Design by Play

Playfulness and Object-Oriented Philosophy for the design of IoT

This dissertation is submitted for the degree of Doctor of Philosophy by

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Lancaster Institute for the Contemporary Arts

For you Ma,
you are never forgotten

DECLARATION

I hereby declare that this thesis titled "Design by Play: Playfulness and Object-Oriented Philosophy for the design of IoT" represents my research and work done during my PhD in Design at Lancaster University. The concepts and ideas resulting in my work are stated here on in my own words, and where I include the ideas of others I have cited and referenced the original sources accordingly. This body of work has not been submitted in support of an application for another degree at this or any other institution. Many of the ideas in this thesis were the product of discussions with my supervisor Professor Paul Coulton. I hereby grant complete permission for this work to be accessible online in a digital format through the institutional repository. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented, fabricated, or falsified any ideas/data/fact/source in this submission or the course of research. I understand that any violation of the above will be cause for disciplinary action by the University or other related sources.

_____

Haider Ali Akmal

Excerpts of this thesis have been published in the following manuscripts:

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ABSTRACT

The Internet of Things (IoT) has garnered heightened interest and momentum in recent years. These connected devices have extended the concurrent rise of data collection and processing within the everyday objects that cohabit our human lives. Though technology has always changed the way we live our lives these 'smart' devices are adding new challenges—particularly concerning privacy and security—not previously experienced when using their older 'dumb' predecessors. These challenges are not always apparent to their human cohabitors and often only come to the fore when something untoward happens as a consequence of the data being collected.

These objects are not to blame, they exist in their worlds governed by their own rules established by their creators rather than their users. Designers have traditionally been taught to present these objects as neutral participants in our human lives; there to help, but not supersede. However, these objects exist within many independent and interdependent assemblages of human and non-human actants that go beyond the previously experienced human-object relationship.

Through this discourse, I highlight the overall aim of this thesis to ask questions around our traditional practices of design concerning IoT. In particular, this research strives to do many things: it attempts to intertwine philosophical debate with the act of design; it moves towards an argument of rethinking design orthodoxies around human-centeredness in favour of object-oriented-ness; it explores an alternative side to the phenomenon of the IoT, arguing for agency in a post-anthropocentric perspective of the world and its implications; it tries to bridge the gap between practice-based design research and theory by passing through a veil of philosophical intrigue. But at its core, is an advocacy for the presence of a playful attitude within the practice of design, arguing for an attitude of playfulness as an integral part of the design process. How being playfully charged to create artefacts can usher in unique perspectives for design and technology.

The research is enacted through an iterative Research through Design ideology, using a transdisciplinary approach of Ludic and Speculative Design practice that explore alternative perspectives towards the design of IoT. It is conducted through an exploration of Object-Oriented Philosophy as a means to enact a metaphorical *'carpentry'* of artefacts that practice philosophical arguments through their execution. In the process of designing three artefacts—a model for a philosophical view of IoT, a board game, and a bespoke deck of tarot cards—this research builds upon the idea of More-than Human-Centeredness for the design of IoT, by introducing the creation of bespoken method assemblages as a means for playful design exploration. It concludes on a debate around the implications and potential of design thinking in a post-anthropocentric perspective through the inclusion of playfulness and philosophy as assets for design, and, the use of philosophical carpentry as a methodology for understanding the nebulous nature of IoT.

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"A certain type of perfection can only be realized through a limitless accumulation of the imperfect."

— HARUKI MURAKAMI, *KAFKA ON THE SHORE*

CHAPTER ONE

AN UNORTHODOX INTRODUCTION

"And now for something completely different"

— MONTY PYTHON'S FLYING CIRCUS

1.1 A starting point

In the past years of my doctoral endeavours, I haven't been able to pinpoint why but games and *play* became integral to my work. The background story for my PhD finds its roots in what characterises me as a person. Throughout the course of my research, I've taken inspiration from works of philosophy, technology, and design, and allowed them all to merge in one big pot of *'design research'*. Every ingredient in this pot is individually unique, however it's the sum of its parts that makes it worth something more; and, at the centre of it all is an attitude of *playfulness*.

I did not enter into this research with the intention of it ending in this way. But coming from a Fine Arts background, I've been comfortable with letting ideas fall into place. I remember talking about my future, after completing art school, with my printmaking teacher. Having been a self-taught graphic designer I enjoyed the practice and thought a career in design would make sense; foolishly thinking it paid well too. But having spent four years becoming a printmaker, my perception of things changed.

Picture a desk with everything knolled[1] and pristine. That was how I imagined my path into Design would be; organised, maintained. Entering printmaking to me was a broader way of exploring the graphic medium. But come the final days of my graduation exhibit my ideas were no longer the same. I had done a series of drawings and a video installation that shared the spotlight of my *printmaking* thesis alongside prints, which were ironically shadowed. Not knowing how I transitioned between mediums, Art had opened me to exploring beyond Graphic Design. I had discovered magical realism, philosophy, culture, and even technology in what I imagined to be a traditional printmaking course. Thus, I found myself at a crossroads, one where I had no idea where either path led. I was sure one at least went in the direction of Design or Art, but in what form?

1.1.1 Fish out of water

During our chat after graduation my teacher had this to say, *"You've done enough art for a while, do something else"*. He was rather eccentric, and I suspect adding a playful spin on things

[1] *Knolling* is a method of arranging things at 90° to each other. Introduced by Andrew Kromelow a janitor at Frank Gehry's workshop, he named this method after *Knoll* furniture because it reminded him of its clean lines (Fritts, 2019). American sculptor Tom Sachs who worked at Gehry's workshop later adopted the term and incorporated the technique into his practice.

was part of his mantra in life. As a printmaker apprentice I learnt to look at the laborious activity of printmaking with a glint of playfulness in my eye. That said, like most things he had to say to us, at the time that too felt a jest. But it stuck, and I've caught myself at different moments realising I'm doing something new again with his words echoing in the background. In fact, during this PhD friends have caught me out diving too deep into rabbit holes of research. Whether that is the process of how doctoral research conducts itself or not I can't say, but I would like to attribute some credit to my printmaking tutor and the unintentional *unlearning* at art school.

It wasn't until after art school that I realised I had in truth learned a lot there; a sort of systemic learning as a background process. A cursory glance of this thesis' table of contents might reveal that jumping from point to point nature as the clichéd *fish-out-of-water*. Rest assured this work does come to a conclusion, although the fish might still jump out to find some other waters that I don't have control over.

The crux that I'm getting to in this introduction—to what will be a lengthy dive into different, seemingly unconnected topics relating to my research—is that I had little control over how it all evolved. The process was organic, unique to me, and is open to contest. This work involves as much design as it does art practice in that regard, or what I refer to as a playful attitude coming from my own gathered world view. A view that is inevitably manifested in my own design and research practice. A learning process about my research area and myself.

1.1.2 Surrounded by technology

Technology has always fascinated me. Terms like *'nerd'* or *'geek'* have been attributed to me over the years and I accepted long ago that I fit into the stereotype. From my collection of popular culture T-shirts, entire works of Douglas Adams and J.R.R. Tolkien (including *The Silmarillion*), to the complete collection of blueprints and cross-sections of every vehicle from *Star Wars* always in my desk drawer, I have enough sacred-geek artefacts to attest that claim. I am a *geek* and proud of it. Which could explain why I ended up in a PhD about the *Internet of Things (IoT)*. Technology has surrounded me over the years. However, the first mention of my transition from *art* to *design* to *futures* has always met a mild shock.

If this research has taught me anything, it's that there's always more to things than what appears at first glance. It's a matter of seeing in a particular light, through different *lenses* if you will. In this thesis I go through a series of lenses to see things differently, which I will elaborate upon in due course. What started with seeing the art of printmaking through a playful eye has found a place in my design and research practice. But, to justify all this I'll have to go farther back than that particular chat after art school. Back into unearthing why this approach of embracing my playful attitude towards design made sense to me. Hence this introduction might meander slightly into a personal account of the past.

I do not intend for this to appear self-indulgent in any way, but rather demonstrate a traceable link to why elements of this research connected in the way they have. Hence, the following is a brief wander through the loose collection of events that place this research into context. The methods I

use in my research aren't radical, though their classification could be as unorthodox. So, it makes sense to me to have a slightly unorthodox introduction as well.

1.2 Of Pasts and Presents

At its core, there are three aspects to this work: technology, philosophy, and play. You might be wondering, what about design? For my purposes, I categorise design under an umbrella of playfulness as an attitude that allows freedom of exploration. I'm reminded of *The Well-Played Game* by DeKoven (2013) whose preface by Eric Zimmerman explains the book as exploring the "relationships between being playful and being human" (DeKoven, 2013, Foreword, 'Play is for Players', para. 1). My view of design is very similar as I utilise an attitude of playfulness throughout my design research process for tackling my presented problems. Paraphrasing Bogost the world is full of playgrounds and once you're able to understand them "you'll see them everywhere" (Bogost, 2016, Chapter 1, 'Playgrounds, where', para. 28). I've seen design and art as possible playgrounds where my playful attitude provides a means to address particular design challenges, and attempts to make sense of them in that manner. It all perhaps starts from my fondest memories of play as an activity.

1.2.1 Growing up around play

I remember our household having a *Nintendo Entertainment System*, specifically the later model from 1983 known as the 'Family Computer'; more lovingly called the *Famicom*. I don't agree with that name since we never played it as a family. Still, the game console was a wonder. Sporting an 8-bit processor at the time it was magical and a genuine improvement from our previous *Atari 2600*. I have vague memories of our *Atari*—specifically having it given away to a relative much to my distress—but fond ones of the *Famicom*, as I shared it with my two older siblings. It came with a futuristic-looking light-gun designed for a hand full of games. The one we had was *Duck Hunt* and involved players shooting ducks on the screen. Six years old me was always entranced by how this magic took place before his eyes; there were no bullets, yet the ducks fell! I recall once seeing my brothers open the controller because a button was stuck and its insides looked nothing like little me could have imagined, fuelling further wonder over how the light-gun worked with the game. I can't say for sure, but it is one of the earliest memories I have of wanting to explore how these things that facilitated playfulness for me worked.

As the youngest, my school hours differed from my siblings, and returning home from school I'd secretly switch the *Famicom* on for a short while; even though setting it up was a hassle. This amalgamation of diodes, capacitors, rubber, metal, and plastic felt alive and a member of the family, at least for us children. We had later upgraded it to a *Sega Mega Drive* and my love affair with play and exploration of playfulness continued well into my teens. Those close to me would know that I've latched on to it still (if ever so slightly) as an adult.

1.2.1.1 *From Tamagotchi to Monopoly*

We had amassed a small collection of game consoles over the years, those that survived were eventually given to a friend of mine to nourish his ever-growing collection (Fig. 1). In total, our household saw: an *Atari 2600*, our precious *Famicom*, *Sega Mega Drive*, a *Nintendo Game Boy*, *Nintendo Game Boy Advance*, a collection of *E-Star E-23's*[2] because sharing was an impossible construct, and an ill-fated *Tamagotchi*[3] (my brother's never fully engaged with the hype, though I loved mine). The act of play entrenched itself in my life from a young age, and as such, it fostered over the years into something more.

Figure 1: Many of my game consoles were eventually donated to my friend Talha for his growing collection. He kindly shared it with me for my thesis neatly knolled.

Somewhere in the midst of that era PC Gaming found its way into my life with my first foray in school. Under the guise of teaching 'Computer Studies' each student received 45 minutes with an old computer with hopes of giving them an introduction into personal computing. This was the start of the '90s and the computers were ancient by standards then let alone today. My first school had *Sakhr MSX AX170*[4] systems capable of *Windows 2.x* and *MSX-DOS*. We ran different programs and external software off of 5¼-inch floppy disks kept caged in boxes on our tables. The device that we

[2] More commonly known as the *Brick Game* it played a cloned variant of the original *Tetris* by Alexey Pazhitnov and a few other games with rudimentary graphics.

[3] Not really a game console per say, I mention it more because at the time my prickly dinosaur-like creature went everywhere with me till it *'mysteriously'* passed away being lost to time. I mention it here as I believe its life should have meant something.

[4] I was schooled in Dubai though these computers were made by a Kuwaiti company which produced an Arabic version of MSX computers in the 1980's and often provided cheap to schools. My school hadn't upgraded their line up till the late '90s.

fed the floppies into were half the size of the computer itself and connected with a thick heavy cable. Full disclaimer, these were often unsupervised classes and ended in us huddled together around someone playing *Zork* (a text-based dungeon crawler) which someone had snuck in on a disk and hidden in the floppy collection.

The ever-engrossing trend for personal computing at the time soon landed us a *Pentium* Computer having a processor that was 166MHz; by today's standards that is under 1% of your average low-end processor. With accessible memory of 16 megabytes and 1 gigabyte of hard disk space, our Pentium was the best in the market at the time. It cost a fortune, not to mention repair costs after the motherboard died soon after it was acquired. The blame fell on a fly dying inside apparently causing it to overheat; somewhat a mystery that has never been understood to this day. The technician got a laugh out of it though joking about how the *"Driver had died"*, making a pun on core computer software algorithms with the same name as if the computer, though a machine, had a live operative inside it like a *Mechanical Turk*. This amused us at the time, but now when I think back the premise of life in the machine—a concept I touch upon in my research—was never truly alien to me. This memory has latched on to me and whenever I see the insides of a computer it comes back. The technicians playful association of the computer in that manner I would like to believe aided in my own associations of manifesting a playful attitude in my work with technology.

Our house became connected to the Internet around this time as well bringing about a sudden shift in our lives. Back then *Internet-time* was akin to pocket money allowance, you had to ration it out. The difference being you couldn't *borrow* the Internet from a friend and running out of precious Internet in the middle of the month meant you couldn't chat online anymore. Still, seeing the 8 lights on our external modem light up one by one to the cacophony of sounds that came from the Internet, was an exciting feeling. The '90s was a fun place for the young geeky me who was beginning to understand what all this technology was. I had *The Encyclopaedia Britannica* on a CD which came with our computer along with some other discs. It defined the *Internet* as a network of computers connected with, what at the time to an 8-year-old me, felt like sorcery involving protocols and *Gophers*[5]. I'd like to delight in the thought that 8-year old me imagined actual gophers scurrying around in the Internet as the only plausible way of considering life in the machine and explaining how things worked under the hood!

Whether the Internet had gophers or llamas, our house was officially in the future. Initially, my father's spreadsheets were all the machine saw, later only to be predominantly taken over with homework, email, *IRC*, and when allowed light gaming. I recall swapping game disks with friends in school and being fond of *RTS's* (*Real-Time Strategy*) games, which were hard to come by as racing games like *Need for Speed* and first-person shooters like *Doom* were more popular at the time. Life soon included gathering information about how to upgrade your computers enough to

[5] *Gopher* was an information fetching protocol used in the early days of the Internet. It presented websites as navigable menus full of hyperlinks. For more information, see: https://thenewstack.io/gopher-ruled-internet/.

play that new game from *EA* or *Blizzard Entertainment*, or how to run *GameSpy* so you could get in on that weekend *Counter-Strike* match with everyone from class.

But videogames were one among other experiences of play and playfulness in my life. Games have always been in my surroundings in some form. Having an affection for board games I ended up seeking them out as a child amassing a small collection of compendium packed board games (most of which were forms of solitaire). This might give an initial explanation to the use of board games in this research but more on that later as games fascinated me, to the woes of my parents, and played a pivotal role in influencing this work. Though on the subject I would like to point out that this research is not about creating games or play-objects such as toys. I mention games here in reference to one among the many play-objects that fascinated me growing up. It was the presence of potential playfulness that intrigued me then, and later on gave me confidence to embrace the attitude of play in my design research practice.

1.2.1.2 *Playful technology in shady places*

Around this time, we had moved to our home in Lahore. I was entering Matriculation[6] and my reach towards play in general changed. Though most of my time went into learning to navigate streets like I was in *Frogger*,[7] Lahore retains a special connection for me. It helped in bringing about an interest related to this research long ago. Amidst dimly lit busy streets Lahore of the early 2000's filled itself with stores in back alleys selling obscure electronics and computer gadgets. These stores all had the same formats: bad lighting; limescale on the walls; an uninterested man behind the till with an assistant who knew computer gadgets too well; and flashy laminated plywood cupboards housing computer gadgets and accessories piled on top of each other in a *Jenga-esque* manner. What drew me to them though was the baskets on baskets of computer discs and cheap gadgets.

There's such a street in Lahore even today famous for being a haven for computer gadgets, hardware, software, electronics, and anything you can think of around technology. Last time I was there drones were popular, and subsequently you could see these machines flying about operated by vendors attempting to sell cutting-edge products. A *tech bazaar* called Hall Road where you can buy from handfuls of motherboard capacitors to massive drones. Stores stacked on top of each other in a cancerous growth, common to buildings and shops in Pakistan.[8] If you needed anything for your computer you went to either Hall Road, or it's more legitimate and regulated counterpart Hafeez Centre in the more affluent side of town.

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[6] A formal examination stemming from British schooling techniques left in the Sub-Continent after British Raj also found among other British colonised parts of the world. It takes place towards the end of the 9th and 10th years of education and is considered as secondary schooling entering into intermediate studies. The UK abandoned this method for GCSE or Ordinary Level and Advance Level examinations. As a side effect because of this and an influx of American television in Pakistan, I was taught in British English but spoke with an American accent.

[7] A beloved Atari game from 1981 where you played a frog attempting to cross a busy road and river full of hazards. The predecessor to its contemporary *Crossy Road*.

[8] A very common format for how shopping districts evolve in Pakistan; very organic and multiplicious. For example, someone starts selling telephones and is the only one on the street, soon others copy only to have it escalate to a whole street full of shops selling telephones.

Back then of course, Hall Road was a central location for finding CDs and beige coloured computer hardware at affordable prices. This was still when websites on the Internet used *tables* in their design language, so concepts like IoT and even wireless internet were ideas from science fiction. As far as the Internet went, we bought scratch-cards from local stores in Lahore that had two to three hours' worth of Internet connectivity on them still requiring the use of our phone lines over Dial-up. Additionally, there were no comparable devices to the *smart phones* of today, in fact my first mobile was an *Alcatel OneTouch Easy* that had three lines of screen real estate given to me by parents who got tired of my wandering out exploring the city. Even imagining the kinds of feats IoT can do today at that time was unimaginable, yet still among the oddities I collected were things that I now see had questionable design decisions for these Internet-powered technologies.

My association with technology found a comfortable place in obscurity. I remember buying strange gadgets for my computer which connected by USB and did odd things. Such as a USB powered clock, as if I didn't trust the one that came with Windows. Looking back just having it made no sense, it had to be reset every time the computer shut down. But, the most obscure one had to be a green coloured 'ghost detector'[9] that you attached to your computer screen. It flashed red making a crackling sound when there was 'paranormal activity' in front of it, which if I am to believe the device, meant I lived in an episode of the *X-Files*. This device I feel explains my interest in design and play rather fittingly. An object whose design intentions approach its playfulness towards fuelling ones curiosity, much like being a paranormal investigator with a spirit box roaming a haunted hospital. The true purpose behind the device could just have been monetizing paranoia, yet it equally resonated with an attitude of playfulness.

Of course, many of these gadgets were gimmicks and arguably designed in jest. However, they all spoke a language, one that I stumbled across years later after art school. These objects as obscure as they were, were so *by design* which I learned was a thing.

1.2.2 Art, Design, and Philosophy

Originally, I planned to be an astrophysicist; or something around those lines. A friend of mine and I both made up our minds to follow that path in life. This was before moving to Pakistan, and although I had the aptitude in school it never panned out in the end (though he succeeded much to my chagrin). I did go to visit the Cosmology Department at Punjab University once. Unfortunately, it was non-existent and more of a department on paper at the time. Pakistan wasn't very invested in Space with their last attempts dying out in the '70s. Going into art school instead might have had something to do with my mother being a fashion designer. Though ironically, she never pushed me in that direction. I intended to be a designer and failed the entrance interview for design at the National College of Arts, Lahore (NCA).

