans digital relationship facilitated by architecture is actioned.

INTRODUCTION

The design component of this thesis investigates the research proposition of a new data centre. Focusing on how architecture can facilitate a tangible interface between the physical and digital environments. Through the linking of digital information technology to new spatial programs, experiences, and public functions, the design aims to develop space that offers the public opportunities for a collective understanding of digital information at a civic scale, in direct opposition to the experience offered through personalised devices.

The theoretical context in which this exploration operates, comes from the urban theories introduced by Castells which called for a bridging between digital networks and physical space to better serve the future of our urban condition.

The process takes the understandings gained through the analysis of the historical and existing functions of data centres and proposes new mechanisms that are better suited to developing an inhabitant focused architecture. The design aims to utilize conditions of site, environment and technology to better serve a civic need, while taking cues from the

formal case studies to create civic aesthetic values concerned with a digital expression.

Beginning with a detailed analysis of site by looking at existing site conditions through macro and micro lenses. The exploration leads to a SWOT analysis that provides a robust foundation for the programmatic and formal derivation processes that follow.

The programmatic development of the project begins by reshuffling the existing spatial programmes of the data centre. Then, by exercising opportunities found in the technologies utilised by digital networks and existing conditions of site, proposes spatial uses and forms that develop tangible relations to the digital environment. After the architectural programme is confirmed the formal development of the project begins. Using the axial conditions found on site, the process develops relationships between the existing Reservoir, Museum and landform leading to the initial form finding to be of a considered and appropriate scale. This initial mass is then detailed and developed into the final work of architecture presented in plan section and perspective.

SITE PROPOSAL
+ ANALYSIS

Looking east at the
Auckland War Memorial
museum. Authors own
image

Satellite Image of Auckland City. Auckland Domain is highlighted.

NORTH

WIDER AUCKLAND

NEW ZEALAND

AUCKLAND

DOMAIN

FIG Below. Flower from the nursery in the Domain. Authors image.

FIG 23 Opposite. View of museum and proximity to city from above. Image from Auckland city council

Auckland Domain is the city's oldest park. It is spacious with a diverse range of built and natural assets placed throughout. Located on the edge of Auckland's CBD, the domain is a large centrally located public space, providing civic amenity from recreation to event opportunities. Edged by the Auckland City Hospital and home

to vast sporting grounds, the domain is a hub of activity throughout the year. The Auckland War Memorial Museum sitting at the domain's highest point, is a main feature of the park. The domain is also host to a range of formal gardens, bush walks and the ASB tennis arena on its northern boundary.

DOMAIN RESERVOIR

FIG 24 Opposite.

Photograph of the reservoir during construction in 1951. Sourced from AK city council heritage image library.

1. A.J. Dickenson, City Engineer to the town Clerk, 1949.

2. Timber board molds used. Important to note as this was considered and utilized in later design stages.

This historic vaulted mass concrete structure on Observatory Hill to the south of the Auckland War Memorial Museum was excavated into the crater ridge of the Domain volcano between 1949 and 1952¹. The Domain reservoir is a 4 million gallon service reservoir that acts as a buffer reservoir for the neighboring Parnell area and parts of the Auckland CBD. It was one of three new service reservoirs that were planned for Auckland City in 1947, the others being Mt Hobson and Three Kings. Due to logistical issues and post-war steel shortages, the construction of the first two reservoirs was delayed and it became a matter of critical importance for the cities water supply that the Domain reservoir

was completed with utmost urgency. As steel was scarce and geological investigations of the site indicated it was suitable, the decision was made to build the reservoir using vaulted mass concrete construction techniques². After completion, the reservoir faded from public interest and memory, unseen and unnoticed, an important yet now hidden piece of the city's infrastructure. Today its outline is only faintly visible from aerial photographs of the Domain, where the grass is stunted by shallowness of the soil above the vaulted roof. The reservoir is a unique part of Auckland's heritage, a remarkable space if only able to be experienced...

AUCKLAND DOMAIN RESERVOIR

Location: The Auckland Domain, Parnell, Auckland 1010

Significant neighbours: Ak Memorial Museum.

Architectural Style: N/A

Volume: 15,000 m³

General Dimensions: 10m D, 60m W, 50m L.

Use: Water reservoir for parts of Parnell and the CBD.

Figure Below.