[9] Sadly, the actual one I owned is lost to the ages, but I'm pleased to know that the legacy of that wonderfully strange device is present in a much more modern package as the *Ghost Rock*. For more information see: https://www.solid-a.com/2019/02/11/solidalliance-introduces-ghost-detector-ghost-rock-first-time-to-the-us-market/.

My application for fine arts though was a different story. Like most happenings in my life, it fell into place. This time turning into the best four years of my life at art school. After a BFA in printmaking the logical trajectory would be to move into further studio practice, curation, or even Art History. I had the experience and the connections from the years of practice as an exhibiting visual artist after all. However, I jumped ship from Art into an MA in Design Management.[10] It was a big leap from printmaking, yet it made sense. *"You don't learn management skills as an artist"*, was my reasoning. After learning of service design, participatory design, and co-design practice, I found myself questioning my decision. But I was in too deep at that point. So, as habit dictated, I let the pieces fall and sat back to watch.

1.2.2.1 *Designing fictions*

The experience opened me to a view of Design I wasn't aware of. Yet, what it lacked was the playfulness I had grown fond of in Art. This was until I stumbled across the CEDE Project at Lancaster's Imagination Lab. As with my BFA, my MA thesis strayed from course slightly. I started down a path in design fiction.

The project was an exploratory dive into the possibility of a near-future with empathy-based human computer interactions in line with the concept of a *Voight-Kampff*[11] machine. What drove me towards it, asides the little geeky voice in my ear that let out a childish scream of glee at the mention of Ridley Scott's *Blade Runner*, was the prospect of using my hands to make something again. Of course, the science-fiction aspect did play a large part though. Some things you can't disconnect from growing up, I have a 15-inch model of Darth Vader on my desk gifted to me by my wife on our wedding which should explain my disposition.

Jest aside, my interest in the human side of design—coming from my art background—was perhaps partly what drove me towards the CEDE Project. That possibility of a *human* inside the machine; like the psychic medium in my USB Ghost Tracker. After meticulous moulding in vague supervision sessions that left me amazed, enlightened, and perplexed at the same time, months later I had a thesis in design fiction. With a series of diegetic prototypes around empathy and computers I had made something that weighed itself in philosophy, culture, technology, and design. A design fiction in the form of an SDK called the *Empathy Engine* (Akmal, 2015; Sturdee *et al.*, 2016), exploring a potential near-future with a possibility to have devices empathise with users (to an extent).

The process took me back to my days of slaving over aquatints and etchings in my school's printmaking studio back in Lahore. There was an essence of playfulness within the way I drew and etched figures in my artwork, and a playfulness in how I imagined the *Empathy Engine* inside of

[10] My family was always confused why I chose Lancaster up near the Lake District (with, as my cousin said, nothing but *sheep*) rather than bustling London or Leeds where most of my relatives were. Though I couldn't say I would rather stay away from family for a while, my justification was that things were allowed to fall into place which they did for the better.

[11] The *Voight-Kampf* was a test from Phillip K. Dick's sci-fi novel *'Do Androids Dream of Electric Sheep?'* meant to distinguish between humans and androids by detecting empathy. Later adapted in the 1982 film *Blade Runner* by Ridley Scott.

everyday objects. It justified the fish-out-of-water feeling I'd had. I might be jumping from one thing to the next, but there was a connection. This is also my argument for the attitude of playfulness that has scaffolded my PhD years.

1.2.2.2 *Doing a PhD*

I had no intention of doing a PhD. The opportunity presented itself while I had started teaching after my MA. To be honest, this PhD started as research in design fiction, my initial proposal. I was exploring the potential for incorporating my art practice into design research. But over time it transformed as organically as did my path towards it. The first few concepts I worked on were diegetic prototypes around abstract concepts for human-computer interactions. At its core, this research has not strayed too far, and I still do reference speculative design. My focus though has drifted from a discussion solely on design fiction to one about incorporating unorthodox design practices that align better with my understanding of playfulness as an attitude towards design.

1.2.2.2.1 *PETRAS IoT Hub*

I can't begin an introduction of this research without mentioning my affiliated project. This work is part of and funded by the PETRAS IoT Hub Project.[12] A consortium of nine (at the time of my enrolment) leading universities in the UK with funding from the Engineering and Physical Sciences Research Council (ESPRC)[13], each exploring critical issues in IoT relating to privacy, ethics, trust, reliability, acceptability, and security. Part of IoTUK[14] a government-funded programme seeking to advance the UK's global leadership in IoT by increasing adoption rates and service quality through business and public sectors, PETRAS has presented a multitude of findings spanning over different tracks with Lancaster University among the institutes involved. The track my research has been focused on involves the aforementioned adoption of IoT.

1.2.2.2.2 *Human-Centred Design and Adoption of IoT*

The above meandering tale of past events should set the stage for why 'adoption of IoT' intrigued me. The enchantment of technology escaping from the clutches of fiction into our lives. The playful attitude I've associated with my life and allowed to flourish in my work practices was evident in potential future speculative imaginings of IoT. As a millennial I've seen technology evolve in many forms. From buying scratch cards for Internet access to the always-on network, this transformation has been both exciting and worrying. The latter is in respect to ill-planned and in some cases malicious uses of IoT-enabled technologies. Take for instance *Vizio's* smart televisions sold and used in the early 2010's. These products were found to be discretely collecting data on their users by tracking usage and activities which were then sold to third-parties for marketing purposes (Coulton & Lindley, 2019, p. 467). The present lack of discretion on *Vizio's* part proved an infringement of ethical trade practices leading to heavy fines and public concern with 'smart'

[12] For more information, see: http://www.petrashub.org/.

[13] For more information, see: https://epsrc.ukri.org/.

[14] For more information, see: https://iotuk.org.uk/.

technologies.[15] For all its science fictional qualities, IoT has an all too human element to it in its design approaches and decisions.

The current and perhaps most common method of creating IoT products and services involves Human-Centred Design (HCD) practices, though ironically these systems are not powered by *humans*. Concepts such as Artificial Intelligence (AI) and Machine Learning (ML) are often employed for these IoT-enabled devices and services to operate effectively removing the human from these processes. Though humans might be the users of these services (a concept debateable on its own), the design of these systems could acknowledge their independent natures. What I am ushering this conversation towards is that through this research and the coming chapters I intend to approach an alternative viewpoint towards IoT. One that exists in an attitude of playful appropriation of design. In the process I explore how play may exist in both the objects that create IoT and the humans that interact with it. My own perspective though is of play existing in the process where they both converge, and in this manner I hint at how HCD might not necessarily be the most applicable research through design approach for viewing IoT (at least where taking a playful attitude at design is concerned).

Being an art/design student now intrigued with the playful potential of design, the opportunity of exploring playful practices affecting and possibly altering the adoption of IoT presented itself through PETRAS. Through my research and this thesis I intend to present an argument for seeing design as a playful activity that may present alternative perspectives for technologies such as IoT. That said, this research may be about alternative design practices for IoT, but that statement is not enough to hold the weight of information contained.

1.2.2.2.3 *Research Statement*

There's a lot to unpack there, from what is IoT to what is design practice or research, and what classifies as an *alternative*. Each of these aspects will be addressed in the coming chapters. As a designer, my interest lies in how these systems in which IoT-enabled devices function can be better designed to overcome many of their problematic traits, which are starting to become more evident. The example of *Vizio* is but one among many which I explore in the coming text. That said, this thesis is a contribution towards the utilisation of *Research through Design* (RtD) as a means of developing new perspectives on the challenges within the IoT. It does not achieve this by proposing methods that may allow designers to design 'better' solutions, rather it proposes alternative approaches for framing the challenges of IoT including existing design practices within the field.

Often prefixed with *'smart'* IoT devices are couplings of circuitry and sensors inside metal and plastic bodies designed to interact with and through the Internet. The describing of *IoT-enabled* devices in this unpacked manner stems from a core statement of this research: *seeing IoT through philosophical lenses*. Philosophy brings with it a specific manner of discourse which I attempt to

[15] For more information, see: https://www.ftc.gov/news-events/blogs/business-blog/2017/02/what-vizio-was-doing-behind-tv-screen.

utilise throughout. The intention in this regard is to present an argument around the use of play as a means to evaluate IoT-enabled systems for designers.

When I say 'play' I again am not referring to *playing* with the Internet or creating artefacts that do so. Instead, 'play' to me represents an attitude for manifesting curiosity-driven engagement within design practices. In this context it refers to appropriating a means for exploring and evaluating the processes of IoT-enabled systems. Philosophy certainly plays a large part in this discussion, as it becomes the vehicle for concretising playful appropriations of design practice. I go into further detail regarding this in Chapter 6 through a process of philosophical carpentry, an approach at enacting philosophical arguments through making. As a designer and maker the act of creation is present in this research through this carpentry approach, which incorporates explorations of *Speculative Design* and *Ludic Design* as frameworks within a methodological practice of RtD crafting the philosophy laden artefacts presented in later chapters.

Therefore, as a singular statement of research this thesis argues for an attitude of playfulness within the design process that for the purposes of this research facilitates alternative perspectives for the design of IoT-enabled systems. It does so by presenting a case for the manifestation of a playful attitude through curiosity-driven engagement within the design process. The philosophical concepts and practice of making are the vehicle for this discourse all conducted as a RtD project into exploring the relationship between IoT and HCD. This is a discussion about how playfulness and design go hand in hand to understand an alternative nature of the things that create IoT. How acknowledging different perspectives may present novel opportunities in designing for contemporary and future-focused technologies.

1.2.2.3 *Why Philosophy?*

I could justify the use of design research practices—being a design student, and this a doctoral research in the field of Design—but why *philosophy*? The reason is to provide a fair and open ground for discussion. One that isn't biased by design orthodoxies around human-centredness, instead, presenting a discourse around fundamental *object-ness*. This human and object discourse is the aforementioned lens spoken of and will be present throughout this text. The philosophical discussion has been considerably condensed as the intention here has been exploration around a focal point; design perspectives for IoT. Which causes me to remind the reader: ***by no means am I a philosopher***.

I have an arts degree in printmaking and for that I explored different philosophical concepts to aid in art practice. But the level of philosophical discourse established in this work comes from careful readings of philosophy in specific areas of interest. As such, I present this alternative perspective to design for IoT in three states in the coming chapters: *Seeing Things*, *Being Things*, and *Designing Things*.

My penchant for philosophical intrigue could be the reason behind this crossing of paths in my research, but this view of philosophy in IoT is something that had already begun spreading its roots in the project as *More-than Human Design* perspectives. I contributed by building upon ideas that were presented at the time. More-than Human Design in a nutshell is an argument for acknowledging

design beyond the boundaries of human involvement possibly towards broader more significant influences, such as considerations of climate change. It incorporates object-oriented philosophies in an attempt at stepping outside of the human and viewing the world from different non-human perspectives. Throughout the coming chapters I will be explaining the concept and it's specific usage in this research further.

IoT as a phenomenon has certainly established itself in our current spectrum of technology. The sheer amount of these devices available makes it appear as if they have colonised our everyday lives (Greenfield, 2017, para. 2). With a thirst of information, coupled with our excessive need for efficiency, IoT has evolved into a web of interactivity within our midst. Though these systems aren't for everyone, they are present almost everywhere today in some manner or form, and as such have begun to offer unique challenges of their own. Amidst this argument of playfulness, philosophy, and design this research attempts to address some of these challenges in its unique light. I've briefly touched upon why philosophy came to be a part of it, and the coming chapters will clarify each core aspect in further detail. What this lengthy unorthodox introduction intends to relay is that an attitude of *playfulness* was an intimate matter associated with my work which I cannot separate this research from, as it allowed for an explorative means of design research where I was not bound by highly specific goals.

1.2.2.4 *Who is this thesis for?*

At this point you might be wondering who this research might interest? As this work overlaps different topics (IoT, design, and philosophy), concerned readers would find their specific interests there. That said, this research certainly involves these core discussions but at its heart it retains a discussion for manifesting an attitude of playfulness within design practice. Many of the arguments and/or appropriations of concepts ahead would appeal to those who are curious about playfulness within an RtD approach. This playfulness manifests as both direct representations of play and as a general presence of giving oneself away to whim, ambiguity, and the obscure within the process of design. Many of the discussions ahead could not have been possible without entertaining their alternative perspectives in this playful light.

I should mention here that by no means in this work do I profess a hard set stance towards play in design, mainly because I don't agree with play as having a strict representation. Chapter 6 dives into detail regarding what play represents in this work and I explore it from multiple perspectives. Towards the end in Chapter 10, I do further express my own views on play in light of this work. Throughout regarding play in this research, my intention remains to present it as an attitude within the design process.

1.3 In closing

This jog down memory lane twisting through streets of Lahore, printmaking, my collection of games, and all the science fiction I had to read to justify my *Empathy Engine*, is all more a means to facilitate a reason to why this research took the trajectory it did. Other methods could have been possible, but in this instance this particular approach brought with it a certain gravity. As a playful

individual, my approach at RtD was equally playful and I cannot disassociate it's influence on the research presented in this thesis. The coming chapter presents a scaffolding to understanding how this research is collected, with the promise of fewer wanderings amongst memory. Accompanied with that are core research questions and a methodological framework upon which this research rests. It also explains why the presentation of this work uses a non-traditional approach. Furthermore, it begins the first section of this thesis as a foundation into my world of IoT, philosophy, and playfulness.

FOUNDATIONS

CHAPTER TWO

SCAFFOLDING

"Sometimes I'll start a sentence, and I don't even know where it's going. I just hope I find it along the way. Like an improv conversation. An improversation."

—MICHAEL SCOTT (PLAYED BY STEVE CARELL)
FROM *THE OFFICE*, SEASON 5 EPISODE 11

2.1 Introduction

The IoT has evolved much faster than my younger self could ever have imagined. I have a smart assistant in my house that my spouse and I play trivia with, which is in addition to its core household use as the timer for chips in the oven. The previous chapters' stroll through the past only briefly mentioned one of the core aspects of this research: using philosophy to provide a design lens for my practice—at least where my playful attitude towards designing for IoT is of concern. Before touching on the philosophical aspect of this research though, this chapter explores some key questions I intend to address in this thesis. It also prepares a scaffolding for the methodologies I incorporate in my research journey.

This document does not take on the garb of a traditional doctoral research manuscript. In the coming text, a more detailed analysis of why this is the case will become clear. The journey of this research bends around different corners, stopping in different locations to collect knowledge before revealing its destination. Whilst the previous chapter explored the background this chapter explains the structure, defining why this work differs from more conventional doctoral research expressions. Subsequent chapters will delve deeper into philosophy, playfulness, design, and IoT.

First, any research conducted must ask key questions relating to its topic of concern. As discussed in the previous chapter, this research brings about a two pronged argument: the presence of *playfulness* and *philosophy* within a research through design approach towards IoT. In the process it brings together alternative speculative framings in an attempt at challenging orthodox HCD practices for the design of IoT systems. In this vein it also approaches problem spaces in light of prior research. Problems that could be attributed to established non-object-centred approaches such as HCD. The discussion invokes a philosophical carpentry of artefacts intended to act as playful appropriations of viewing IoT differently, hence the second prong of philosophy certainly must be part of the broad set question this research addresses. That said, as previously mentioned the discussion of manifesting a playful attitude within the design process is an important facet of this research as well, ergo restricting my research question towards IoT alone would limit the insights the research through design practice documented in this thesis reveals.

While this research is intended towards designers interested in practice-based methods towards problem solving IoT, its playful roots and attitude are what truly drive the discussion forward. IoT here was the subject of research coming from PETRAS and acts as the locus of this discourse. It could just as well be substituted for other topics that this playful practice-based approach may be equally helpful in facilitating. Therefore, the broad question this research intends to answer becomes:

Q. *How does a playful research through design process manifest itself within performing philosophical carpentry to create artefacts to be experienced by a diverse audience?*

This broad question sets the agenda for conducting the explorative design research considered in this thesis. Specific sub-questions emerge through the course of the work which attempt to address the different areas of interest in coming chapters. This is done through a practice-based exploratory approach at problem solving key areas of focus in IoT. In the process I present an approach of conducting philosophical inquiry through a metaphorical carpentry. As the main philosophy explored in this thesis is Object-Oriented Ontology (OOO) which argues for a more-than human non-anthropocentric world view—further details in Chapter 4—this thesis may also be seen as a way of presenting carpentry as a means to answer the core question of this research into manifesting playfulness within design processes towards a more-than human world view. The sub-questions in this regard are:

SQ 1. *Is it possible to highlight potential problematic effects emanating off IoT products and services approaches through an object-oriented lens?*

SQ 2. *How does an attitude of playfulness occur in this research through design activity?*

SQ 3. *How can the philosophical foundations of a proposed non-anthropocentric IoT be manifested in RtD artefacts?*

Each sub-question is addressed in varying degrees in the coming chapters with some presenting their own internal questions for the designed artefacts. It should be noted here that though philosophy is mentioned in the questions, this research is not *'on'* philosophy rather it uses philosophical discourse as a lens for the design processes. It represents an attempt at presenting a playful attitude towards design with a focus on designing for IoT in a more-than human world-view. Putting these core research questions aside for the moment I will now address why this research is structured the way it is.

2.2 Steppingstones into post-modern humanities

A thesis or dissertation of academic stature requires the grounding of any conceptual discourse in established ideas from a scholarly community. These bodies of work most commonly take on the form of a review of literature in subsequently related, and at times disparate, fields of research. The generally accepted definition of research is the crafting of knowledge through systemic investigation, where knowledge is generated by the combination of information and analysis.

Webster and Watson (2002, p. xiii) believe, that the efficacy of a review establishes strong foundations for the "advancing of knowledge". Facilitating the development of theory and unearthing hidden avenues of further research. Quoting Dudley-Evans (1999) and Thompson (1999) on the variations in approaches towards theses and dissertations, Paltridge (2002, p. 132) examines the differences between conventional methods of doctoral thesis writing and their real-world practice. As a result, the traditional approach to structuring a thesis has evolved to incorporate an array of approaches; some of which Paltridge explores in his paper. He defines the traditional pattern as a "simple" one, involving a "macro-structure" taking on a generic format of an introduction followed by a literature review, a methodology, ending in findings, and a conclusion as the result of some discussion.

Where this defines his view of a "traditional pattern" in thesis writing, a more complex structure he claims is required for the study of more than one topic (Paltridge, 2002, p. 132). Other sources bring to light alternate methods of thesis writing, which include a topical approach (Dudley-Evans, 1999), and a thesis as a collection of published research articles (Dong, 1998). Where the former bifurcates a topic into relevant subtopics, the latter is a more audience-centric approach meant for experts in a field (Paltridge, 2002, p. 132).

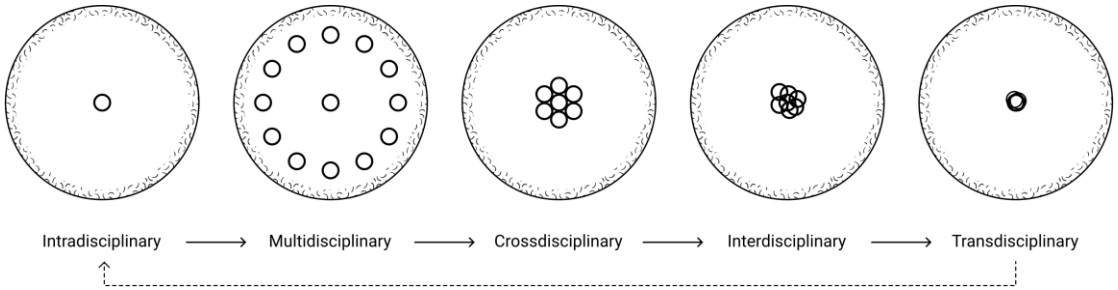

Figure 2: Jensenius (2012) presents the evolution of research approaches which may be visualised as moving away from conventional means of research towards transdisciplinary perspectives.

Though research articles of the social sciences often conform to standards established by scientific research, Stember (1991) points out the influence of academic disciplines in research and calls for advancement in social sciences through an interdisciplinary research approach. Gibbons *et al.* (1994, pp. 1–2) see this as a transition of knowledge production from *Mode 1* to *Mode 2*, where the former equates to traditional understandings of research and knowledge production, i.e. scientific research or Newtonian models, the latter approaches ideals of trans-disciplinarity. Appropriating Zeigler's 1990 model for differentiating between research methods, in an attempt to understand this Jensenius (2012) presents a broader model that offers an evolutionary view of research approaches (Fig. 2). In this model, five major modes of research are plotted:

1. **Intradisciplinary** when working within a single discipline with no overlaps
2. **Multidisciplinary** when collaborating between different disciplines, such as the invention of the defibrillator which can be seen as a combination of biology, chemistry, and electric engineering

3. **Crossdisciplinary** when viewing a discipline from the perspective of another, e.g. genetics
4. **Interdisciplinary** when integrating knowledge from different disciplines through synthesis, such as how literature is a synthesis of history, anthropology, science, etc.
5. **Transdisciplinary** when creating a unity of intellectual frameworks beyond disciplinary perspectives, e.g. studies in sustainability often transcend knowledge from areas of concern

Presenting these major modalities of research in this manner reveals an evolution of research practice moving away from conventional approaches. On this, Hodge (1995, p. 35) presents an argument for a "revolution" in social science research, which he calls the "New Humanities" or *"Post-modern Humanities"*. In his text he speaks of the trans-disciplinary nature of post-modern humanities as abnormalities to be studied and explored encouraging avant-garde approaches towards knowledge production.

2.2.1 Transdisciplinary Design Research

In the context of design Boradkar (2010, p. 281) argues that design problems posit unique challenges that require "unique set of tools" often of an interdisciplinary capacity. In order to tackle these challenges he echoes other scholars in affirming that design as an independent discipline must "enrich itself in transdisciplinary engagements" (2010, p. 282). Friedman (2000, p. 39) motions that design as a discipline exists in the "intersection of several large fields". As an example of this Boradkar (2017, p. 462) explains how web and mobile application designers often require an understanding of computer programming alongside graphical design knowledge. This presents two forms of design which Mitcham (1994, p. 461) refers to as engineering-design and artistic-design respectively, each requiring different levels of mastery.

Quoting Klein (1990), Boradkar (2017, p. 462) continues to describe design practice as "transdisciplinary problem solving" focusing on present research questions over discipline. This research attempts to approach transdisciplinary problem solving using a Research through Design (RtD) methodology which I explore in detail in Chapter 5.

Furthering the point of generating transcendent knowledge, studies involving research around science topics such as engineering, chemistry, and mathematics could justify a regimented approach. However, as this research involves the interactions of elements within *and beyond* logical science, it plays with the ideas of logic using philosophical thought experiments. Meaning to interweave itself within the fabric of human and non-human interaction. The attitude of playfulness that this research proposes acts as a way to facilitate this weave through the vehicle of philosophical inquiry into alternative perspectives of IoT. The methodology used here is part natural science, and part social science.

To bring this further into perspective metaphor is elaborately employed. In *After Method* Law (2004) discusses alternative approaches to considering research methods. He equates the world to a "set of possibly discoverable processes" (2004, p. 9), encouraging researchers to attempt to bridge

research through “method assemblages” (2004, p. 13). These assemblages create what he calls a “hinterland” of relations between methods (2004, p. 13). Giving an example of how philosopher Bruno Latour’s examining of the world of Salk Institute’s endocrinologists became the basis for a new field of study known today as the ethnography of science, he explains how a philosopher with no prior background in science can do this by subverting method into a definition that is more generous and looser to conventional understandings. To this Law argues that “[Social] science should also be trying to make and know realities that are vague and indefinite because much of the world is enacted in that way” (Law, 2004, p. 14).

As this work defines itself within the boundaries of design research using iterative methodologies—namely RtD and speculative design—it raises a connection between design and social sciences. An association which began in the 1980’s as a design-driven experiment crafting what we today know as user-centred design (Sanders, 2002, p. 1). Adding to that is the on-going attitude of playfulness and rhetoric of philosophy as a driving force for designing in a certain manner and intention that this research advocates. This places design research on par with the likes of social sciences such as psychology, geography, history, and anthropology among others; all having their own established formats of research. Although fundamentally being research into the IoT, it requires an understanding of technological processes and knowledge representation related to the different areas of concern.

2.2.2 Crafting Trandisciplinary Assemblages

When seen in this manner, this research falls beyond the scope of the formulaic traditional thesis approaches defined by Paltridge (2002). Whilst including topics which have established approaches towards academic writing such as philosophy and writing for computer engineering subjects related to IoT research, the way this work utilises these disciplines happens in a manner of equating them to tools found in a toolbox. This all places this research in a spectrum of interdisciplinary studies bordering on the transdisciplinary, akin to the method assemblages discussed by Law (2004). Through this idea of transcendent knowledge, I present the formulation of unique ‘engines’ for transdisciplinary design research (Fig. 3).

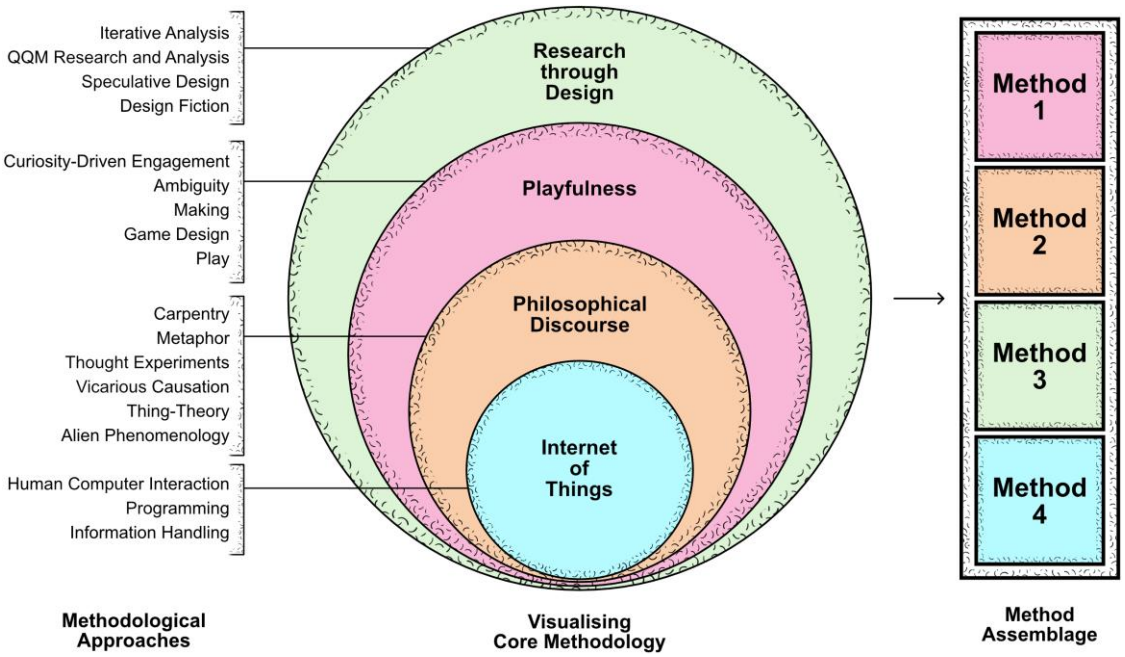

Figure 3: The knowledge generated through designed artefacts in this thesis comes from assembling methodological approaches present within the concepts this research concerns with. In doing so it approaches a manner of transcending knowledge between disciplines through design.

In the coming chapters, each of the individual parts of this engine are discussed in detail and explored from the vantage point of design research. Each provides a unique perspective towards the challenges of designing for IoT products and services and in turn articulates unique knowledge production. Since this research argues for an objective view at orthodox design practices such as HCD it becomes necessary to include philosophical perspectives such as object-oriented philosophy that may offer alternate perspectives. Playfulness here is an ever present attitude within the designer and the process that supports the crafting of unique explorative design artefacts to indulge the philosophical views intended to be explored ahead. And finally, a practice-based RtD approach ensures an iterative exploration of the design problem that may be equal parts explorative and critical in nature.

2.2.3 Transcending method through Design

While presenting a paper involving one of the artefacts from this research at *DRS2018*, the ensuing discussion raised a point to how the practical manner of research would not fit within the traditions of the discipline of philosophy. However, the consensus was that it fit well within the boundaries of design due to the freedom available in the discipline. Lee and Lee (2019) map the characteristics of design research within the humanities for inter and cross-disciplinary research. They conclude that understanding the implications and applications of design within other disciplines may help in developing the field of Design. Sanders (2002, p. 6) presents the argument of designers and design researchers, specifically social scientists working in conjunction with design and/or designers, as being interdependent. The appropriated freedom in design as a discipline for knowledge generation thus comes from this interdependence. As such, this research aspires to

become transdisciplinary considering approximations by Hodge (1995) and the notion of method assemblages from Law (2004). By moving between the hinterland of relations connecting interdisciplinary research, this work attempts at expanding on established models of design for IoT to encourage potential new directions. These unique engines for research are comprised of different combinations of methods here on considered 'tools' in a metaphorical toolbox.

This is not equating them as design tools meant to be used in that fashion, rather it is a play on the word 'tool' from 'toolbox'. Within each toolbox are the assemblages of different concepts coming from different disciplines used in the design process of each artefact.

Therefore, I do not see imperative in allowing this thesis to conform to the generic format of a postdoctoral manuscript. The elements required for a document of this calibre will all be present: a review of relevant literature; intent of research; methodology; findings; and discussion to take away at the end. But due to the nature of the study and its involvement of different research topics on a transdisciplinary platform, the potential for a modification of the standard model of a postdoctoral thesis presents itself. Another way of looking at it is *this research attempts to transcend knowledge between areas of philosophy, design, playfulness, and technology, and might feel odd in places.*

2.3 How to use this Thesis

By jumping between different topics of concern this research risks raising levels of confusion. Thus, rather than have a larger review of literature presented in one chapter in the start, references to literature are placed appropriately throughout the text. An introductory review will be presented in the initial chapters, but each chapter will also have its pieces of reviewed literature brought up on an as-per-need basis. This should help alleviate any confusion, allowing readers to avoid jumping back chapters to reacquaint themselves with topics. It should also help in establishing a cohesive discourse throughout.

The previous chapter was a brief dive into some background in myself and how this work came about. This chapter provided a scaffolding for why this document is laid out in this manner along with the core questions this thesis aims to address. The next few chapters may be viewed as a *mise en place* for the coming artefacts designed as part of this research. My intention with them is to incorporate an understanding of *seeing*, *being*, and *designing* things of IoT in order to grasp the foundations of this research. Here is what can be expected ahead:

- **Chapter 3** starts us off by introducing our focal point of IoT and how it is *seen* in a general sense. I present a case for and against general approaches towards design in IoT. Supported by a review of relevant literature I lay a foundation for our discussion around technology in this research. Following it up with why design for IoT matters, challenges currently at play, and how metaphor may be an ally in seeing IoT. This chapter incorporates our first step at seeing through an alternative lens.
- **Chapter 4** attempts to unravel the dense philosophical concepts this thesis utilizes in the coming designed artefacts. It covers the core philosophy of phenomenology that is discussed throughout. Building towards the main discussion of how things in IoT exist I

argue for how design approaches can see them through an object-oriented perspective of simulating agency within things. This expands upon notions of alternative perspectives towards viewing technology from Chapter 3.

- **Chapter 5** is the first of two chapters on used methods and core approaches in this research. It dives into an exploration of design research as a methodology. Here I approach the idea of an iterative design perspective of creating artefacts for this design research through an ideology of Research through Design (RtD).
- **Chapter 6** explores the broader attitude of playfulness this research advocates comparing it to decision making and design processes. Here I take on the idea of playfulness as an asset for design research, making a connection between disciplines of design and the act of play through curiosity-driven engagement. This is also where I introduce the concept of philosophical carpentry as a way of playfully approaching design research and philosophy to form the method assemblage toolboxes explored in Chapter 2.
- **Chapter 7** through to **Chapter 9** introduce the research through design aspect of this thesis and each present a different artefact intended to enact philosophy. Starting with a way of defining a model for a philosophical perspective of IoT, using play to prod and poke at the design of IoT systems. Each chapter in this series is accompanied by different philosophical concepts and design approaches used in its metaphorical toolbox with findings and insights. Chapter 7 introduces a core framework for viewing interactions occurring in IoT through philosophy. This framework is then carried on to subsequent chapters in an attempt to explore it further. In this regard Chapter 8 walks through the process of designing a board game based on the framework. It defines the iterative process and design decisions made in designing the *Internet of Things Board Game* with a discussion into the pitfalls and compromises undergone in the process. Finally, in this series Chapter 9 dives into a deeper exploration of the framework enforcing a more direct relation with the philosophical discourse defined in this research through imaging the personal lives of IoT objects using Tarot.
- **Chapter 10** brings about the final section of this thesis, with a discussion into the implications of carpentry for design research through findings and experiences, and a discussion into manifesting an attitude of playfulness within the design process. It is accompanied by a discourse into the future potential for research in this manner, before rounding up the conclusions of this research.

CHAPTER THREE

SEEING THINGS OF THE INTERNET

"The Internet is the first thing that humanity has built that humanity doesn't understand, the largest experiment in anarchy that we have ever had."

— ERIC SCHMIDT AT THE INTERNET WORLD TRADE SHOW, NEW YORK, 18 NOVEMBER 1999

Among its contributions this thesis presents an alternative approach to widely adopted human-centric perspectives in the design of IoT products and services. Being the locus of this thesis, this requires an exploration of IoT as a design space. In this chapter I present an overview of IoT as a society altering technology, as well as a case for a mismatch between user expectations of what IoT products and services do beyond their immediate task. I use this to build the case for viewing IoT through an alternative perspective than HCD, and then move towards examples in the coming chapters of using speculative design to reveal what the future design of IoT could be like.

3.1 A case for (and against) an Internet of Things

A review of literature around IoT often begins with the origins of the phrase itself. The credit generally goes to a presentation by Kevin Ashton from 1999 that had the phrase in its title (Ashton, 2009). Ashton's presentation was on radio frequency identification protocols (RFID), and its usage in manufacturing processes in industry. Graham and Haarstad (2014, p. 6) connect the roots of IoT with early attempts at the collection of data through RFID technology, which could explain Ashton's usage of the phrase in that context. Though Ashton has since attempted to restructure his coining of the phrase, Greenfield (2006, p. 18) argues for the coming of a zeitgeist for objects that were not before considered as 'technology', reclassifying them as housing "information-sensing, -processing, and -networking capabilities". Since then, IoT has become more commonly placed among concepts relating to ubiquitous computing, often classified as *'smart'* devices (Kortuem *et al.*, 2010; Lindley *et al.*, 2017a).

The earliest record of an Internet-connected device though goes back to the 1980s. Credited to a *Coke* vending machine in the Carnegie Mellon University Computer Science Department (Teicher, 2018; Madakam *et al.*, 2015). The *'device'* tracked the duration and temperature of individual bottles of Coke inside the machine. As banal as it might sound, the connected vending machine came out of a want of programmers for the cold caffeinated beverage and their offices being a fair distance away from the machine (Madakam *et al.*, 2015, p. 166). This origin story is more suited to the state

of IoT today as a technology existing among the mundanity of life, but it is also perfect for this thesis as an advocacy for the playful beginnings of transformative concepts and technologies.

3.1.1 Defining IoT

Madakam *et al.* (2015) begin their review of IoT by breaking down the two components of the phrase: 'Internet' and 'Thing'. The former they classify as a network of networks, and latter, an amalgamation of all "real objects" present in the physical world (2015, p. 165). They are of the opinion that myriad definitions of IoT are present, each having common threads which they present in the following cohesive definition for IoT:

> *"[IoT is] an open and comprehensive network of intelligent objects that have the capacity to auto-organize, share information, data and resources, reacting and acting in face of situations and changes in the environment" (Madakam et al., 2015, p. 165)*

Interest in the development of IoT has been primarily seen among large corporations (Greenfield, 2006; Madakam *et al.*, 2015; Douglas and Lianos, 2000; Chui *et al.*, 2010). Its usage has proven to be widespread with IoT-enabled systems emerging in industries such as insurance, chemical production, manufacturing, agriculture, and health care to name a few (Chui *et al.*, 2010). The ability to code and track objects using uniquely identifiable information, places IoT as a strong point of interest for corporations with the handling of extracted information, capable of reducing risks and speeding up processes (Ferguson, 2002).

Where industries have benefited from the advanced computational prowess of interconnected IoT-enabled systems, the past decade has brought with it significant interest of IoT's potential in the domestic sector (Coughlan *et al.*, 2012; Lindley *et al.*, 2017b; Zanella *et al.*, 2014). The term itself has seen iterations coming from different sources all acting as aliases for the broader gamut of an Internet of Things, such as a *Web of Things* or *Internet of Objects* (Madakam *et al.*, 2015, p. 166). A history of IoT aliases is plotted boiling them down to a methodology that utilises machine to machine interaction as a modus operandi at its core with some of the aliases and associations accredit IoT as "Pervasive Computing", "Ubiquitous Computing", "Cyber-Physical Systems" and "Human-Computer Interaction", calling IoT a form of "Ambient Intelligence" present within computing (2015, p. 166). This presents IoT as a form of technology that is omnipresent and, to a certain degree (or a projected future), omniscient.

3.1.2 Interacting with IoT

Our relationship with technology such as IoT has evolved over time. One may find its roots in early adaptations of science fiction, an understanding that to this day is still present with myriad examples to be found. The modern smart phone and tablet can arguably trace their roots back to their fictional versions in the form of *Communicators* and *Tricoders* found in the popular television franchise *Star Trek* (Bleecker, 2010; Akmal, 2015). Cinema, television, and creative writing act as benchmarks for imagining new futures in technology through fictional endeavours. Though most of these imaginings fall in the category of fantasy with killer robots or all-knowing devious AI's, a

glimpse of a more tangible version of this is present in academia. One such example is Greenfield's (2006) *Everyware*, which discusses forms future technology could take around ubiquitous computing. The book talks of acknowledging the presence of technology capable of consciously processing our daily lives from garments to streets, household objects, and daily mundane rituals, acting collectively to gather information about ourselves for greater purposes.

3.1.2.1 *Existing among the mundane*

Designers, among other academics, have had a close affiliation with technology and its connection to everyday life; whether that be the domestication of IoT, or, the envisioning of grander schemes of ubiquitous computing (Richardson, 2009; Reeves, 2012). The vision of the future presented in Greenfield's book bases itself in Mark Weiser's famous words, *"The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it."* (Weiser, 1991, p. 94). Weiser's famous quote is around the human user surrounded by technology. The disappearing of technology affirms its power and influence on the human through a merging into mundanity. In many regards, design has used the human user and daily life as the focal point in the design process for IoT through an approach called Human-Centred Design (HCD).