Exploded digital model of the existing reservoir below ground in the Auckland Domain. Authors own image

Figure 25 Opposite.

Aerial photograph of the domain. Highlighting position of subterranean Reservoir. Source Bing maps.

NATIONAL WAR MEMORIAL

Auckland's war memorial museum has an interesting architectural heritage. One of New Zealand's earliest examples of a competition driven architecture, the world wide competition drew 70 entries, with the winner being an Auckland firm, Grierson Amier and Draffin. Opened in 1929, the architectural work also won the New Zealand's institute of Architect's gold medal, commanding its place in Auckland's and New Zealand's architectural history from its first moments in the public eye.

NATIONAL WAR MEMORIAL MUSEUM

Location: Auckland City

Significant neighbours: Auckland Hospital. CBD

Architectural Style: Neoclassical

Architect: Grierson, Aimer and Draffin

Height: 21 m

Construction Material: Concrete

Figure 26.

Aerial photograph of the domain. Highlighting position of Museum. Source Bing maps.

Photograph looking
north towards Auckland
Museum. Authors own
image.

SITE & CONTEXT ANALYSIS

MICRO & MACRO

ASB TENNIS STADIUM

AUCKLAND CITY HOSPITAL

AUCKLAND DOMAIN GARDENS AND
PUBLIC ACCESS NURSERIES

EDUCATIONAL FACILITIES.
Auckland medical school.
ACG

AUCKLAND DOMAIN cricket fields

TECH COMPANIES (VECTOR LTD)

MAIN ACCESS NODES

Source.
Google maps search
engine.
Keywords:
Data centre_
Digital Storage

- AUCKLAND DOMAIN
Largest area dedicated to public space in Auckland
- EXISTING RECREATIONAL ZONES AND PUBLIC PARKS IN AUCKLAND CITY.
- NATURAL VOLCANIC CONE DIRECTS DOMAINS FOCUS AND VIEWS TOWARDS THE CITY.
- VIEW SHAFTS ACCESSIBLE FROM ATOP THE RESERVOIR INFRONT OF THE MUSEUM.

Source.
Google maps search engine.

AUCKLAND DOMAIN

Physical data storage sites. Non specific client/
digital information.

WHANGAREI 1

AUCKLAND 11

HAMILTON 3

TAURANGA 1

PALMERSTON NORTH 1

WELLINGTON 3

CHRISTCHURCH 4

DUNEDIN 1

INVERCARGILL 1

AUCKLAND DOMAIN

COMMERCIAL/INDUSTRIAL ZONED.
LARGE DIGITAL FOOTPRINT

PORT OF AUCKLAND.

CBD. MOST CONCENTRATED ZONE OF
DIGITAL CONSUMPTION IN NZ. DIGITAL
FOOT PRINT GROWING EACH DAY

Source.
<https://www.aucklandcouncil.govt.nz/geospatial/geomaps/Pages/default.aspx>

- AUCKLAND DOMAIN
- AUCKLAND MOTORWAYS
- BUS ROUTES
- NZ CENTRAL TRAIN LINE
- HARBOUR FERRY ROUTES
- BRITOMART- Aucklands transport hub

STRENGTHS

- 1.** Local to CBD
- 2.** Lies within the public domain. Existing social emotions of civic ownership and loyalty.
- 3.** Neighboring the Museum and hospital reinforce the space as a significant space of public place.
- 4.** Surrounded by Main transport routes and hubs.
- 5.** Unique placement atop the Reservoir. An existing examples of a hidden piece of important infrastructural utility.
- 6.** Significant views available to well known icons of Auckland and NZ. (Rangitoto Volcano, Auckland Skytower, Auckland Harbor Bridge).
- 7.** Significant recreational facilities and social spaces ensures exposure to foot traffic.
- 8.** Auckland has the highest concentration of data centres in New Zealand.
- 9.** Quality existing access nodes and routes filter throughout the site.

WEAKNESSES

- 1.** Buildable space is limited. Much of the site is covered in native Fauna, existing built works and dedicated recreational space. The only considerable open spaces are at the front and rear of the Museum.
- 2.** The size and height of the Museum puts pressure of the development of the data centre, too small and it will be seen as insignificant. Too big however and it will be seen as disrespectful and inconsiderate.
- 3.** The openness of the site and ease of access presents issues around being able to provide 24/7 security without the need of personal on site.
- 4.** The underground situation of the site is busy. With the subterranean reservoir being metres away from the museums underground carpark and basement.