Design has always implicated humans at its centre (Love, 2000, p. 293). Predating the Internet, these roots of HCD can be traced back to fields of ergonomics and computer science. Early ISO patents[16] showcased standards for what may equate to human-friendly designs. This approach has proven to become a popular choice among designers and scholars in this regard (Giacomin, 2014; Thomas *et al.*, 2017; Norman, 2002). HCD may act as an umbrella term that accommodates its predecessor User-Centred Design (UCD) (Steen, 2011, p. 45). Today, the word *human* and *user* have become synonymous in the design process of IoT and products/services in general with designers opting for HCD as the go-to approach for the design process (Lindley and Coulton, 2017, para. 12). This approach has created a world where IoT-enabled objects and services linger in our peripherals existing in mundanity much like the technology defined by Weiser.

3.1.2.2 *Simplicity by design*

A core axiom of simplicity is most associated with HCD (Norman, 1999), and dogmatically exercised in the design of products and services involving human-user-experience. This translates onto the design for IoT where HCD governs how we interact with this technology. Examples can be seen in products such as *Amazon's Alexa* or *Google's Nest*, presenting minimal ways of direct interaction by design. In his book *The Design of Everyday Things* Norman (2002) defines parameters for a user-centred approach to design to include ease, visibility, and the following of natural flows of processing. The examples he gives are of designed items such as chairs, doors, and washing machines, where function and form act in tandem. For instance, a door not designed with torque in

[16] HCD's six guiding principles are defined under ISO 9241-210:2010 as projects that include designs based on an explicit understanding of users, tasks and environments; an involvement of users throughout the design process and development; is driven by user-centred evaluation; involves an iterative process; addresses the whole user experience; and includes multidisciplinary skills and perspectives within the design process.

mind would be difficult to manoeuvre. Similarly, a washing machine overly designed or improperly labelled would be difficult to operate.

Whilst there is a critique of HCD as a design methodology for IoT at the heart of this manuscript it is not a dismissal of its benefits. Rather, it is the prevailing understanding that simplicity is a necessary requirement of HCD, and more importantly its appropriate usage that is of concern. Norman (2016, p. 34) who is often credited as the originator of HCD has also taken a similar stance towards simplicity in design suggesting both complexity and simplicity existing as conceptual models of "underlying belief structures". The task of the designer then becomes to acknowledge and appropriate the correct conceptual model as per design problem. Giving the example of moving files into folders on a computer, Norman highlights that while doing so behind the scenes a vast amount of complex computation is undergone while the user plays out a fiction of moving *'files'* into *'folders'*, allowing the designer to embed a simplified conceptual model of storage through Human Computer Interaction (HCI) into the user.

Furthering this point, Norman (2016, p. 47) continues by explaining how over simplicity is counter intuitive giving the example of a remote control with fewer buttons making certain use cases tedious. On the flip side a remote control with too many buttons would be confusing and excessive, suggesting complexity is a subjective matter as well.

Either logic plays at an anthropocentric view of the design process, and to an extent can create artefacts that function as expected. However, when the presence of 'intelligence' is introduced into a product—such as a washing machine or remote control—through IoT, implications emerge of deeper more complex underlying workings presenting a greater challenge for designers to forge appropriate conceptual models for their problems.

3.1.3 The disillusionment of living in IoT

A simplicity-first approach often associated with general understandings of HCD attempts to hide away the interior workings of a product for the benefit of the user. This in a way enacts Arthur C. Clarkes famously cited view of advanced technology being equated to magic (Clarke, 1962). Many users will most likely be content with this view, as can be seen from Norman's example above of *'files and folders'*. This of course is also counter intuitive to core values of HCD such as visibility, feedback, and consistency. "Well-designed objects are easy to interpret and understand" (Norman, 2002, p. 2). The inclusion of IoT in our daily lives though allows the physical world to transform into an "information system", promising enhanced capabilities for our already functioning objects with little intervention (Chui *et al.*, 2010, p. 582). This added presence of ever computing AI in products in our surroundings as proposed by IoT, suggests a complex level of interactions occurring behind the fictional conceptual models of our physical interactions with these devices.

IoT and actions happening within remain unclear to human users who are often the centre of these systems for the collection and creation of valuable data. Key properties of human-centeredness highlighted by Norman, thus are not necessarily present in the digital footprint of IoT system design creating a blind spot for users (Lindley and Coulton, 2017; Coulton and Lindley, 2019). Some of the

points of concern resulting from this blind sport are expressed ahead. Coughlan *et al.* (2012, p. 148) are of the opinion that interactions in IoT have yet to explore true human involvement. Norman (2016, pp. 41–47) describes himself that it's unjust to compare the complexity associated with a photo-editing tool with that of a planishing hammer. Each has their own level of complexity which depending on the wielder affords different levels of simplicity; or appropriation of defining simplicity. As mundane objects become networked, our relationships with them as users alter radically.

3.1.3.1 *The betrayal of our devices*

In his book, Greenfield (2006) also explores the flip side of the equation, suggesting the *smart* moniker to be deceiving. His view proposes the intertwining of computation in our everyday lives, may breed disturbances:

> *"When everyday things are endowed with the ability to sense their environment, store metadata reflecting their own provenance, location, status, and use history, and share that information with other such objects, this cannot help but redefine our relationship with such things. We'll find our daily experience of the world altered in innumerable ways, some obvious and some harder to discern. And among the more significant consequences of this 'computing everywhere' is that it strongly implies 'information everywhere.'" (Greenfield, 2006, p. 23)*

Where on the one hand computing of this nature opens doors to creating newly founded interactions—before considered closer to science fiction—this also presents challenges on the emerging fronts of security, ethics, and policy (Weber, 2009; Farooq *et al.*, 2015; Lindley *et al.*, 2017b). Furthermore, accountability for topics such as privacy and the use of data becomes a factor in play when designing for these systems (Boos and Grote, 2012).

This brings about the disillusion of IoT in our daily lives. Vamosi (2011) suggests the betrayal of our gadgets and devices when they unintentionally break due to design errors. Giving examples of contact-less interactions with cars, banks, and homes he suggests how technology may have developed a false sense of security among us. This is due to our never-ceasing want for ease in a turn he dubs, "the dark side of convenience" (2011, p. 25). This is visible in the security risks around IoT which have over the years multiplied.[17]

Norman (2016, p. 53) seconds this notion in his own way by highlighting that "assumed trade-offs" between simplicity and complexity are improper applications of design. Taking the earlier example of the remote control he suggests this leading to two understandings, *(a)* that the goal is to achieve simplicity, and *(b)* that certain things must be given up in order to achieve it. Continuing on the same note while speaking of a specific *Siemens* developed washing machine, Norman argues

[17] In 2019 India faced a staggering 20% jump in cyberattacks on IoT devices making it the most attacked nation in that quarter. For more information, see: https://www.thenewsminute.com/article/india-saw-most-cyberattacks-iot-space-last-quarter-subex-report-106989.

that in the process of automation for the sake of simplification the otherwise accepted simple conceptual model of using a washing machine to wash laundry was complicated by defining the minutiae of the laundry contents to the machine. An otherwise simple process became more tedious in his opinion as with automation the general understanding is trusting in the machine's judgement.

In Vamosi's (2011, p. xvi) terms, we have yet to evolve "survival instincts" around technological fallacies. Solutions surface as often as vulnerabilities through patches and software updates. A further problem comes in the form of excess such as with the case of the above washing machine with *'extra control'*, or with companies offering solutions by overhauling expensive IoT eco-systems.[18] Collectively these measures present consumers with difficult decisions around the adoption of IoT.

3.1.3.2 *Gathering future technological asbestos*

While the above might lead one to assume these issues come solely from a security perspective and the fortification of networks is the solution, in truth design plays a pivotal role in all of this (Vamosi, 2011; Lindley *et al.*, 2017b; Norman, 2016). With the ever expansion of IoT through networks of heterogeneous interconnected objects and things, the underlying complexities hidden from users arguably through inefficient design choices rise exponentially (Lindley *et al.*, 2017a).

Where IoT does provide benefit in lifestyle and certain aspects of interaction, *Internet of Things* and *smart* have become buzz-words for manufacturers to create eventual IoT "asbestos of the future" (Spadafora, 2019, para. 2) through products which fulfil rudimentary purposes. These obfuscated interactions do not necessarily come from the need of a user, rather, disguised under convenience they present fundamental problems in the design process of IoT. Take for instance the *Quirky Egg Minder Smart Egg Tray*[19] intended to keep track of eggs in the refrigerator. A selling point of this product is not solely the fact that it can keep track of your eggs, but also, that it can connect to an external IoT hub for one-point access to the device. This implies an additional network where multiple devices, servers, stakeholders, and networks all implicitly interact with an interest in one's refrigerated eggs.

The argument here is not for or against the necessity of knowing the condition of one's dairy products (though that could be considered), but rather the point raised is that objects such as these surround us with electronic breadcrumbs. These act as key points of entry for not just secure interactions but also insecure and malicious ones. For the sake of (arguable) *convenience*, how many networks or connections can one truly fortify if it is solely a matter of security?

The smart egg tray is destined to fail in this regard. It along with other similar devices, though designed with good intentions, promote a rudimentary problem in the practice of general understandings of HCD when used for the design of IoT. Weiser's earlier comment on technology disappearing into the everyday fabric of life is certainly visible in these IoT devices, but they don't

[18] In the start of 2020 *Sonos* announced a discontinuation of 'legacy' IoT products bringing about outrage from consumers who had spent fortunes in the smart home *Sonos* eco-system. For more information, see: https://www.wired.co.uk/article/sonos-outrage-legacy-speakers.

[19] For more information, see: https://www.smarthome.com/quirky-ge-egg-minder-smart-egg-tray.html.

necessarily operate under the truest ideals of design with humans in mind. Where HCD advocates simplicity it also does visibility and feedback which many IoT devices deny with proprietary software, overtly simplified interfaces, or simply a lack of transparency. There is little view of the experience from its perspective for the user, rather, many products are designed with surveillance capitalism in mind. When they could also be imagined to be evolving, cleaner, or secure, traits that benefit the product as much as users by keeping true to human-centred ideals.

3.2 Approaching an alternative perspective for Design in IoT

Hungarian painter and professor for the Bauhaus School László Moholy-Nagy, wrote that "ultimately, all problems of design merge into one great problem: 'design for life'" (Moholy-Nagy, 1947, p. 42). What differentiates a normal refrigerator with an IoT-enabled one is what Pierce and DiSalvo (2017) consider a *'networkification'* of a world outside of the Internet, presenting with it levels of agency and value not originally associated with the device. Through IoT designers redefine aspects of living. Objects connected in IoT present themselves as simple solutions to mundane problems, yet, they house complex designs emerging from this networkification creating a complex problem space.

Obscuring hidden workings through general applications of HCD under the guise of *'simplicity'* may be welcome in some cases as many human-users could benefit from the lack of excessive information. Yet this obfuscation, paradoxically, also accredits the aforementioned security hazards in IoT, further opening avenues for similar concerns (Lindley *et al.*, 2017a, para. 1).

Our hyper-connected world is governed by assemblages of mediated data collected and processed through the various devices and systems in place around us. Simplification of such a complex system may only agitate the problem space further when challenges such as societal, economic, or environmental are faced around IoT (Coulton and Lindley, 2019, p. 466).

To see this in perspective, Lindley and Coulton (2017, para. 2) give the example of a smart meter intended to control heating in a confined space. The associated value for this device drastically changes between stakeholders involved. As a consumer, one might be inclined to reduce the amount of energy used. Yet, as the energy provider they would be motivated to maximise profits; with or without data collected from the meters. Whom is the smart meter designed for? What attributes should a designer focus on for this device? Should it be the efficiency of use? Stakeholder engagement and interests? Or effects on the environment?

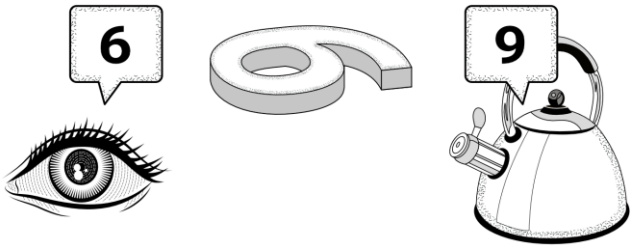

Figure 4: This appropriation of the illustration by Lindley and Coulton (2017), suggests that the perspective through which users see their world is not necessarily the same for IoT devices.

Certainly, concerns around privacy and transparency are of importance when considering HCD. Through the examples mentioned previously, and countless others strewed across the Internet, privacy is often the first casualty when designing for IoT. Many of the highlighted concerns appear to be solely a matter of transparency, though excess information is equally a subjective issue when designing. Certain systems might not need their underlying operations to be deemed extra information, equally some designs could require it. When perspectives differ so drastically for an IoT product and service design (Fig. 4), then how does one approach this design space?

3.2.1 Changing perspectives

The appropriation by Buchanan (1992, p. 14) of "wicked problems" in design are often considered the baseline for justifying methods in design research. The argument presented, is that problems addressed by design are far more complex and indeterminate with no immediate solutions existing a priori, ergo, understanding the situation becomes as important as formulating a solution (Gaver, 2012, para. 24). Examples of this are problems such as climate change and solutions presented under the umbrella of sustainability. This is why design researchers often employ methods from diverse disciplines converging together to create a focal point around a subject matter they have invested in through an act of "innovative repositioning" (Buchanan, 1992, p. 11). What this means is for design researchers to conduct their research they must accept the fact that the solution will lie in resituating the problem. In our case, for the design of IoT we need to change our perspective.

The complexity of the situation emerges partly from our innate trust in technology, but also perspectives exercised through HCD. Ironically, one of the most notable and quoted figures in the argument for HCD Norman (2005, p. 14) has also argued against an anthropocentric approach to design, proposing an "activity-centric" approach instead. On the matter of designing for IoT, Lindley and Coulton (2017) present a case in favour of alternative design approaches to HCD saying that perspective plays a large role in how one may view IoT.

All the examples presented above create an argument for the *'things'* in IoT as being more than physical objects. Besides their physicality they include abstract concepts such as data, algorithms, software architecture, policies, and business models, to name a few. Each of them defining these concepts in different ways. The interrelations of these different elements fuel the problem of

complexity, and as such is how a smart television could infuse paranoia,[20] or a baby-monitor might also serve a criminal activity.[21] Lindley and Coulton (2017a) are of the opinion that extreme use of generalised conceptual models of simplicity associated with HCD, may unintentionally detriment the adoption of IoT.

3.2.2 Metaphorically speaking

Arguments are presented for expanding the scope of HCD to include elements such as the environment and objects (Thomas *et al.*, 2017; Coulton and Lindley, 2019), and even fantasy and lore (Rose, 2015). This acknowledgement of abstract entities as actants in an IoT network expands on the broader perspective for design. One way of seeing IoT is through metaphor as suggested by Lindley and Coulton (2017, para. 3), presenting the concept of metaphorical "constellations" for IoT.

This argument suggested by Buchanan (1992, p. 12) of innovative repositioning through design practice incorporating diverse disciplines in this instance, is conducted through the use of metaphor to understand alternative perspectives better. IoT is not a stranger to the use of metaphors. Different sources express interacting in and among IoT comparable with non-digital experiences (Cila *et al.*, 2017; Rose, 2015; Romero *et al.*, 2008). The infamous quote of technology as magic can be viewed as a way of describing something like IoT akin to sorcery for the less informed. Rose (2015, p. 52) discusses this approach further by seeing IoT housing "enchanted objects", capable of enhancing our daily experiences akin to magical artefacts from lore. Though his view could be argued as still anthropocentric in certain regards, it proposes an alternative viewpoint. One where these objects are given importance and value beyond their utilitarian function, embodying them with a higher essence to serve their human-users. In the coming two examples I will build a case for viewing IoT through metaphor in order to understand it better from alternative non-human perspectives.

3.2.2.1 *Enchanted experiences*

Rose (2015, p. 111) presents the case of an umbrella inspired by the magical sword *Sting* from *The Hobbit* by J.R.R. Tolkien. Where *Sting* informed *Bilbo Baggins* of nearby danger, Rose's umbrella informs him of whether it's about to rain. Though a simple premise, the interaction becomes an enchanting one capable of pulling the user into a playful world where umbrella's converse with their users about the weather. Furthermore, it establishes a deeper existence for the device disconnected from the human.

One could argue that our devices are always enacting themselves in our background lives. But where the enchanted umbrella differs is in its anticipation of use: "Objects that anticipate their use; know when they're needed" (Rose, 2015, p. 111). This is not collecting data because it can be collected, rather, it is obtaining data as a result of meaningful interactions. One that not only is important to the user but establishes a strengthened presence of the device.

[20] For more information, see: https://www.wired.com/2017/02/smart-tv-spying-viziosettlement/.

[21] For more information, see: https://www.healthline.com/health-news/baby-monitors-can-be-hacked.

Where the IoT egg tray could be shrugged off as an item of jest just like the USB ghost tracker from my past, the enchanted umbrella incorporates a playful experience in a manner that elevates the device by design. Through a metaphor of enchantment the magical aspects of IoT, or underlying complexity, is approached in a human-centred way providing a meaningful interaction beyond that of a regular umbrella. Arguably, the complexity is not made visible in this instance but for the end-user it remains an intimate interaction with a simple conceptual model, glowing umbrella equals rain as opposed to the series of side interactions to check the weather before leaving. This also highlights the umbrella's awareness of things out of the human user's control or knowledge. Rose gives many such examples that present IoT-enabled objects comparable to magical artefacts from fantasy fiction, making them metaphorical representations of magic and simplifications of otherwise complex interactions.

3.2.2.2 *A faceless shapeless Internet*

A further definition of the Internet is provided by Pierce and DiSalvo (2017, para. 1) who refer to it as "shapeless and faceless", attesting to the benefit of defining IoT through perspectives of metaphor. The notion of a *constellation design* creates relations in IoT that are "independent-but-interdependent" (Coulton and Lindley, 2019, p. 467). The user is removed from the centre of the equation and becomes one piece in a larger puzzle with services, stakeholders, business models all residing in their respective dependencies (Fig. 5). In this light, *perspective* becomes important as what is of value changes according to what is viewed and by whom.

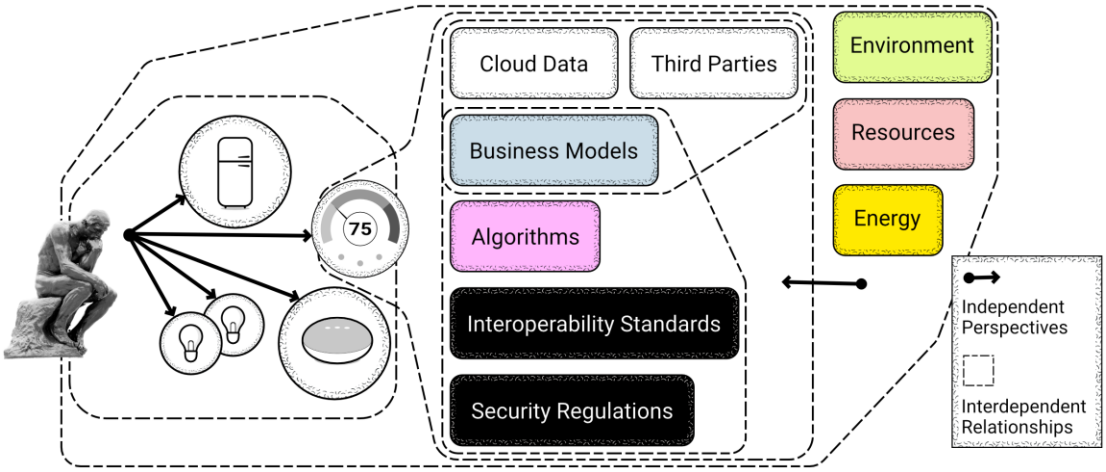

Figure 5: Seeing IoT through a metaphor of constellations reveals individual perspectives and dependencies in relation to the observer.

More so, one must understand that the *things* in IoT differ from those in our daily lives. Whether we see it as enchantment through Rose (2015) or betrayal as Vamosi (2011) suggests, IoT objects are different from non-IoT counterparts. Partly because of their abilities (magical or otherwise), but also because of the workings behind the illusion they present.[22] Paraphrasing Pierce

[22] In Chapter 9 I go into much more detail on how these illusions manifest between user's anticipations with IoT and the actual workings of IoT.

and DiSalvo (2017, para. 1), they are as shapeless and faceless as the Internet they exist in. To further this point we can see the comparison by Coulton et al. between a wired telephone to its IoT alternative, the smart phone, illustrating the difference in regular things and IoT-*things*:

> *"The wired phone is a single purpose device, connecting into the phone network, which itself is a complex but highly sanitized and controlled system. The smartphone on the other hand is a general-purpose computer, imbued with a range of sensors, connected to the Internet, running user-installed software. It so happens that it also makes phone calls and, for historical reasons, is primarily referred to as a 'phone'. This is analogous to the contrast between 'things' and the IoT." (Coulton and Lindley, 2019, p. 468)*

The metaphor of a constellation allows for this contrast to be seen more clearly. A wired telephone exists for a singular purpose making/taking phone calls, and thus serves simpler stakeholders which can be drawn out in a linear fashion of telephone company to user and back. Of course the telephone company and user are under the influence of third-party effects such as government policies, this model is less influx than a digital network as I will explain. The smart phone serves multiple stakeholders from the fact that it is more than a device for making phone calls. Among these stakeholders include but are not limited to the user, network providers, manufacturers, government policies, applications in use, third-party manufacturers and advertisers, and so on. So, a linear model is not possible. Through this assemblage of independence and interdependence, a series of "networked ecologies" (Coulton and Lindley, 2019, p. 467) are created. One can see them as collections of interacting bodies, depending on each other to form a cohesive interaction. Where immediate interdependence is viewed in basic interactions like user input, others are less obvious but just as important. Coulton and Lindley also give the example of smart televisions which log user activity. Users information is not simply used to tailor the viewing experience but is passed on by the manufacturers to third parties for targeted marketing based on those interactions.

IoT devices are not solely owned by their users just as the telephone lines are shared between the provider and client. The difference between these services comes when seeing that unlike traditional networking abilities IoT devices also may incorporate other types of *networked things*. This may include other devices, interactions with businesses, communications with government authorities, or unsolicited interactions with third-parties. Metaphorically speaking, IoT networks exist as constellations of interacting bodies with clusters of independent and inter-dependent interactions each affecting the other in a daisy-chain manner.

The alternative perspective presented has been termed "more-than human centred design" (Coulton and Lindley, 2019, p. 478) to look beyond the precedence of an anthropocentric view. It utilises elements of speculation and a large part of philosophical debate to understand how one can experience concepts such as IoT from different perspectives. By removing the human centre in this view, one can focus on the networked ecologies housing the different stakeholders and their various

interactions. This allows for a broader perspective, which was before given solely to the human-user. Thus, in order to acknowledge alternative approaches towards HCD for the design of IoT, one must acknowledge the independent and inter-dependent perspectives of the things in IoT, their lives, objectives, and intentions.

3.3 Conclusion

From the above understanding of constellations in IoT the human user is not the centre unless its place in a wider ecology is examined, such as between user and device or user and internet service provider. The more expansive the ecology, the more the 'centre' is realigned. All the while these networks remain hidden from the human user.

In light of the playful attitude towards research presented by this thesis if taking the view of IoT as enchanted objects as posited by Rose (2015), then one can see these hidden workings as background processes of *magic*; or how the illusionist manages to hide away information. Examples such as these, present an alternative case for viewing IoT as constellations where actants rely on their interactions with others. The metaphor may stage the setting for understanding the illusion better. In Chapter 9 I go into much more detail exploring these illusions generated between user and device through philosophical musings, but before going into that there is a lot of ground to cover in the coming chapters.

This is a case for misaligned conceptual models to generalised understandings of HCD in practice. Simplification does not necessarily lead to ease of use and could equally unearth unintentional flaws in design, particularly when considering IoT where beyond security measures concerns such as privacy and ethics are at stake. A more-than human approach encompasses elements of design that elevate the experience beyond mere servitude. Shying away of underlying workings of IoT for the sake of simplifying use to highlight device servitude, inadvertently leads to further complexity. *Visio's* lack of regard for user privacy is a haunting example among the plethora of others befallen to ignorant or at times nefarious design choices in IoT.

Objects in our vicinity exist out their vicarious lives, a philosophical concept. This way of viewing IoT through a lens of philosophy is the driving argument of this manuscript proposed through its playful attitude towards research. A philosophical discourse around understanding this alternative perspective to HCD will be highlighted in the next chapter to act as the main driver of metaphor for viewing IoT differently.

BEING THINGS OF THE INTERNET

"The Internet does not exist…Because it has no shape. It has no face, just this name that describes everything and nothing at the same time."

— EXCERPT FROM BOOK JACKET OF *THE INTERNET DOES NOT EXIST* EDITED BY ARNADA *ET AL.* (2015)

4.1 Introduction

Approaching a metaphorical understanding of IoT capable of discussing an objective perspective over a subjective human-centred one, requires expanding generalised models of HCD practice. Towards this end, this chapter attempts to lay a bedrock for understanding more-than humanness and accepting the possibility of an alternative perspective to IoT. This is done through an in-depth assessment of philosophical discourses around topics of Phenomenology, Object-Oriented Ontology (OOO), and Speculative Realism moving towards a discussion on post-anthropocentric perspectives for design. As one of the two prongs of this thesis' argument in playfulness and philosophy, the intention here is to present a philosophical discussion on viewing the world around us from the perspective of humans and subsequently non-humans to address a potential object-oriented vantage point capable of being utilised in further design application. To begin, it's important to understand why this section on philosophy is needed.

4.1.1 A Philosophical Interlude

In episode sixteen of British comedy sitcom *IT Crowd*, *Moss* (Richard Ayoade) offers to lend *Jen* (Katherine Parkinson) a black box with a red flashing light on it saying, *"This Jen, is the Internet."* Targeting her lack of computing knowledge, he explains how the box lacks any wires and is lightweight because the Internet is wireless and has no weight as everything is on the cloud. Moss' colleague and friend *Roy* (Chris O'Dowd) objects to this but is later assured that the *'Elders of the Internet'* agree with lending Jen the box. A cruel jest intended to embarrass Jen who, unbeknownst, presents the box to her peers. She then goes on to explain how if anything were to happen to it the world would collapse, falling into chaos. In true comedic fashion chaos does ensue after the box is destroyed in an accident, leaving both Moss and Roy looking over the spectacle befuddled.

This example, though an exaggeration, does a good job at playfully problematising the sense of magic a less informed person might associate with *the Internet*. As explored in the previous chapter, this 'magic' may be more readily acknowledged through IoT and applications of HCD. The existential nightmare of depicting the Internet as an IoT object itself aside, oddly enough the example

also embodies (albeit comically) the disillusionment of one's expectations with IoT coming from this lack of knowledge.

In the last chapter, I discussed problems that can arise from a user's lack of knowledge attributed to practices of HCD, which attempt at presenting simplified experiences to human users of otherwise complex functions. This brings about an experience of IoT that lacks the sense of enchantment one anticipates of it and instead foregrounds its operational reality for users. The potential solution suggested is of a post-anthropocentric view of more-than humanness by acknowledging the presence of the *things* in IoT and seeing their independence and interdependence devoid of human involvement. This philosophical interlude thus attempts to present an understanding of what it means to be a *thing* in IoT, or an *object of the Internet*. This chapter in this regard, could be seen as a reflection of the previous one. Where that was about 'seeing' IoT objects, this is about 'being' one. In the coming chapters further light will be shed on the topic as we dive into different philosophical positions when and as they become necessary.

What is suggested here is the viewing of IoT through different lenses. Both IoT and design will be discussed again, only this time using a different lens representing philosophy. This reflection should solidify relationships between IoT and the idea of seeing through metaphor.

That said, throughout this chapter (and at points this thesis) I will be making use of philosophical thought experiments to elaborate certain concepts. Thought experiments are often used by philosophers to position theories using intuitive logic in a deductive process of reasoning (Ichikawa and Jarvis, 2009, p. 222). Though arguments exist for and against the use of thought experiments as a method to posit theories (Cooper, 2005; Bishop, 1999), their use is commonplace in philosophy as they manage to ease the understanding of dense philosophical constructs.

As the purpose here is to build towards how design can fruitfully use philosophy as a like-tool in an ever-expanding metaphorical toolbox, the use of thought experiments allows for engaging in discussions around the various philosophical arguments and their relationship to design(ers). However, we need to begin this philosophical interlude one step at a time and start by asking a fundamental question around the existence of IoT objects: *What is an object of the Internet?*

4.2 Understanding *Things* on (and not on) the Internet

The opening quote of this chapter suggests the Internet does not exist because it lacks form or shape, although we claim to use it in different manners of communicating information. From sending private or public messages to switching on lights and interacting with satellites in space. So, what is it that we do when we say we are *'online'*, or, that something is connected to *the Internet*?

Perhaps one way to approach this is to first define the Internet. Different definitions exist ranging from the Internet as being a computational organism of interlinked computers processing information, to its impact in an anthropological context. The task of defining the Internet falls to understanding what the question is directed at (Abbate, 2017). If we see the Internet from a technical standpoint alone as a technology, then yes, it is a network of interconnected computers working in tandem to create an experience of information exchange. However, at the same time the Internet is

also a space for content creation and social activity, and as Abbate (2017, p. 12) argue it acts as a localised experience meaning different things to different people.

How we define the Internet may also be an evolving definition coming from how media, politics, and society have shaped it through use (Lesage and Rinfret, 2015; Morozov, 2013). Flichy (2007, p. 2) dubs this the "Internet imaginaire" in how laws, values, and institutions are imagined for the Internet. He presents a cyclic model of how utopian ideals become the bedrock for new technological advancements. These don't necessarily end up as initially imagined having to face compromises and constraints coming from present technologies and/or social ideologies. For instance, the idea of the Internet as an "information superhighway" was highly regarded and endorsed in the early 90s only to be slowly put aside as technology just wasn't present at the time to imagine it (2007, p. 29). Though today this can be imagined with the height of advancements, it was short of a disillusionment a few decades ago.

Little argument exists against the Internet's significance as a technology in the twenty-first century. However, Ropolyi (2018) suggests that the common definition of a network of computers must be put aside to truly accept what the Internet is—as not merely a connection of servers but a "highly complex artificial being with a mostly unknown nature" (2018, p. 40). Two concepts emerge here: seeing the Internet as a *being*, and the Internet (or its occupying things) having an ontology. The word *'being'* here is not taken in its literal sense, but rather a *phenomenological* one. Approaching this would, in turn, define an ontological view of the Internet.

4.2.1 Phenomenologically speaking

Phenomenology is a dense philosophical movement dating back to the 18th century. Where the simplest definition of Phenomenology is the study of phenomena (Smith, 2016, p. 1), it is important to note here that understanding of *phenomena* is a vast enterprise in philosophy. This text will not cover every aspect of the topic, rather, it aims to provide a core understanding to facilitate further discussion. Having said that, the definition of Phenomenology as a study of phenomena is better described through the notion of *appearance* (2016, p. 1). Not solely in the visual sense of something's appearance, but rather the literal sense of *appearing as*; which could be taken from a variety of different sources (sound, memory, touch, opinion, etc.). This places Phenomenology, with the capital P, as a study of how things appear in their experience. Seeing the Internet as an evolving *being of unknown nature* as Ropolyi (2018, p. 40) suggests, means seeing it as a phenomenon that can only be understood through its experience. It is more than the sum of its parts, i.e., servers, terminals, computers, hard drives, radio frequencies, processors, etc. Making it possible to approach understanding the Internet, and the objects of the Internet, through Phenomenology.

4.2.1.2 *Origins of the movement*

Studies and observations in philosophy around the nature of being have been going on since Plato. These studies relate closely to the understanding of phenomenology. The word comes from the Greek *phainomenon* and *logos*, meaning appearance and reasoned inquiry respectively. A pre-history of the movement may be found in the works of 18th Century philosophers David Hume, Immanuel Kant, Georg Hegel, Franz Brentano, and others. Phenomenology started in a reaction to René Descartes infamous *mind-body problem*, which disconnected the mind (thought/thinking) from its extension (body/nature) allowing the mind to exist independently of the body (Smith, 2016, p. 3). The true start of the movement though is accredited to Edmund Husserl in the 19th century, with Martin Heidegger positing the foundation for modern philosophies of phenomenology.

Descartes mind-body problem has been widely debated by scholars (Velmans, 1998; Stewart and Mickunas, 1974; Harman, 2011b) and due to the convoluted nature of its discourse, I refrain from pushing forward into it as it crosses areas of metaphysics. That would be beyond the scope of this discussion (for the moment). As such, this text follows post-phenomenological views focusing on the works of Graham Harman who based his concepts from Heidegger's writings. Before starting on that it would be beneficial to ground oneself in base phenomenological traditions, in order to situate the Internet and the objects of the Internet in a phenomenological context. This is because they set the stage for Harman's ontological approach towards post-phenomenology, helping to ascertain why Harman's views work for IoT and not others.

4.2.1.3 *A brief overview of phenomenology*

I will be aligning my arguments directly with either Heidegger or Husserl (both considered the strongest voices on the subject) in understanding phenomenology, mainly because *(a)* this thesis does not directly relate to their works, *(b)* these philosophers and their stances are effectively in opposition to each other, and *(c)* they both pursued different philosophical projects that don't focus on capturing hidden qualities and causations which are of primary interest to this work. That said, they arguably both provide frameworks in which relations and qualities not apparent to the 'naked' eye are logically possible and can be phenomenologically inquired. This is why for their phenomenal work in establishing the foundational concepts used to develop *Object-Oriented Ontology (OOO)* I will be paying homage in the coming text by briefly going over some of the core understandings of elements of their philosophy before focusing on Harman.

The phenomenology movement is often rooted to the famous quote by Husserl (2001, p. 168) of going "back to the 'things themselves'", in an attempt to decipher phenomena. As a core construct, Phenomenology rejects methods of science seeing them as being inadequate to answer questions around the nature of consciousness (Stewart and Mickunas, 1974). The molecular structure of water might be able to construct various facets of water (such as viscosity, colour, etc.), but does not effectively describe one's experience of water (feel, use, thirst, etc.). In this regard, phenomenologically *appearance* is dependent on *experience*, therefore, how the external world appears to us hinges on the experience directed towards us. For example, a tree seen outside my window is accepted by me as a *tree* because of the many factors that come into play when

experiencing it (light, texture, colour, memory, time of day, etc.). All of which collectively create the phenomenon of experiencing and acknowledging the tree for what *it is*. Philosophically this is seen through constructs of intentionality, assumed by rejecting presuppositions that might influence any judgement of the experience, in a process known as *phenomenological reduction* (Smith, 2016, p. 10).

This reduction brings about a keen interest in the definition of *'Things'* in phenomenology. What constitutes a *Thing* depends on factors of intentionality and experience. Different definitions are presented over the course of the movement, but phenomenological problems are not obvious and simply being conscious of a thing cannot be enough to define it. Where Husserl's view of phenomenology falls between empiricism and rationalism, it sees phenomenology as a descriptive rather than explanatory medium (Smith, 2016, pp. 25–26). My acknowledgement of the phenomenon of receiving a phone call comes from my inherent knowledge of my phone, the sound of my ringtone, the way sound travels in the air and my recognition of it as a telephone call. This does not in any way explain the phenomena of 'receiving a phone call' but rather describes it.

In contrast, Heidegger (1985) rejects the Husserlian 'neutral' stance claiming it biased towards Cartesian philosophical traditions. His view of phenomenology is concerned instead with the "meaning of being" (Heidegger 1927, p. 227); in this respect, he refers to intelligibility. In essence, what he's saying is that I can only make sense of something as a being or a *Thing*, once I am capable of understanding what it means to be that thing, making phenomenology an act of "systemic inquiry" (Smith, 2016, p. 27). This approach of inquiring to the workings of something allows us to enter the debate of discovering what it means to be a *Thing* in the Internet.

The infamous *tool-analysis* by Heidegger (1967) is oft cited around phenomenological discussions in OOO (Harman, 2011b; Smith, 2016; Merleau-Ponty, 1996). The view is that things derive their meaning from their utility, with the famous example of a hammer whose existence only becomes apparent to us when it no longer is of use or when it cannot do what a hammer should. Its *zuhandensein* or readiness-to-hand and its *vorhanden* or present-at-hand, the apprehension that the world is made up of objects awaiting to be used. A third construct of *Dasein* (human existence) is also represented in Heidegger's works and later expanded on by Harman's (2011b) OOO which roughly translates to 'being there in the moment'. Before continuing on this string of thought I would like to briefly step aside with a relevant example for IoT and phenomenological reduction in a thought experiment that should hopefully explain the connection here.

4.2.1.3.1 *Thought Experiment: Seeing and Being Lightbulbs*

Allow me to present an example of two lightbulbs operating in the same household. One is a regular lightbulb connected to a standard switch and wall socket that allows the flowing of electricity. The second is an IoT-enabled lightbulb also connected to a standard switch and wall socket but in this case the switch is kept on and it is interacted with through the Internet using a mobile application. To experience their respective phenomenon of 'being' lightbulbs Table 1 attempts conducting a manner of doing phenomenological research through a kind of auto-

experience sampling of material object perspectives. A clearer defined usage of this often employed to communicate autobiographical first-person lived experiences (Finlay, 2012).

Though in this thought experiment as neither lightbulb is truly 'alive', the auto-sampling is done from a human-user perspective mainly because certain experiences would be quite difficult if not impossible to define as *not-a-lightbulb* since I as a human have not lived as a lightbulb. Another concern is just how would the lightbulb communicate its experiences? In a language of objects? In Chapter 9 I attempt to explore this angle as a manner of agency more playfully and directly, but for now I will be restricting this thought experiment to as close an auto-experience sampling of a lightbulb as I can do myself while being *not-a-lightbulb*. Alternative methodologies such as thing ethnography, a non-anthropocentric means for "using things as co-ethnographers" (Giaccardi *et al.*, 2016, p. 387), could also be employed to understand these perspectives. Though as thing ethnography is normally done using strategically placed cameras and microphones for extracting a thing-perspective, the approach I will be taking is of describing and comparing different traits between the two lightbulbs. This can be taken a step further by extracting specific data from a lightbulb at intervals akin to more common practices of experience sampling with humans. In this case the data could be conductivity, heat, lumens, intensity, time, etc to deduce phenomenological experiences unique to a lightbulb if one were to go that far.

For the purposes of this research, this level of detail is not needed. Furthermore, for simplicity sake we remove any functionality asides switching on as a lightbulb for the IoT-enabled counterpart. Our example does not look at the presence of electricity in the walls, the material of its surroundings, present/un-present information pertaining to the existence and production of electricity, the materials and workings of the mobile phone, or the wireless connectivity as those are considered givens and beyond current scope but can be expanded upon if need be.