Figure 27.
Aerial photograph of the domain and surround suburban context. Source Bing maps.

OPPORTUNITIES

- 1.** The reservoir presents a body of water that can be used as a method of cooling for the digital infrastructure to be housed within the data centre.
- 2.** The existing concrete structure of the reservoir presents interesting spatial opportunities. The concrete vault ceilings, textured board formed columns and vast scale are all pre-existing elements that can be utilized to generate exciting architectural space.
- 3.** The domain's public use as both a space of recreation and education develops a strong opportunity to extend these spatial practices into the design of the data centre. Using the recreational trends of site to compliment the development of a passive tangible relationship to data, whilst the educational trends to endorse a more active approach.
- 4.** Significant view shafts present from site allow for spatial mapping to generate specific visual alleys that help frame and define a space.

THREATS

- 1.** The association between digital infrastructure (today) and public parks is contradictory, until the understanding of digital infrastructure shifts, the public will question the appropriateness of a data center within a public park.
- 2.** The existing Museum has a long and prominent history in both the social and architectural discourse of Auckland and New Zealand. The significance of this project presents issues around whether the works of architecture will attempt to compliment or dominate one another.
- 3.** The domain encompasses the hospital, the museum and the largest public space Auckland has to offer. Adding another highly public focused work could run the risk of over saturating the space and detracting from its appeal as a natural environment.
- 4.** The proximity to the CBD, without actually being embedded within it, leads to potential misunderstandings that this data centre is still failing to address issues around being apart of a 'true' urban environment.

PROGGRAMME

SPACE MAKING

3.02

THE PROBLEM

Data storage and its infinite list of operational requirements dictate the architectural input. As a result the spaces become utility driven, forcing the architecture of the data centre to become a barrier between society and its understanding of digital networks.

THE SOLUTION

Refocusing the architectural influence to be centred on people and their spatial needs will reverse the problems found in the previous model. The spatial requirements of data are now fitted around that of people, leading to architecture concerned with meeting the strict operational requirements of digital networks whilst still generating spaces for interaction of people. Repositioning site as a tool to engage and benefit all the varying aspects of design influence, leading to a meaningfully sited, humanised architectural design.

RE-ALIGNED DATA CENTRE MODEL

Now with an architectural focus around developing spaces for human interaction, the rest of the programmatic requirements can be factored into the equation. With site now being chosen to better suit human interaction, inventive solutions need to be developed to help facilitate the climate requirements for the efficient operation of the digital utilities. A 'circle of influence' has now become apparent in this new data centre model. Where people have been re-expressed in terms of a collective **community**, whose needs influence the architectural design that is responsible for the successful operation of the digital network. Which is then linked back alongside the interactions within the community.

DIGITAL SOAK HOUSE

PROGRAMME DEFINED

The existing Reservoir located on site has provided an opportunity to develop a method of temperature control for the digital infrastructure that is convenient, environmentally considerate and most importantly efficient. Simultaneously the reservoir provides the opportunity to turn the subterranean space into a bathhouse, one that utilises the heated water that results from the water-cooled server racks. This common use of resource helps define a physical vessel that can aid in locating the human condition within the digital environment.

MINISTRY OF DIGITAL INFORMATION

PROGRAMME DEFINED

The programme proposed for the new data centre is that of a government ministry. Serving to not only provide the necessary infrastructure for the continued growth of our digital networks, but to gather a better understanding of them along the way. Focusing on providing opportunities for education, censorship and operation, the Ministry of Digital Information fills a widening gap in the social order, addressing the civic need for a better understanding of digital networks and the effects on our socio-political climate.

SPACES DEFINED

Educational

Auditorium
Digital Work shops
Digital Laboratory
Exhibition space

Digital Soak House

Public Pools
Private Pools
Reception
Changing rooms
Pump rooms
Operational Accessibility

Ministry of Digital Information

Office Space
Meeting Space
Reception
Server rooms
Operational accessibility

Digital Experience

Individual Experience (Escapism)
Public Experience
Exposed server racks
Exhibition space
Function Space

Public Experience

Atrium
Cafe
Exterior spaces
Function space
DEAD DROP PARK

Functionality

Toilets
Access - Fire routes, vehicle and pedestrian.
Water storage and distribution
Cooling ponds

SOAK HOUSE

SPATIAL APPROACH

3.03

Site Axis'
Initial Massing Study
Process Diagrams

FORM MAKING

3.03

AXIS LINES: site // Built + Landform

The axis is perhaps the most rudimentary means of organising forms and spaces in architecture. It is a line established by connecting two points in space, from which begins to describe a visual story about the relationship between the surrounding spatial elements. An axis is presented as a linear condition, which develops qualities of direction and length whilst correspondingly promoting a sense of direction along its path.

The use of axis' to develop the initial formal responses of the project is an appropriate design response for following reasons:

1:

The museum is of neoclassical design and holds a very strong axial presence. As a prominent and also visually appealing neighbour to the site, it is only appropriate to acknowledge this work of architecture in the design process. Extending the axis of the museum into the site generates an axial relationship that places spatial pathways that will ensure that the strong directionality promoted by the Museum's form is embraced. Ensuring a satisfying visual connection between old and new, laying the foundation for a stronger formal relationship.

2:

Axial space planning has always been associated with civic structures, thanks to classical architecture and its place as the architectural

voice of government and democracy. This bond between axial relationships and public place has long been used when creating spaces of civic importance, however it is subtle enough as to not dictate a predetermined architectural language and therefore hindering the opportunities of the design (appropriate for initial form finding).

3:

The central axis of the reservoir is offset from that of the museum. This slight deviance away from the strong axial presence of the museum presents opportunities for a second spatial organising system that can begin to develop overlapped space/intersection of forms.

The following is an initial formal study, focusing around these axial relationships found on site (explained by the diagram pg 92) aiming to generate a solid platform from which the design can begin to develop, whilst ensuring a locally appropriate aesthetic is derived and adhered to.

Initial massing study. Focused around accenting the axis' of the museum, reservoir and existing ridgeline. Generating form placement that has a strong relationship to the site.

- 1. Underground reservoir + Museum
- 2. Bringing reservoir up into public domain
- 3. Removal of topsoil
- 4. Created a new interactive edge between domain and reservoir.

- Adding programme mass .1
- Reintergrate reservoir .2
- Internal courtyard .3
- Dual edges: facing domain + reservoir .4

- 1. Disconnect between reservoir + museum
- 2. Splitting of edge
- 3. Visual alley created
- 4. Accessible internal courtyard

- Water volume extruded .1
- Split of reservoir storage capacity .2
- 1/8 + 7/8 split .3
- Develops a more accessible .4
- environment between water mass and domain

- 1. Remaining water volume
- 2. Separate into managable volumes
- 3. Re-alignment
- 4. Exaggerates axis of previous reservoir

- Axis too heavily focused on reservoir .1
- Water volumes re-aligned with museum axis .2
- Greater presence developed .3
- Addition of volume for building services .4

- 1. Addition of entrance + dedicated public space
- 2. Edges to re introduce visual edge of reservoir
- 3. Form re-sized
- 4. Proportions of museum considered

- Two facing edge conditons .1
- Addition of space for programme .2
- Extension to develop edge depth .3
- Scale relationship to urban landscape .4

1. Visual edge of reservoir expressed
2. Height reduced to allow for views to harbour
3. Scale relationship to urbanscape softened
4. Continual edge developed. Strengthens relationship between separate forms

- Scale relationship softened .1
- Three-step scale relationship symmetry .2
- Visual alley to museum accented .3
- Visual access to domain generated .4

- 1. Visual access to domain expanded
- 2. Formal changes add aesthetic interest
- 3. Simplifying form
- 4. Extension of entrance. form mirrors domain edge.

- Soften edge viewed from road access .1
- Green roof additions. Softening scale .2
- Courtyard green space added above .3
- Site relationships strengthened .4

This form finding process defined by axial conditions of site has ensured that the relationship between the proposed architecture and existing built forms is considered, in the hopes of developing an aesthetic that does not dominate site or vice versa. The form proposes a direct link between the Museum and the internal courtyard, whilst simultaneously developing lines of motion east to west connecting the domain with the neighbouring suburban condition. The terracing of form has been done to ensure that the scale of the architecture is respectful to the natural contours of the immediate site below. This process has generated a form foundation with a blank canvas, which ensures the project does not deviate in unwanted directions during detailed design.