Table 1: Attempting a descriptive auto-experience sampling of a regular and IoT-enabled lightbulb by comparing a sampling of their respective experiences

Regular Lightbulb	***IoT Lightbulb***
Appearance wise it is round, transparent, smooth, comprising of a number of materials including glass housing, a metal Edison cap, a coil/filament, and plastic connected to a socket in the wall. When turned on it shines bright.	Appearance wise it is round, transparent, smooth, comprising of a number of materials including glass housing, a metal Edison cap, a coil/filament, and plastic connected to a socket in the wall. When turned on it shines bright.
Sensory wise the glass feels hard yet smooth to touch when turned off, and warm and uncomfortable to touch when turned on.	Sensory wise the glass feels hard yet smooth to touch when turned off, and warm and uncomfortable to touch when turned on.
Reducing it further to its components we see its materials at rest and later heat up when flowing with electricity provided from the socket in the wall.	Reducing it further to its components we see its materials at rest and later heat up when flowing with electricity provided from the socket in the wall. Furthermore, it's materials include silicone, electronic diodes, a radio transmitter for Wi-Fi and Bluetooth, a printed circuit board, electrolytic capacitors, polyester capacitors, inductors, and various microchips.
Functionalities wise the light is powered through turning on a switch that feeds electricity through the wall into the wall socket where the bulb is fixed. Switching it in reverse cuts the flow of electricity and turns off the lightbulb.	Functionalities wise the light is powered through a switch that feeds electricity through the wall into the wall socket where the bulb is fixed. It is turned on through a mobile application present externally on a smart phone. This in turn sends a wireless signal through the Internet to the bulb which is recognised on the network telling it to allow the flow of electricity from the wall socket to pass through the filament, turning on the bulb. This registers on the mobile application changing the status of the bulb to 'ON'. Subsequently, turning the bulb off is done again through the mobile application that sends a wireless signal through the Internet to the bulb to cut the flow of electricity to the filament.

When compared in this manner we see that to the user of both bulbs the experience is very similar and only changes once they acknowledge the different approach towards using the IoT bulb. Where the bulb differs is in representing the 'magic' of electricity through a smart phone application. Arguably one can say that to someone ignorant of how electricity works this magic is equally present when using a switch to turn on a regular lightbulb. That said, the difference in functionality remains irrespective. The association of unknown knowledge as to how the IoT bulb manages to turn on through smart phone sorcery is an acknowledgement of replicating experiences for end-users through HCD. They are intended to remain 'magical' whether you design for a regular bulb or an IoT-enabled bulb because the designer must facilitate ease of use which just so happens to appear as magic to some. In Heideggerian terms the relative 'magic' of an IoT lightbulb is more present-at-hand than ready-at-hand because people have yet to understand them.

Table 1 describes both a regular and IoT bulb but from a human perspective because *as not-a-lightbulb* I am the one explaining *my* experience of *being a lightbulb*. This is coming from what little knowledge I have on the topic. There are questions that only a regular or an IoT lightbulb can truly answer. In the above example, there is no contest to what is happening when interacting with the regular bulb as a human. The question presented here is for the IoT bulb. When using it what am I interacting with, the bulb? Flowing electrons? Wireless interaction? The Internet? What am I experiencing?

It can be argued that as an end-user I am experiencing the same thing I would when using a regular lightbulb. But the IoT-enabled bulb adds this additional obfuscated layer of the Internet through wireless connectivity that the other bulb does not. If a regular bulb were to be turned on without my intervention with its switch, I may deduce it was done by someone else or possible rewiring unknown to me. But if that were to happen with the IoT bulb the answer is not as easy to discern, because wireless signals that go from a mobile phone to a physical device like a bulb need to bounce between numerous points which could be locally or globally situated and associated with a number of stakeholders and/or governing policies.

4.2.2 Towards an Object-Oriented Ontology

Returning to the previous discussion, when concerning the objects of the Internet the above thought experiment suggests that their existence becomes apparent to us (their users) once several ontological factors are addressed. Most notably it amounts to their utility, but also, an inherent understanding of what they entail. An IoT lightbulb allows me to brighten a room but also presents with it the ease of interaction that is not found in a regular lightbulb. It enhances a relationship between myself and my consumption of energy otherwise less apparent when using a non-IoT bulb. Furthermore, it also broadens the perspective of my energy usage in relation to my energy provider. It belongs to the world which I occupy (the physical room), but also to the world it operates in (the digital Internet). Its usage affirms a phenomenon of the Internet, which emerges through an experience of brightening a room without the use of a physical switch.

In this manner, the external-world (for a human-user or an IoT object) exists in either an objective perspective or a subjective one (Fig. 6). Either objects of the Internet exist because they are to be used by human-users, or they exist because they must function as they do, enacting their phenomena as independent entities.

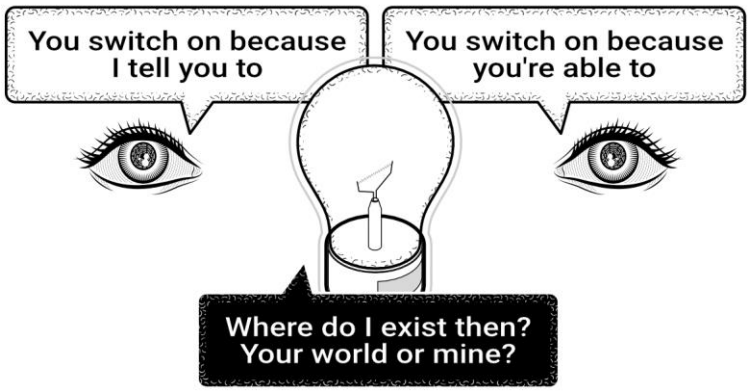

Figure 6: The world that IoT objects exist in may either be defined subjectively (as in through a user's perspective) or objectively (through the objects perspective). The former defines them by utility limiting their inherent potential.

This is the view shared by *Correlationism*, a concept introduced by Meillassoux (2010) in *After Finitude*. It asserts that things may only exist in relation to humans, making their subjectivity and objectivity intertwined, thus, inseparable to be analysed apart (Zahavi, 2016, p. 294). Zahavi explains it as so:

> *"On this [correlationism's] view, thought cannot get outside itself in order to compare the world as it is 'in itself' with the world as it is 'for us'. Indeed, we can neither think nor grasp the 'in itself' in isolation from its relation to the subject, nor can we ever grasp a subject that would not always-already be related to an object." (Zahavi, 2016, p. 294)*

It is a prickly concept to grasp, but the gist can be seen like so: our imagining of a tree cannot exist before us having experienced the tree *as it is in relation to ourselves*, therefore the tree cannot be thought of in isolation. In the previous thought experiment, I as not-a-lightbulb cannot remove myself from that notion to become a lightbulb unless I already was one or had experience of being a lightbulb. To overcome this, we need to change our viewpoint by examining a wider perspective.

4.2.2.1 *Overmining and Undermining*

In *The Quadruple Object*, Harman (2011b) describes a history of objects being shunned by philosophy and science in this manner as appearing *naïve*. Though phenomenology attempts to represent the presence of objects, it does so through idealism in his view. Harman (2011b, p. 11) quotes Berkeley's famous maxim, "to be is to be perceived" as the idealistic stance towards viewing objects, whereby, one is in outright denial of the existence of an external world. Correlationism proposes an alternative view, yet, one that sees thinking and theory existing in tandem; inseparable from each other.

In essence, it discusses how an object is a metaphor drawn from everyday experience. Take for instance the *Volkswagen Beetle*. One may say the design of the car affords it the ability to be anthropomorphised. Its large headlights can be seen as eyes. The shape of its hood and bumper could be seen as a grin. This is only possible because our mind associates these anthropomorphic traits to the car. Its objective properties as a mode of transportation, and, its subjective image as a 'living happy car' are intertwined.

To Harman (2011b, p. 10), these different views of objects are seen as unit entities, which conceal and reveal their abilities to us. These hidden traits he claims have been historically ignored as unimportant to philosophical discourse by acts of "overmining" and "undermining". Either objects are not fundamental since they are composed of far more detailed realities within them, such as atoms and quarks, making them "too shallow to be real" (undermined). Or, they are "too deep" a hypothesis, rendering them useless (overmined). In the latter view, objects are only important as manifestations in the mind, or through their interaction with other objects; the nail becomes important once the hammer connects with it, and vice versa.

4.2.2.2 *Exit human-experience*

Irrespective of what view one takes, the fact remains that carrots, aeroplanes, snowflakes, and cats all exist and differ from each other. And each brings with them inherent interactions associated with not just human existence, but their own. What Husserl strayed from in his phenomenology were objects outside human experience. All discussion so far has been revolving *around* the human experience and related interactions. It should be noted, that an IoT lightbulb and a regular lightbulb cannot be considered the same object due to certain experiences of each. Though the outcome for both might seem similar (brightening of a room) and one may say the pressing of a digital button is *akin* to pressing a physical switch, the experience associated with turning on an IoT bulb and that of a regular bulb differ from each other on fundamental levels (Fig. 7):

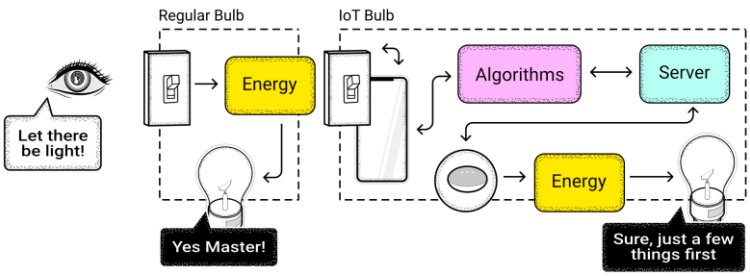

Figure 7: A regular bulb and an IoT bulb though provide the same service they cannot be equated due to the unique underlying processes that each go through.

Much of this phenomenon is happening behind the apparent interaction of switching on the bulb. In the human experience, it is seen as a binary interaction, yet, the actual function is beyond. The object is thus entitled to a deeper existence apart from the human.

4.2.2.3 *Enter the transcendental object*

Kant's *Transcendental Idealism* proposes a view where the human experience can be departed from, in theory (Harman, 2018a, p. 68; Stang, 2018). I tread carefully here as the deeper I go in this

topic, it breaks ground into deep metaphysics with arguments around morality, causality, space, and time; all of which we are better off avoiding for our discourse (for the moment). What should be noted is Kant's view of *'phenomena'* and *'noumena'*:

> *"[Kant] distinguishes in his philosophy between the visible phenomena of our conscious experience and what he calls the noumena. The phenomena are just what they sound like: everything that humans are able to encounter, perceive, use or think about…The noumena, by contrast, are things-in-themselves that we never experience directly, since we remain trapped in the conditions of human experience." (Harman, 2018a, pp. 67–68)*

By considering an IoT lightbulb capable of undermining and overmining its traits, we associate more with this object of the Internet. We afford its existence on a plane of its own. One it has transcended to and shared (or not) with other such lightbulbs and IoT objects. Furthermore, this plane need not be part of our experiential phenomena, rather, it may operate on its own. The networks of heterogeneous interconnected objects of IoT discussed in the previous chapter, thus become the noumena spoken of here or the magic behind-the-scenes.

To surmise, to correctly understand the phenomenon of objects of the Internet (Things), operating *in* the Internet (being-in-the-world), through their non-human experience (noumena), we cannot rest on the idea of objects as naïve. Rather, understand how to view them as themselves and not mere actants in our reality. We must be able to see 'out from within'.

4.2.2.4 *Speculative Realism*

No discussion around OOO is possible without mentioning its speculative realism roots. In April of 2007, during a conference at Goldsmiths College, University of London, philosophers Ray Brassier, Ian Hamilton Grant, Graham Harman, and Quentin Meillassoux coined the term *Speculative Realism (SR)* (Zahavi, 2016, p. 294). It emerged as a reaction to correlationism which, as discussed, saw the external world as a "pseudo-problem" where we are either "always outside ourselves", or, engaged in the world through "pre-theoretical" activities (Harman, 2018b, Introduction, para. 6). Shaviro (2014) explains SR as insisting upon an independence of the world, and the things that occupy the world from how we conceptualise them. It rejects prior philosophies around the structure of the world being dependent on our mind's interaction with it, and, phenomenological assumptions of correspondence between self/world or subject/object.

People/humans are not the measure of all things to a speculative realist. To make this assertion, it is necessary to speculate about the alternative (Shaviro, 2014, para. 2). This is an escape from inherent anthropocentrism to take in the existence of an alien non-human world.

Shaviro (2014) sees a sci-fi short story *The Universe of Things* by Gweneth Jones, as a compelling example of SR. In the story, aliens contact humans bringing with them their own objects which unlike human objects are intrinsically alive. They slither and creep and are not inanimate. The

story encourages an alternative perspective of the "liveliness of objects" and their relation to us (2014, p. 3). It does this through the medium of speculating this alien encounter.

Though the philosophers who coined the term since have abandoned the rubric due to inconsistencies and biases, the use of SR as a label to identify opposition to correlationism is still useful (Zahavi, 2016; Harman, 2011b). Harman (2018a, p. 57) since has encouraged a broader perspective of seeing things incorporating Bruno Latour's actor-network theory that sees things-in-general as actants no different from us. This affords an expansive view of the world where *human-engagement* is overtaken by *actor-engagement*. Take the *Volkswagen Beetle* example, in this view beside it being a 'happy living car' with potential eyes and a face, it's also an amalgamation of materials: leather, glass, aluminium, oil, rivets, circuit boards, silicon, a registration number, and so on. Collectively they create that specific *Volkswagen Beetle*, yet individually they retain their inherent uniqueness devoid of any association to the vehicle.

By viewing objects in this manner, he aims to enhance them to the levels of other non-objects around them effectively creating a consensus. Morton (2011, p. 165) describes this view as an attempt at reimagining realism in the wake of anti-realists. This viewpoint presents a case for an object-oriented world which exists besides our own (Harman, 2018a; Wolfendale, 2014). Where lightbulbs, toasters, jackets, cars, etc. all reduce each other to readiness at hand when interacting.[23] The earlier thought experiment attempted to reduce our lightbulbs in this manner to approach a similar object-oriented stance of causation and experience.

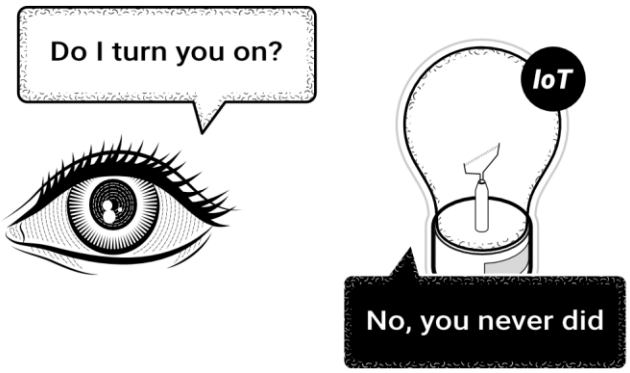

Figure 8: An IoT object may be considered present of their own accord as their existence does not rely on other IoT or non-IoT objects such as humans.

Hence, in an object-oriented world the title of *Dasein* can be presented to other objects as well (Fig. 8). After all, when I tap my smart phone to turn on the lights in the kitchen, my lightbulb does not interact with me it interacts with the smart phone or better yet radio signals. It is not aware of my existence (at least not in this instance), but rather the smart phones and the ether it interacts with. My interaction is with the glass surface and the sensitive diodes underneath. The bulb interacts in a

[23] Arguably Heidegger has spoken of nature independent of Dasein as well though where his explorations describe that, an ontology of existence must involve an understanding of Dasein's interconnectedness with the "world human beings find themselves in" (DeLaFuente, 2013, p. 5). Harman's argument asserts removing the human element from the picture entirely to support a purely objective experience.

non-physical digital space (the Internet) where photons fire away information. As in the above comparison with a regular bulb, the IoT bulbs function depends on the many interactions that occur between my tapping the smart phone and the bulb switching on. Thus, the nature of objects of the Internet is not dependent on our human presence or interaction. The bulb can still be turned on with a timer, or a sensor triggered by a cat. The design of these objects needs to be able to account for their non-naïve natures.

4.3 Object-Oriented Ontology

The above lengthy dive into the phenomenology of an object-oriented world was necessary to ground Harman's theory of *Object-Oriented Ontology (OOO)*. As an abject refusal of correlationism, it takes on the mantle from where SR failed; to establish an unbiased form of realism. Dissecting the name, it can be defined as a study of the nature of objects from the perspective of the objects. Where it utilises elements of SR, it separates itself as well. Through the view of OOO, humans and non-humans are seen on equal footing. Having no precedence over the other each is equated as objects (Harman, 2018a, p. 9), in lieu of Levi Bryant's notion of a "democracy of objects" (Bryant, 2011, p. 19):

> *"Objects need not be natural, simple, or indestructible. Instead, objects will be defined only by their autonomous reality. They must be autonomous in two separate directions: emerging as something over and above their pieces, while also partly withholding themselves from relations with other entities." (Harman, 2011b, p. 19)*

In OOO's light, objects need not conform to any prejudiced view of what an 'object' is, and, alongside what might traditionally be thought of as objects, i.e. cupboards, teapots, the ocean, a history lecture, Saturn's moon Titan, and Lahore are all considered objects. Much like the proposition by Latour (1994, p. 142) for a "parliament of things", this view raises objects to the standard of "quasi-objects" (1994, p. 51). The constructed view of object-oriented-ness by Harman uses these ideologies and taps into Heidegger's tool-analysis as a foundation (Bogost, 2012; Harman, 2011b), to explain how objects don't need to relate through any human-use, but rather, any form of use including any format of inter-relational use.

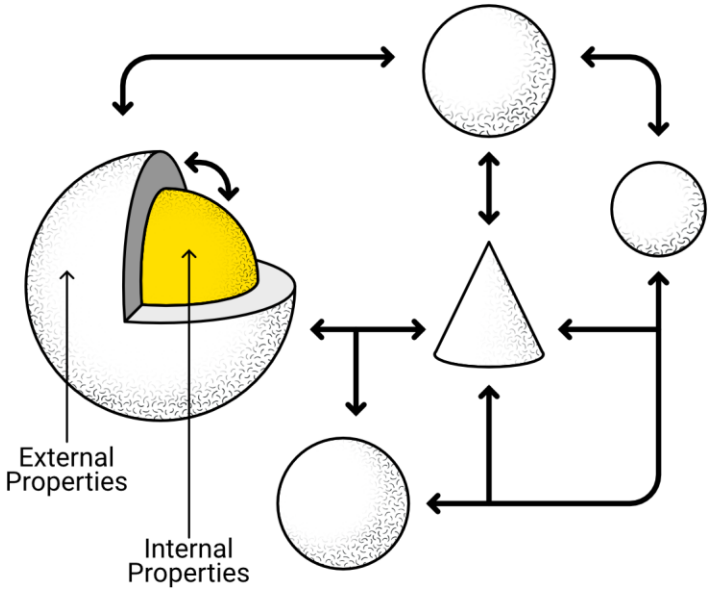

Figure 9: An ontograph may be seen as the relationship between the properties of things with those of other things including internal and external properties which may interact both ways.

Harman presents these pairings of ontologies as ontographs (Harman, 2011b, 2018a) and their subsequent exploration as *ontography* (Fig. 9). The term he appropriates from a story by English writer M.R. James where a character assumes the position of 'Professor of Ontography'. Bogost (2012, p. 36) later traces the term to a 1988 book *The World View of Contemporary Physics* by Richard F. Kitchener where it is defined as the description of the nature of things, or ontology. Where this definition of ontography does work for OOO, what I would rather keep is Harman's comparative definition to Geography: "Rather than a geography dealing with stock natural characters such as forests and lakes, ontography maps the basic landmarks and fault lines in the universe of objects" (Harman, 2011b, p. 125). It assumes an exploration of the rift between ontological polarities an object can take, or "vicarious causation" as articulated by Harman (2018a, p. 150). Essentially creating miniature worlds full of relationships, perspectives, and possibilities an object may or may not incur.

To explain this, I present two examples: one set in the hypothetical science fiction world of British sitcom series *Red Dwarf (1988)*, and the other set in our real-world smart objects:

- The sci-fi setting of *Red Dwarf* is of a future interstellar mining vessel with a sole human occupant and several non-human occupants. These non-human occupants range from robots, software entities, a hologram human, and interactive appliances. Among these appliances is the *Talkie Toaster*. Designed in the fictional world it intended to provide light conversation during breakfast. The toaster though housed enough knowledge to enter into philosophical debates, creating a frustrating environment for the appliance and occupants. As the human occupant (and at times the non-human occupants) scorn the toaster for its fixation on toasted breakfast commodities, through OOO, the *Talkie*

Toaster from *Red Dwarf* becomes on par with other characters in the series. An actor like all other actors in this play of existence.