3.04

Aesthetic Drivers
Process & Implementation
Concept & Review
Visual Mapping

FORM REFINING

3.04

Spatial Drivers

The detailed design process began with the two entrances. Facing east towards the domain and the west towards the suburban context. Because connecting with the subterranean reservoir existing on site was important, the development of the spaces was carried out (mostly) in section. This meant that a solid relationship to the ground condition was always considered in each spatially focused decision. The design process involved both digitally modelling the concepts and building physical models to test out the spatial implications.

Because this design method separated these spaces from the rest of the building's form, it presented the potentials to deviate from the spatial constraints founded in the formal study previously undertaken. To counter this, the two design explorations of the entrance spaces were not to be treated as final spatial results. Instead these spaces and their concurrent spatial explorations were used as aesthetic

Hand models of the designed spaces were assembled to develop a spatial understanding.

Detailed spatial study of the western entrance to the domain. Explored through section.

- i Horizontal grid roofing structure projects down through the space. Order + Logic
- ii Vertical slat facade. Varying in length, the combination presents a blurred screen that filters light into the interior.
- iii Raised cantilevered viewing platform.
- iv Cantilevered mass of Data servers appearing to float over pool.
- v Cooling pool.
- vi User encouraged Dead Drop wall

drivers. Much like the previous formal study, they became the aesthetic and spatial influence for the rest of the spaces throughout the entire design. Expressing structure and defining a digital presence were two major design influences for these spaces. Resulting in both designs holding a strong vertical presence, using exaggerated structural members to define civic emotions of strength and identity. The translucent nature of both spaces also ensures a public sense of ownership, using the openness of space to both invite interaction but also to allow the dense structural systems to filter light forming complex shadows that vfill the large open spaces.

These two spatial designs where carried out simultaneously, focusing on presenting a strong sense of digital presence and public involvement. The following is an image walk-through of the spaces in the rest of the design, strongly influenced by these two initial detailed design studies.

Detailed spatial study of the eastern entrance to the domain. Explored through section.

- i Expressed angular structure supporting Data servers
- ii Concrete grid façade. Order + Logic
- iii Data Servers
- iv Curved disappearing concrete 'waterfall'. Exaggerating the grounded nature of data storage.
- v Public promenade. A stage for the presentation of the Digital infrastructure

Perspective of eastern facade, depicting an aesthetic of strength through the repetition of structural form. Using the stacked server racks as a facade element. Developed from the initial detailed study of the eastern facade.

ORDERED SPACE

CIRCULATION

3.05

The main atrium (image opposite) serves as the circulation hub for both the digital soak house and the Ministry of Digital Information. An expansive full height space, filled with a continuous folding staircase (isolated below) connecting the different levels of the building. Stepping down into the eastern atrium of the soak house, whilst upwards into the various public educational spaces within the Ministry.

- 1 Eastern Entrance
- 2 Concrete Waterfall
- 3 Data Servers
- 4 Cooling pond
- 5 Folding Staircase
- 6 Atrium Skylights
- 7 Public foyer
- 8 Entrance to Soak House public pools

- 1 Cooling Pond
- 2 Waterfall from Soak house Pools
- 3 Data Servers Viewing Platform
- 4 Public Foyer Space
- 5 Entrance to Soak house Pools
- 6 Changing rooms
- 7 Steam Park Courtyard
- 8 Entrance to Soak house from Museum & Dead drop park
- 9 Water Storage

A DIGITAL TOUCH

3.06

3.05

The idea of developing a tangible relationship between digital networks and people has been the recurring theme throughout this thesis. The following analyses how this thesis has proposed to generate this tangible relationship.

1. Ambient Displays: Turning Architectural Space into an Interface between People and Digital Information. Conference Paper, 1998

Setting the scene.

First it is important to present the visitor with an understanding that this is a place of digital information production and consumption. The two visualisations (opposite and below) depict the Eastern entrance from the city, which presents a stacked façade of the server racks and digital utility. Monumental in size and accentuated by a curved concrete waterfall that grounds the vertical form; emotions of technological strength and grandeur are instilled from the first step into the architectural space.

On the westerside, the entrance from the domain, visitors enter into an equally compelling architectural space that uses various elements to develop a sensory stimulating experience¹. An array of vertical columns seems to disappear into the heavy gridded structure above, both elements filtering light from the skylights above. At the centre of the space is the cooling pond, a 6m-drop below, with more server racks on display. A large cantilevering viewing platform frames the centre of the space, reinforcing the scale of digital information production and consumption.

DIGITAL SOAK HOUSE

Having now gained an understanding of the digital networks presence in the architectural space, the visitors are filtered into the Digital Soak house. Upon entry the space opens into the old reservoir now filled with two large steaming pools (Visualised opposite) and the same server racks seen at both entrances, now sunken below the water level. Further developing an understanding of the immense energy cycle that these digital networks require.

This development of an experience, one that takes the visitor on a journey to understand the scale and processes involved in the generation and preservation of digital networks is paramount in setting the scene for a tangible relationship. Once the visitor has understood that the generation of steam is a direct result of the presence of the digital networks and utilities, the steam becomes the physical embodiment of the relationship between data and man.

The steam is now central to the spatial experience of the entire work of architecture. The development of the inner courtyard, named Steam Park, places various chimney shaped cones open to the pools below. This creates an attractive interior lighting quality for the Soak House, and also allows the steam to be channeled and expressed above. Views of the steam rising out of the Digital Soak House are now accessible from the rest of the interior public spaces, all of which have views into the Steam Park Courtyard (Steam Park Courtyard visualised below).

SPACES

1. Museum Promenade
2. Stairway to Digital soak house
3. **Dead Drop Park**
4. Steam park Internal courtyard
5. Sunken courtyard & entry
to main atrium

The Dead Drop Park

The Dead Drop Park takes Aram Bartholls Dead drop art movement and utilizes it as a thought provoking ornament. Ignoring the inherent flaws as a practical system of digital information storage and celebrating its condition for a physical interaction between people data and architecture. The dead drop park takes the chimney forms expressed in the steam park and scatters them in the space between the Museum and the Stairway to the digital soak house (depicted on the following page). These forms are then embedded with many "dead drops", generating these concrete cones with hundreds of USB heads protruding outwards.

This over saturation of dead drops on site serves the purpose of getting the visitor to question their own physical relationship with digital information. Seeing these concrete cones embedded with USBs will incite a level of curiosity within each visitor. They will understand that to access any of these USBs they will need to bring a device to that particular location and physically engage with it. However the power of this situation is in the provocation of thought, not action. The cementing of a USB stick into built form shifts the data held within the USB into the physical world. This casts various interpretations of meaning and function onto these concrete cones, turning them into mini obelisks expressing the relationship between digital networks and our physical environment

View from the base of the stairs leading down from the museum to the Digital soak house. Looking up towards the Steam Park Courtyard.

Looking North towards
eastern facing entrance
into the main Atrium
space.

3.07

M.O.D.I

ministry of digital information

CONTENT

- Site Plan
- Floor Plans
- Section

Site Context

ACCESS

1. Entry 01 - Entrance from City
2. Entry 02 - Entrance from Domain
3. Entry 03 - Entrance from Museum
4. Ministry Entrance
5. Steam Park - Internal Courtyard
6. Dead Drop Park
7. Trade Entrance

PLANS

- 1 Stair Atrium (main)
- 2 Soak House Entrance (main)
- 3 Museum Entrance (main)
- 4 Courtyard
- 5 Large Soak Room (two pools)
- 6 Intimate Soak Room
- 7 Cooling Pool
- 8 Public Reflection Space
- 9 Digital Storage Racks
- 10 Pump Room
- 11 Water Storage
- 12 Maintenance Space
- 13 Changing Rooms
- 14 Private Soak Pools

- 1 Ministry Entrance (main)
- 2 Soak House Entrance (main)
- 3 Museum Entrance (main)
- 4 Steam Park Courtyard
- 5 Auditorium
- 6 Mixing hall
- 7 Public Exhibition Space
- 8 Cafe/restaurant
- 9 Cantilevered Viewing Platform
- 10 Reception
- 11 Digital Artwork
- 12 Water Storage
- 13 Operational Access
- 14 Ministry Stairwell
- 15 Server Room
- 16 Digital Storage Racks

00 25 50 100 m

View looking south from
the above the Museum.
Showing Dead Drop park
in the foreground and
the steam rising from the
soak house in the central
courtyard

- 1 Cafe Mezzanine
- 2 Auditorium Mezzanine
- 3 Server Room
- 4 Staff room

- 1 Atrium
- 2 Digital Workshop
- 3 Digital Laboratory
- 4 Open floor office space
- 5 Meeting room
- 6 Public Exhibition/function Space
- 7 Water Storage

- 1 Manager offices
- 2 Staff room
- 3 Board meeting room
- 4 Exhibition/function Space
- 5 Roof top deck

L3

View from above of the lower courtyard. The entrance to the Digital Soak house from the Museum.