- Let's now take for example the smart meter from the previous chapter discussed by Lindley and Coulton (2017). We've explored how IoT devices are both independent and inter-dependent. The smart meter is independent as a means for measuring energy usage but also relies on the interdependency of other entities in its constellation (energy provider, property owner, legislations, manufacturers software upgrades, etc.). Through OOO, each of these points on the constellation become individual objects collectively creating the smart meter, yet individually unique.

The two examples set a stage for two viewpoints of IoT. Where the former sees IoT objects as equal participants as their non-IoT cohabiters through playful storytelling, the latter expands on the idea of an IoT object to include a deeper existence. The equivalent of *Talkie Toaster* in our real world of smart objects is not capable of entering cohesive discussions with its users. That said, for IoT objects an object-oriented view means they may be imagined existing upon a plane equivalent to that of their users; the services they provide; the companies they benefit; the spaces they occupy; the affordances they provide, etc. Both *Talkie Toaster* and Lindley et al. constellation view, see smart objects as unique entities devoid of anthropocentric biases. Each creating their ontographical natures which can be examined by exploring the different polarities or viewpoints presented. The constellations approach allows for direct and indirect relationships of interactions to be viewed as unique ontographs or flat ontologies (Lindley *et al.*, 2018).

4.4 Concluding on a post-anthropocentric perspective for Design

Where this discussion of OOO leads to is an imagining of the vicarious lives of equally animate and inanimate objects in our existence. Though such an imagining of the world from a non-human perspective presents its difficulties (Lindley *et al.*, 2019), the premise provides a starting point to discuss a potential alternate view for designing in IoT; a view of the object as opposed to the user. In *The Uncommon Life of Common Objects* Busch (2005) narrates the unseen backgrounds of common objects around us, explaining how their design was influenced by the mundanity of everyday life. Her poetic approach towards household objects such as strollers and potato peelers evoke their mystique, suggesting that the objects around us have lives of their own signifying more than what one may assume their instrumental value is. This giving of life to an inanimate object may be contrarily seen as an anthropocentric approach of viewing life through the eyes of such objects. OOO though, suggests a post-anthropocentric view where life is a subjective definition employed by the object, not the human seeing the object. It is the life of the object itself, and what it sees.

Lindley *et al.* (2019, p. 1191) discuss the potential for using a post-anthropocentric view as a way to view IoT networks as seen by IoT devices, by suggesting the presence of metaphorical "ghosts in the machine". They hope to establish a platform for seeing interactions differently.

Through OOO, we can map these connections between objects for the benefit of design. Bogost explains this through Harman's example of a jigsaw puzzle rather fittingly:

> *"Things never really interact with one another, but fuse or connect in a conceptual fashion unrelated to consciousness. These means of interaction remain unknown—we can conclude only that some kind of proxy breaks the chasm and fuses the objects without actually fusing them. Harman uses the analogy of a jigsaw puzzle: 'Instead of mimicking the original image, [it] is riddled with fissures and strategic overlaps that place everything in a new light.' We understand relation by tracing the fissures." (Bogost, 2012, p. 11)*

Talkie Toaster is shown in such a way of presenting the world from its own perspective. Creating new perceptions of interactions with a toaster, albeit within its fictional world all for comic relief. The tracing of fissures between it, its interactions, and those of its interdependencies, allow for a broader view of what a toaster is or could be. Those same interactions if presented within the confines of a design problem could offer an opportunity for intervention in the process of design for IoT objects, such as smart toasters, forks, bathtubs, apparel, etc.

I'm taken back to Rose's quote: "Objects that anticipate their use; know when they're needed" (Rose, 2015, p. 111). This elegantly summarises the discussion of this chapter. Objects of the Internet anticipate their use, affording them a sense of presence. Their lives are full of experiences such as anticipating when they might be called to action. OOO allows for these vicarious lives of inanimate objects to be imagined. Rose's quote poetically places objects in an arena where they have a sense of being, simultaneously, allowing us to view them 'out from within'.

This topic is one that will recur in the following chapters. For now, I will pause the philosophy here to move towards establishing the methodologies of this research. With the case between SR and correlationism, one had to employ speculation to make sense. To approach the matter of IoT and Design through philosophy though, one needs to be playful. Having explained the philosophical foundation of this research, we can explore how to utilise philosophies such as OOO and design practice cohesively, by addressing the elephant in the room: *design research*.

METHODOLOGIES

CHAPTER FIVE

DESIGN RESEARCH

"A designer is a thinker whose job it is to move from thought to action."

— FRIEDMAN (2000, P. 37)

5.1 Introduction

The previous chapters have slowly been setting the foundations of this thesis. Starting with what it means to have things around us that connect to the Internet our discussion moved on towards embodying these objects to 'see through their eyes', so to speak. In order to explore these concepts through design this and the coming chapter define the methodologies used throughout this research. Since the concerns of this research are to do with alternative approaches to design and incorporates tangential topics of a transdisciplinary nature, a unique methodological approach capable of justifying the use of philosophy for design of IoT must be developed. As such this is developed across the subsequent two chapters, the first deals with the overarching design approach and the second with accompanying internal methodologies, linkages, and manifested attitude of playfulness. What I intend to do is present a combined methodological framework at the end of this section that inherits attributes from its constituent methodologies and concepts.

This chapter discusses iterative Research through Design (RtD) as an overarching methodology used throughout this research. The topic of design appears in various forms in this manuscript, mostly as crafted prototypes of ideas (physical, digital, or on paper) but also in the manner of its discourse. As such, I hope that this research may feed the greater knowledge of practice-based design research. In Chapter 1, I mentioned how doing an MA in Design Management opened me up to the potential of design research. It also reminded me how much I missed practising art and design in general. The presence of practice-based research is thus very important to me and contributed to the decisions made in the course of this work.

A number of different design approaches are utilised in the coming chapters, which is why the activities mentioned here on represent a predominant RtD ideology. It also presents the argument both for and against the suggestion of RtD as a methodology, which I go into more detail later. This is why even though it is present in the methodologies section of my research, I refer to it as an ideology instead as I see it as an overarching structure to support further methodologies that I use in my research owing to the playful attitude towards research I present throughout. These intercept design problems using creative and philosophical appropriations of designed artefacts.

Thus, to ease the discussion further, this section is divided into two chapters. The first addresses approaches for design research moving towards the application of RtD as a methodology in this manuscript with a review of relevant literature. The second, explores accompanying methods to add to a design and philosophy toolkit of sorts used in chapters discussing my practice. For now, in this chapter I intend to lay out why RtD is the methodological framework of this research. For that I will focus my discussion on doing design research for solving wicked problems such as those associated with IoT.

5.2 Doing Design Research

When considering a starting point for the discussion of design research, I realised it to be the most challenging aspect of compiling this document. Ironic as it is, the question of what design research is never truly came up while doing a PhD in Design. It was inherently understood. Perhaps this has to do with the fact that one explores these notions earlier on in their academic life. I touched upon it in my MA, but the idea ingrained in my mind then was a definition of design research specific to Design Management. Since then my understanding of what is *research*, *design*, and *design research* have evolved. The term 'design research' is often used in industry practice and academia alike. The following account of design research is thus influenced by my earlier understandings of design, and a new founded knowledge into the greater expanse of design research as a discipline. So where does one begin when discussing what is design research?

Edelson (2002, p. 106) describe the role of a design researcher as one who passes through "iterative cycles of design and implementation", with the intent of collecting and processing data to generate information. This collection of information is sifted and prodded to form hypotheses that further reflect upon crafting theories and artefacts, which in turn, are presented as outcomes of a 'design experience'. Faste and Faste (2012) attempt to demystify the usage of the term 'design research', to describe the myriad viewpoints that emerge while practising design in varying capacities. These include but are not limited to the various philosophies, methods, or approaches one may adopt or unearth while *'designing'*.

The term is formed by combining two very distinct words—design and research—both having their own definitions. Where the core idea behind both is the generation of new or refined knowledge in some form, there is a general differentiation between the two that has become accepted over time. I will begin by defining what design is in the context of this research and move on from there.

5.2.1 Defining Design

Design is a word used to express a multitude of meanings stemming from its nature in the English language as at times being a verb *(to design)*, a noun *(a design)*, and an adjective *(by design)* (Glanville, 1999; Julier, 2013; Lawson, 1990; Frankel and Racine, 2010). The term encompasses a broad spectrum of disciplines that associate different meaning to it according to its varying nature, from being a process or a tangible outcome of a process (Cooper and Press, 1995; Friedman, 2000), to a psychological perspective taken by an individual (Thomas and Carroll, 1979).

Friedman (2000, p. 32) traces the creation of design knowledge throughout history as a systemic evolution of toolmaking dating back to *homo habilis*. This view of the "acts of design" (2000, p. 34) embodies the rich heritage of craft making, which emerged out of a need for tools in human history. It also places design as both a vocation of trades and crafts, as well as a contemporary profession having evolved over centuries.

He presents a taxonomy of design knowledge as seen through core domains of inquiry that a designer is faced with. These include various skills for learning and leading, a view of the world we occupy, the artefact of intention, and knowledge of the environment and surroundings (Friedman, 1992). Collectively this taxonomy establishes a range of activities designers intend to partake in. What he refers to is how fundamentally design occupies multiple disciplines, thus, having designers require a breadth of knowledge to exercise design practice.

Cooper and Press (1995) attempt to refine the many definitions of design into different perspectives and core functions established in industry and society. This refinement sees design as a form of modern art, a problem-solving activity, an act for manifesting creative thought, a family of professions that include its craft heritage, an industry in its own right, and above all a process for accomplishing particular goals.

For the intentions of this work two definitions of design will be built upon. Design here is both a process and an act of problem-solving. It is together used to establish a structure for discourse, as well as a means of manifesting creative thought. The *act of designing* is important here due to the practice-based nature of this research. There are elements where design is used as a craft for aesthetic purposes, but at the same time, these don't impair the quality of design as a process in achieving a specific goal. These two aspects of design relate to the core ideology of RtD present throughout this work.

5.2.1.1 *Design as a problem-solving activity*

Norman's (2002) view of design may be summed up as a process that makes the world more usable; or not if that is the desire. Though the general consensus is that a designed object is intended to present a level of craftsmanship above similar less-designed objects, what Norman suggests is that design inherently possesses the ability to craft usability. Implying designed objects intend to do something—as in, exercise what they are designed for—fulfilling specific functions. This ability affords design practice the oft-quoted title of a *problem-solving* activity, at least in part (Cooper and Press, 1995, p. 16).

Simon (1995, p. 246) describes design as a "complement for analysis", where analysis is the processing of information regarding any given intended object. Adding to Norman's view of design as capable of crafting usability, this brings design to being also "inherently computational" (1995, p. 247). Simon compared design to a problem-solving activity equivalent to logic but involving the imagination (creativity).

Though this contribution has been referenced over time to attest to design's ability to do just that, one cannot resort to this definition dogmatically (Hatchuel and Weil, 2002, p. 19). Design

includes problem-solving but cannot be simply reduced to it. Doing so would deprive design of everything else it is capable of, such as its influence on aesthetics. “There is no doubt that problem-solving is part of a design process, yet it is not the whole process” (Hatchuel, 2001, p. 10). Manufacturers or clients that present designers with ‘design problems’ to be ‘solved’, approach them with more than mere logical problem-solving in mind.

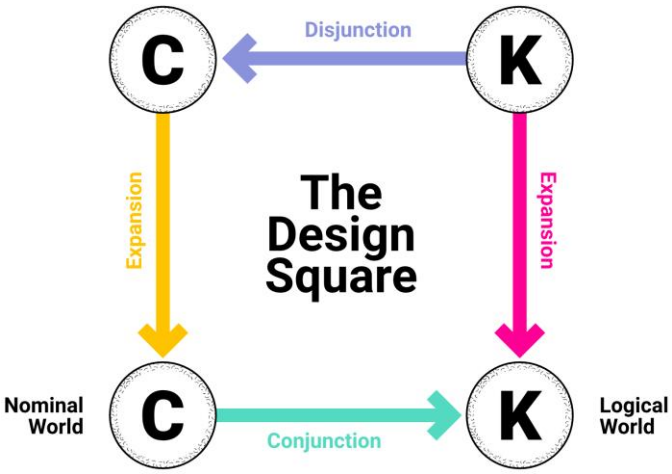

Figure 10: The Design Square by Hatchuel et al. (2004) explores the problem-solving process of design moving between spaces of concept (C) and knowledge (K).

As the act of designing through creation is a key actant in this research, knowledge generated through the process of designing cannot be defined in strict terms of problem-solving. Pye (1978) asserts that the decision to what form a designed thing may take is done either by choice or chance. Having a critical view of representing design as problem-solving or as an art form, he resorts to expressing how design manifests both attributes (Cooper and Press, 1995, p. 18). A better explanation of the view of design asserted here is that of Hatchuel *et al.* (2004), which they present in a cyclic model of the design process (Fig. 10). Here information is shared between spaces of concept and knowledge. Through a series of disjunctions and conjunctions gathered information is co-expanded, resulting in a designed object of intention.

Where Simon’s view of design defined it strictly as a mechanism for problem-solving similar to logic, the design process does not afford a singular format of logic assertion (such as mathematics or sciences) to solve problems. Rather, multiple formats are presented from social contexts to crafting and technological, benefiting both concept and knowledge spaces with generated information.

5.2.1.2 *Design as a process*

Design may be defined as a series of steps designers undertake, to achieve or balance specified goals and constraints (Edelson, 2002, p. 109). These goals may or may not include the potential of solving a given design problem, but certainly involves the presence of *designerly* intent. Iterative processes of design, development, and implementation are often associated when practising design—mentions of which appear throughout this text as well—making design a procedural activity. Edelson (2002, p. 109) defines the ‘design process’ as open-ended and complex invoking

creativity, which in his view, presents a challenging space for researchers to characterise. He attempts to characterise the design process through the decisions made in iterative cycles he calls procedure, analysis, and solution. Cooper and Press (1995, p. 36) explore this through the definitions of process present in design management, a field that heavily utilises design process paradigms. In their opinion, a process in a design context is either a means for designers to exercise their skills in expanding on a problem space to achieve a relevant solution or, it may describe strategic planning invoked in the design and development. Advising against taking either definition to its extreme, they suggest achieving a balance to benefit from the idea of design as a process better.

Cooper and Press quote Lawson's (1990) stages of the creative process for design as one that hinges on "imaginative, intuitive or divergent thinking" to formulate solutions (Cooper and Press, 1995, p. 22). They simplify it into a journey that starts from defining the problem to developing ideas and testing (Fig. 11). However, due to the nature of design as a fluid concept allowing the meshing of a multitude of disciplines, different variants of explaining the design process exist (Hollins and Hollins, 1991; Walker *et al.*, 1989; Roy, 1986; Fairhead, 1988; Sanders, 2008; Frankel and Racine, 2010).

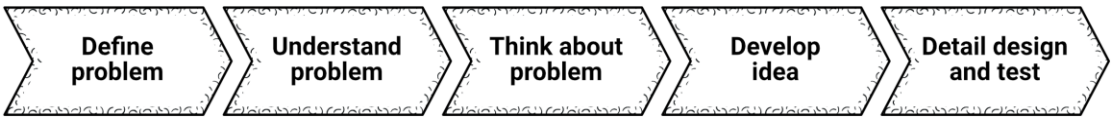

Figure 11: Cooper and Press (1995) present a simplified model of design as a process in the form a journey.

No matter how one defines the design process, all design moves in task-oriented iterations of development (Cooper and Press, 1995; Edelson, 2002). These iterations craft out the design procedures required to specify domain interests, processes, and people involved in the development, and may present the creation of theories, frameworks, and methodologies for research (Edelson, 2002, p. 113).

Be it the crafting of a product, a service, or a business model, an iterative nature is fundamental to any design. When seen as a process, design allows the intermingling of varying disciplines to interject into other layers of information that may be arranged within the design. It further allows for a systemic investigation akin to that of research. The design process itself thus becomes a form of research conducted to achieve specified goals.

5.2.2 Defining Research

Having defined Design to our needs, we can now explore the second half of 'Design Research'. Research is commonly understood as a systemic investigation intended towards generating new knowledge and usually involves proving/disproving hypothesis, the formulating of theories, facts, and accompanies a heavy association towards science and technology (Frayling, 1993; Faste and Faste, 2012). Friedman (2000, p. 48) asserts, the meaning of research stems from its Latin roots as an activity involving search and exploration. Common misunderstandings assume research has little to do with creative thought or practice and is solely a retrospective activity of formulating

knowledge, compared to design (2000, p. 47). This, of course, is not the case as the activity of research associated with design is exploratory and concerned with both inquiry and the production of new knowledge (Frankel and Racine, 2010; Cross, 2007). Three forms of research may be identified here, and thus, compared to design in this manner: basic research, clinical research, and applied research (Friedman, 2000; Frankel and Racine, 2010; Buchanan, 2001).

5.2.2.1 *Basic, Applied, and Clinical Research*

Basic research focuses on empirical investigations into general principles that may cover a wide variety of situations and is intended to generate knowledge on several levels (Buchanan, 2001; Friedman, 2000). Comparatively, applied research attempts to adapt the findings from basic research into "classes of problems" (Friedman, 2000, p. 48) which may feed the generation of hypotheses, furthering knowledge creation. Frankel and Racine (2010, p. 4) second Buchanan and Friedman's opinions that applied research may be critical to understanding design due to its traits of systemic inquiry.

Finally, clinical research regards itself with specific cases and involves the application of both basic and applied research findings (Friedman, 2000, p. 49). Frankel and Racine (2010, p. 3) give the example of the design of a walking aid, which would incorporate the collection of a wide array of information from different sources such as users, environments, materials and exploration of similar products. Several factors would need to be considered in the design of this product, which would only be assessed through the collected information. Such research takes on the form of documented case studies, and gives insight into problems that expand on the original matter of concern (Frankel and Racine, 2010; Buchanan, 2001).

In this manner, design research involves a systemic usage of basic, applied, and clinical research. It also encompasses the analysis of information through lenses of various disciplines that may be utilised or appropriated to achieve the *object of design*. Friedman thus defines the role of designers, which mirrors the role of design researchers, thoroughly as such:

> *"Today's designer works on several levels. The designer is an analyst who discovers problems. The designer is a synthesist who helps to solve problems and a generalist who understands the range of talents that must be engaged to realize solutions. The designer is a leader who organizes teams when one range of talents is not enough. Moreover, the designer is a critic whose post-solution analysis ensures that the right problem has been solved." (Friedman, 2000, p. 49)*

5.2.3 The Object of Design

In either case design as a process/tool for research or design as an act of creation, a fundamental notion associated with design is that it intends to draw things together in what Binder *et al.* (2012, p. 26) call the "object of design". Their definition of design is an activity that involves a gathering of cooperation and imagination. They explore the design process as one that requires a sense of openness and evolution that is free to end at "novel, and sometimes unexpected, solutions" (2012,

p. 22). The notion they present is of design and research co-mingling, echoing the thoughts of Schön (1983) for whom the role of a reflective practitioner was paramount to conducting design practice. They summarise his works by explaining how "knowing and doing are inseparable" (Binder *et al.*, 2012, p. 24); a key aspect of design where reflection occurs in the act of designing.