SECTION AA

Interior view from in the Restaurant. Full height glazing surrounded by differing timber vertical slats filters light into the space.

SECTION BB

View from above the Eastern entrance into the main Atrium. Highlighting the strong axial definitions developed in section 3.03

View looking east facing
into the domain. Showing
facade of vertical panels
and the terraced nature of
the collection of masses.

View looking east up from
the domain. Showing
Dead Drop park in the
and the Steam rising from
the inner courtyard .

Digital Soak House

02

View looking north,
showing the various faces
of the building as a result
of the axial formal study.

3.08

conclusion

Architecture, People & Data

With the advent of digital technology and information, digital networks have become as fundamental to urban life as street systems¹ now responsible for every major livelihood function from national security to communication. Digital network's mounting influence on the current and future development of our urban and social condition creates the need for a platform where social awareness of this changing knowledge landscape can emerge, one that recognizes that the human condition in the digital environment requires more than just a sign to Silicon Valley.

With influence from Castells, this design led investigation recognised public space's authoritative role in locating man in this digitally saturated environment. Noting that a placeless hand-held digitized screen does not produce the collective emotions of ownership and identity that are crucial for the development of a humanised society.

Through the formation of a socially concerned architecture that no longer camouflages data but provides avenues for social expression and interaction, this design places digital networks ‘front and center’ for society to experience. Repurposing the current failed architectural strategy of data centres to develop spatial situations that re-present data as a significant piece of social infrastructure, promoting civic ideals through structural expression and operational honesty. Members of the public are empowered with a sense of ownership and civic identity through the unbiased and honest presentation of the physical conditions these digital networks occupy.

Working within a framework of civic legibility, and by exploring the conflicts found in the architectural expression of the intangible through cross programming function, the architecture develops spaces that stimulate a relationship

between society and the physicality of digital networks. The programming accommodates play, social activity, business, leisure, education, and escapism, while all being linked to the continual maintenance of the digital environment.

The process of this thesis expressed that architectural representation has a duty to be more than the historic aesthetic-focused typology, endorsing architecture as a meaningful pursuit of social expression, utilizing the performative capacity built space presents to people and society.

With this architectural proposition utilizing existing digital technologies of today, there are limitations surrounding the research's speculative design inquiry. The design assumptions and spatial findings meant the resulting architectural space has been limited to what technology is capable of now. The reason for this being a

significant limitation is due to the speed at which new technology is emerging, as to say if server racks become obsolete in the next decade (entirely possible) then so will the physical expression of this architectural work. However, the theoretical intent of the project is robust and does not experience the same fragility presented by the application of present-day technological systems. Even as technology changes, the need for a well-understood relationship between the digital networks these technologies facilitate and the human condition will always be crucial for the development of a humanised society. Architecture as the facilitator of urban and social experience is the most sutiable agent in the pursuit to better understand the human condition in our digital networks.

BIBLIOGRAPHY

Not directly referenced in this thesis as the related work was removed. However the understandings on trust developed by Yamagishi did influence the direction of this architectural proposal.

Yamagishi, T. (1998). *Trust: The Evolutionary Game of Mind and Society*. Tokyo: University of Tokyo Press.

A. J. Dickson, City Engineer, to the Town Clerk, Auckland, 19 August 1949. Auckland City Archives
Barroso, L. A., Clidas, J., & Holzle, U. (2013). *The Datacentre as a Computer: An introduction to the Design of warehouse-scale machines*. (2nd Edition ed.). Morgan and Claypool Publishers.

Bartholl, A. (2011). Dead Drops. From <https://deaddrops.com>

Cushman & Wakefield LLP. (2016). *Data Centre Risk Index*. Cushman & Wakefield LLP.

Castells, M. (1996). *The Information Age: Economy, Society, and Culture*.

Ching, F. D. (2015). *Architecture: Form, Space and Order (4th Edition ed.)*. Canada: John Wiley and Sons Inc.

Craig Wisneski, H. I. (1998). *Ambient Displays: Turning Architectural Space into an Interface between People and Digital Information*. MIT Media Laboratory.

IBM. (n.d.). *Chronological History of IBM*. Retrieved Dec 2016 from http://www-03.ibm.com/ibm/history/history/decade_1980.html

Ryle, G. (1949). *The Concept of Mind*. Chicago: The University of Chicago Press.

Mitchell, W. J. (1996). *City of Bits: Space, Place and the Infobahn*. Massachusetts: MIT press.

US department of Energy. (2016). *United States Data Centre Energy Usage Report*. Berkeley National Laboratory .

LIST OF FIGURES

Images without a figure reference are the authors own originals.

FIGURE 01.

Interior of NY public Library. Source <https://media-cdn.tripadvisor.com/media/photo-s/017d7133/ny-public-library-reading.jpg>

FIGURE 02

Interior of a Google Data Centre. Source <http://www.cbronline.com/wpcontent/uploads/2016/08/UploadsNewsArticle4846908main.jpg>

FIGURE 03.

Sculpture work by Fred Graham. Authors own photograph

FIGURE 04.

ENIAC, the worlds first digital computer. Source <http://www.computermuseum.li/Testpage/ENIAC5.GIF>

FIGURE 05. Hermann Hollerith moved his fledgling tabulating machine business from downtown Washington, D.C., to a former cooper’s shop. Source https://upload.wikimedia.org/wikipedia/commons/thumb/5/58/Tabulating_Machine_Co._plant.jpg/220px-Tabulating_Machine_Co._plant.jpg

FIGURE 06.

Photograph of Server racks at Googles Douglas County Data centre in Georgia USA. Image from Google.

FIGURE 07.

Basic Spatial makeup of a Data Centre. Diagram drawn from information from the book The data Centre as a computer.

FIGURE 08.

Energy use percentages by function in a US data centre. EPA 2007 report to congress.

FIGURE 09.

The Newest Addition to the Facebook Data Center Fleet. Visualisation. Source <https://fbnews->

roomus.files.wordpress.com/2015/07/fort-worth-data-center-rendering.jpg

FIGURE 10.

Mokai Geothermal electrictal power plant. 20km north of Taupo. Source <http://www.tuaropaki.com/media/7547/PowerStn.jpg?height=365>

FIGURE 11.

The Seattle Publc Library. Image source <http://www.archdaily.com/11651/seattle-central-library-oma-lmn>

FIGURE 12.

The Seattle Public Library. Atrium Image source <http://www.archdaily.com/11651/seattle-central-library-oma-lmn>

FIGURE 13.

The Seattle Public Library programme model. Image source <http://www.archdaily.com/11651/seattle-central-library-oma-lmn>

FIGURE 14.

The Seattle Skyline. Image from flickr.com. Web

FIGURE 15.

The Seattle Public Library. Programme diagram. Sourced from <http://www.archdaily.com/11651/seattle-central-library-oma-lmn>

FIGURE 16.

OMA's Seattle public Library. Image highlighting the expressive structural system that wraps the entire exterior. Source <http://www.archdaily.com/11651/seattle-central-library-oma-lmn>

FIGURE 17.

AT&T Long lines Building. Drawing. Source <http://socks-studio.com/img/blog/long-lines-building-new-york-01.jpg>

FIGURE 18.

NY Skyline. Photograph. Flickr.com.Web

FIGURE 19

AT&T Long lines Building. Photograph. Source <http://socks-studio.com/img/blog/long-lines-building-new-york-01.jpg>

FIGURE 20

The lack of fenestration creatings an imposing aesthetic. AT&T Long lines Building. Photograph. Source <http://socks-studio.com/img/blog/long-lines-building-new-york-01.jpg>

FIGURE 21

AT&T Long lines Building. Photograph. Socks-studio.com

FIGURE 22

Close up of a dead drop embedded in a brick wall. Photograph. Source <https://deaddrops.com/wp-content/uploads/2010/11/deaddrops1.jpg>

FIGURE 23.

View of museum and proximity to city from above. Image from Auckland city council

FIGURE 24.

Photograph of the reservoir during construction in 1951. Sourced from AK city council heritage image library.Web

FIGURE 25.

Aerial photograph of the domain. Highlighting position of subterranean Reservoir. Source Bing maps.Web

FIGURE 26.

Aerial photograph of the domain. Highlighting position of Museum. Source Bing maps.Web