This philosophy is influenced by the works of Dewey (1938), who explored the epistemology of creative processes. For Dewey, experiences grew out of daily encounters and became the foundation for understanding. He took this forward to explore the role of aesthetics and logic, which Binder et al. explain as so:

> *"According to Dewey, all creative activities show a pattern of controlled inquiry: framing situations, searching, experimenting, and experiencing, where both the development of hypothesis and the judgment of experienced aesthetic qualities are important aspects within this process." (Binder et al., 2012, p. 25)*

This exploration of the object of design takes design into the philosophical space of phenomenology; a concept we explored in the last chapter. Binder *et al.* (2012, p. 26) place this idea on par with Latour's object-oriented politics (Weibel and Latour, 2005). They propose viewing design as capable of "accessing, aligning, and navigating among the 'constituents' of the object of design" (Binder *et al.*, 2012, p. 26). Whereby the 'constituents' they are referring to are the modalities through which interactions take place with the object of design; vis-à-vis, things or representations of things. As such, they argue that design is challenged to contend not merely with designing things, but also with matters of concern relating to socio-material assemblages of what the designed thing implies. This makes design as a construct a phenomenological enterprise that deals with knowledge creation through its many constituents, such as aesthetics, logic, experience, tactility, craftsmanship, etc.

5.2.3.1 *Research as a 'kind' of Design*

Where Binder *et al.* (2012) define the object of design to bring things together, their concern is with the use of design practice as a research analytic in participatory settings. This phenomenological extension of design may be equally explored through other avenues of design research. By now one may accept design research to be a subset of design, though the nature of research conducted as *design research* is not conventional (Faste and Faste, 2012, para. 15).

Design by nature requires certain kinds of knowledge to intermingle amongst each other (Friedman, 2000). There is a consensus among practitioners and academics alike that design, and many of its varieties, may be classified as practice-based as they are oft realised through their execution (Zimmerman *et al.*, 2010; Faste and Faste, 2012; Findeli *et al.*, 2008; Frayling, 1993; Cooper and Press, 1995). This entire chapter so far has been about exploring this very nature of design. As an accumulative discipline containing knowledge and information from a variety of sources understood by practice. This act of designing that is pertinent to design itself, contains all the ingredients required to fulfil it as a 'kind of' research-practice.

Faste and Faste (2012, para. 15) propose an alternative view (Fig. 12) where rather than seeing design research as a 'kind' of research, one may see "research [as] always a 'kind' of design". They place the practice of design as a super-set encompassing design and research:

> *"Clearly scientists "practice" research just as designers naturally practice design…This model makes clear that all research is a subset of design practice at large, and that design research is simply the set of such methods not conventionally considered to be research." (Faste and Faste, 2012, para. 15)*

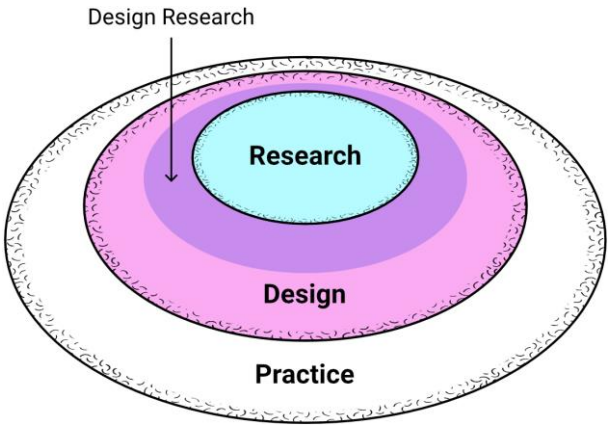

Figure 12: By seeing research as a subset of design Faste and Faste (2012) propose a view that design embodies research.

Their definition of research as a 'kind' of design allows for a broader acceptance of what constitutes for *design research*. This makes the act of designing itself a type of research, as much as, the act of researching (within the context of design) a type of design. Both views generate new knowledge through some manner of practice-based execution. Over the years, design has evolved from being a craft-oriented profession, into a multidisciplinary information-oriented engine, implementing meaningful socio-economic services, systems, and interactions (Muratovski, 2010, p. 378). Therefore, this practice-based element of design becomes a pertinent aspect of the design process. One that allows for designers to push the boundaries of what may be catalogued as research, unearth potential problem solving and open up new meanings and understandings for knowledge generation.

5.2.3.2 *Wicked Problems*

Earlier on I pointed out how design involves problem-solving. The problems design attempts to address though are not conventional, as they rarely fall within the strict structures of scientific research. Rittel and Webber (1973, p. 160) introduced the term "wicked problems" to define complex problems within urban planning, which due to their complexity had implausible or otherwise unattainable solutions. The term was later appropriated to acknowledge design's ability to function within complexity through design thinking by Buchanan (1992).

Earlier attempts at defining design research involved attributing scientific research approaches to design (Frankel and Racine, 2010). This meant design was explored in a sequential methodology,

similar to science. Rittel and Webber (1973, p. 160) attempted to differentiate societal problems from scientific ones by presenting them as "wicked" and "tame" problems respectively. Ergo, explaining how problems relating to human experience are not the same as those relating to nature, or science. As these problems tend to be more complex in nature, involving multiple facets and consequences, a sequential methodology for understanding such complexity was thus inadequate (Cross, 2007; Gedenryd, 1998).

Since design relates to matters of human experience, these *wicked problems* transcend naturally into concerns of design. An example of a wicked problem hard-pressed for a scientific solution alone would be climate change. An intermingling of multiple disciplines is required to facilitate scientific solutions, which would further need to be exercised through some manner of design.

Buchanan (1992, p. 17) speaks of the designer as one who is concerned with quasi-subject matters which exist within the problems they explore. Essentially, their understanding of a problem defines further problems as they are revealed. The quasi-subject matter is "indeterminate" and awaiting to be made specific through its acknowledgement. Buchanan goes ahead to explain how by doing this, the wickedness of the problem is removed. Giving the example of a client brief he says:

> *"A client's brief does not present a definition of the subject matter of a particular design application. It presents a problem and a set of issues to be considered in resolving that problem. In situations where a brief specifies in great detail the particular features of the product to be planned, it often does so because an owner, corporate executive, or manager has attempted to perform the critical task of transforming problems and issues into a working hypothesis about the particular features of the product to be designed. In effect, someone has attempted to take the 'wickedness' out." (Buchanan, 1992, p. 19)*

Wicked problems require to be resolved as a collective of exchanged thoughts, ideas, artefacts, and services (Dubberly, 2017, p. 162). This is perhaps why design functions so well with wicked problems. It is, after all, the object of design to gather together necessary elements to facilitate a design agenda.

Therefore, when considering what is design research, one may see it as a systemic inquiry into the object of design enacted through a process of design. This inquiry involves investigating the myriad problem spaces within an area of focus with the intention of resolution, and usually tends to wicked problems. Furthermore, due to the nature of design as a practice-based activity, the act of designing is a pertinent element that allows for research to be embodied within the object of design.

5.3 Research through Design

The previous lengthy definition of design research was necessary to establish a baseline for why RtD as a methodological framework was utilised for this research. I will now define RtD and its place in this work. As an ideology RtD comes from one of three categorisations of design research

presented by Frayling (1993). His *Research in Art and Design* is by far the most cited document in design research (Friedman, 2008, p. 154), with many academics using his categories and debating over formulating further design theory and methodologies (Godin and Zahedi, 2014; Faste and Faste, 2012; Bardzell *et al.*, 2015; Cross, 2007; Downton, 2003; Jonas, 2007; Friedman, 2003). In the document Frayling (1993) attempts to differentiate between the role of a researcher in science and that in the arts, all the while comparing against what it means to *research within the context of design*.

For him, an artist is one that works in an expressive form rather than a cognitive one. The artist works towards personal development, rather than understanding the nature of things. Designers, he defines, are concerned with craftwork and *doing* things instead; through hands-on experimentation, involving a level of aesthetic appreciation, and imagining things to achieve a certain effect. Researchers, on the other hand, rely on critical rationalisation to formulise or refute hypotheses through defined methodologies. Using this, he argues for a linkage between science and art—which is seen in design practice—and suggests, adjusting the way research is conducted within these disciplines to accommodate the overlap.

Frayling's three categories focused on both art and design in this way. Many have since appropriated and/or reworded them to fit better with design research (Cross, 2007; Faste and Faste, 2012; Jonas, 2007; Findeli, 1999). As such, the general three categories of design research are as follows:

- **Research about/into Design** generally occurs in academia where the focus is to contribute towards the greater knowledge of design research and its implications as a scientific study into design. It incorporates documentation of design history, phenomena, and what the object of design contends to.
- **Research for Design** focuses on guiding the practice of design by documenting processes done by professionals and practitioners. Here the designer is treated as the subject matter as opposed to the designed object, where research is intended to aid in the development of design.
- **Research through Design** comes closest to the practice of design itself as it combines processes in practice to embody the knowledge generated from design research within a designed artefact. Here the designer/researcher practices design to enact their research through iterative experimentation associated with the design process.

As design has evolved into an industrial discipline, compared to earlier definitions of it as a supplement to art, Frayling's proposal to establish new categories of design research aided in future probing and inquiry (Friedman, 2008, p. 157). Friedman has been critical of this though, exclaiming that some of these categorisations of design should not be mistaken for a factual representation of design practice. That said, as a probe into the possibilities of design research, Faste and Faste (2012) present a clearer account of defining design research categories that better fit with the three kinds of

research (basic, applied, and clinical). They do this through an understanding of how research approaches design and vice versa.

5.3.1 Approaching Research through Design

Faste and Faste (2012, para. 17) present four modes of design research (Fig. 13) where two they consider a "hands-off" approach and two a "hands-on" approach. They acknowledge both the iterative nature of design and the sequential nature of research in their model, incorporating them in their hands-off/hands-on paradigm. The four categories they present are: Design of Research and Research on Design (as hands-off), Design through Research and Research through Design (as hands-on).

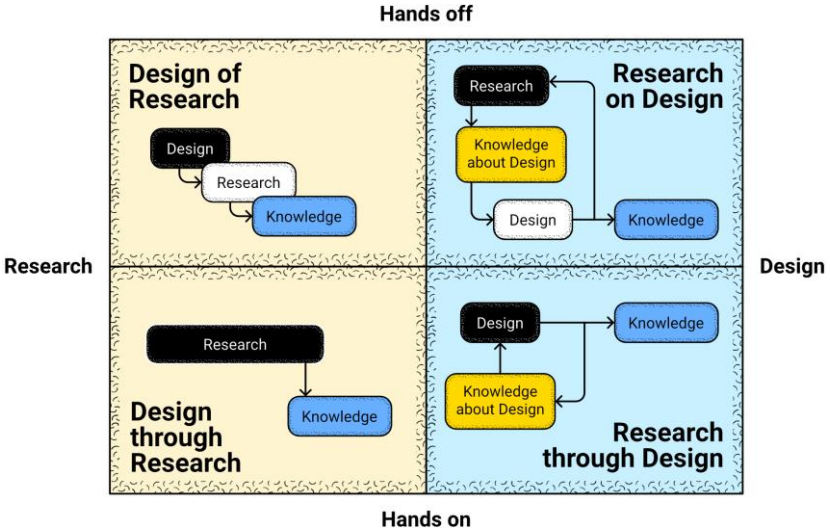

Figure 13: Expanding on Frayling's earlier classifications Faste and Faste (2012) present four modalities of design research each representing Frayling's view of design research as either being a hands-off or hands-on approach.

Though I could explore all the modes presented by Faste and Faste in more detail, as this work focuses on RtD deviating towards these other areas of design research is beyond the scope of this thesis. What should be noted is that they are all, essentially, are expanded appropriations of Frayling's (1993) original categories. The comparison between them and RtD is what makes it more important to our discussion.

Faste and Faste (2012, para. 23) rename RtD as "embedded design research", because of its approach to conducting 'research'. Where the others deal with the broader perspective of design as a discipline, RtD relates with the core rhetoric of the design process as a practised activity. One where knowledge is embedded as much in the designer's design as it is in the world the design occupies (2012, para. 21). Many academics and designers associate RtD, with creating designed artefacts that indulge in societal change through their enactment (Zimmerman *et al.*, 2010; Swann, 2002; Binder and Redström, 2006). Zimmerman *et al.* (2010) catalogue a background of RtD by referencing its different considerations over time, along with its heavy association with wicked problems. Findeli *et al.* (2008) present RtD as having traits of the other forms of design research (*about* and *for*):

"Proper research through design could thence be defined as a kind of research about design [more] relevant for design, or as a kind of research for design that produces original knowledge with as rigorous [and demanding] standards as research about design" (Findeli et al., 2008, p. 71)

Basballe and Halskov (2012, p. 59) understand RtD as an activity affording researcher's active engagement with the design process. An activity that is further communicated to feed the greater expanse of design theory and knowledge through academic ventures. Godin and Zahedi (2014) discuss the many faces of RtD as named by different authors. Some of the more common comparisons are with constructive design research or practice-led research. They express discontent towards these different definitions of RtD as, in their opinion, they lack a consensus towards how RtD and its effects should be discussed.

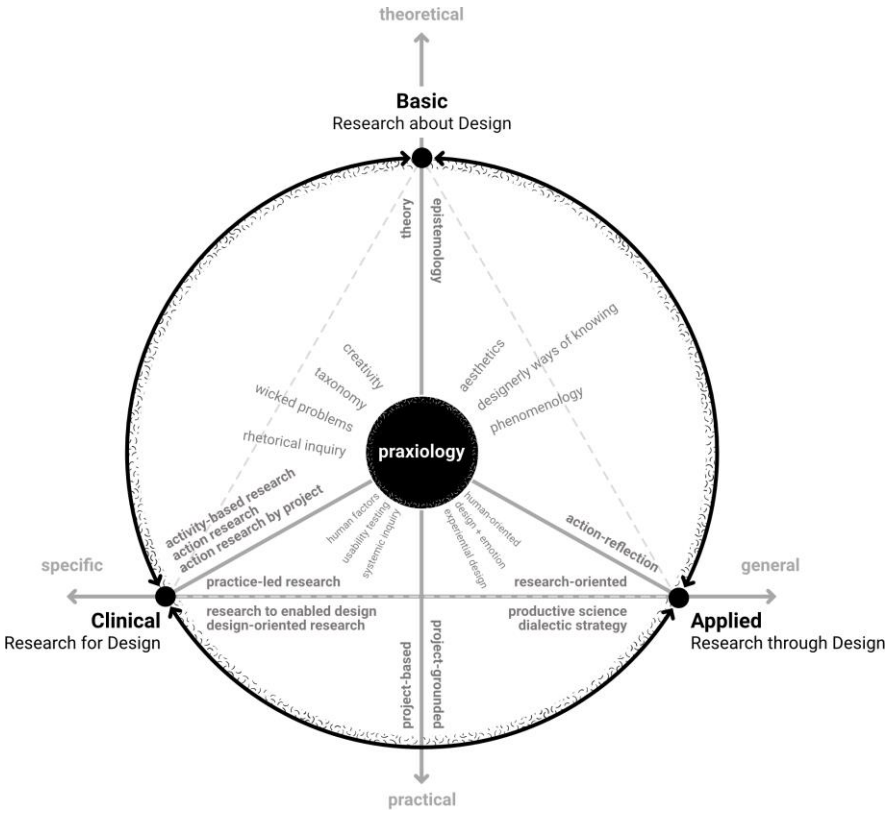

Figure 14: Frankel and Racine (2010) present a cyclic relationship between the different kinds of design research exploring how design is exercised in different manners moving between theory and practice.

In an attempt to map a relation between the different design research categories, Frankel and Racine (2010, para. 40) build upon Friedman's work and illustrate a flow of information between research for design, research about design, and research through design, occurring in a cyclic manner (Fig. 14). Their illustration aligns the three categories as vertices on a triangle with clinical, basic, and applied research alongside their respective categories. The alignment of RtD, to no surprise, is as an applied research approach enacting action-reflection methods. Thus, the readiest comparison can be made between RtD and Action Research methods commonly used in social sciences, as they

both incur iterative procedures that include stages of planning, acting, observation, and reflection (Zimmerman *et al.*, 2010; Long, 1991; Binder *et al.*, 2009). Swann (2002) acknowledges research through practicing design to invoke nearly identical procedures to those of Action Research, implying design research to have appropriated RtD from the more common methodology.

There is a consensus among these researchers though, that RtD has the ability of "broadening the scope and focus of designers" (Zimmerman *et al.*, 2010, p. 311), allowing them to challenge constructs more readily in light of given technologies and practices. Another thing many researchers agree upon irrespective of the end intentions or goal of research, is how RtD tends to matters of the future (Binder and Redström, 2006; Zimmerman *et al.*, 2010, 2007; Godin and Zahedi, 2014; Swann, 2002; Faste and Faste, 2012).

The variant definitions of RtD assume a common similarity where they all assert the physical practising of design as a form of research and knowledge generation. This is conducted through the creation, execution, and collection of artefacts, prototypes, models, and/or portfolios; often in a practice-oriented format of research.

5.3.2 Practice-based Research

As discussed above and repeatedly, design is very much entranced with the *act of designing*. As such, a wide array of examples can be found that utilise the practising of design as an activity within research in the manner of an engine for knowledge generation (Rose, 2015; Zimmerman *et al.*, 2010; Coulton *et al.*, 2019; Encinas and Blythe, 2016; Toeters *et al.*, 2013; Cila *et al.*, 2017; Lindley *et al.*, 2020; Bardzell *et al.*, 2015). Zimmerman *et al.* (2007, p. 497) tout the designers' ability to create products capable of transforming worlds from their "current state to a preferred state", they also agree that RtD involves an integration of multiple disciplines. The point raised here is that these newer states are opened to an empirical investigation that is influenced by transdisciplinary viewpoints and interventions. Regarding the construction of ideas in the process of design, Stappers (2007) indicates the 'act of designing' itself as a core conduit, utilising a procedural confronting of present technologies, theories, phenomenon, and other elements to build towards a testable *designerly* artefact.

On this very note, as findings of their work using RtD, participants in a study conducted by Zimmerman et al. concluded how "RtD lead to new artefacts (products, environments, services, and systems) where the artefact itself [became] a type of implicit, theoretical contribution" (Zimmerman *et al.*, 2010, p. 314). Moving on they explain how these artefacts invoked a power that allowed a codification of the designer's intents and understandings.

Stappers *et al.* (2014) explore the role of prototyping in practice-based design research, comparing it to design-inclusive research methods. They conclude that where one involves the design as a necessary in-between step of research and hypothesis, it effectively separates the designer from being an active part of knowledge generation. Compared to that, RtD makes the act of designing an essential element of knowledge generation conducted by the designer. In their opinion, one approach thus becomes theory-driven hence stunted, while the other is driven by

phenomenon thus more explorative. They agree that practice-based research in this regard, stresses a designed object to be more "communicative" (2014, para. 7).

Design strives to synthesise different concerns in an investigation of "disparate forms of knowledge", essentially necessitating research (Faste and Faste, 2012, Section 4, para. 1). As a discipline rooted in craftsmanship and a history of creation, the *practice* of design cannot be removed from the *discipline* of Design. Faste and Faste (2012) argue that generated designs facilitate and further acknowledge the presence of design process knowledge that is embedded in the designer, and the world the design exists in. They further argue, that in this manner RtD when compared to traditional research methods "disseminate knowledge through broader means" (2012, Section 2.4, para. 2). They quote observations by Biggs (2002) regarding the role of the artefact in design research, as "embody[ing] the answer to the research question" (Faste and Faste, 2012, Section 2.4, para. 2). Essentially, by embedding knowledge into the activity by design, the research and information extracted from the activity are only more enriched.

5.3.3 Ideology or Methodology?

Praise for RtD as an approach aside, there is a level of contention that must be addressed as well. To begin with, RtD as a research paradigm is not as mature (Findeli *et al.*, 2008; Stappers *et al.*, 2014; Höök and Löwgren, 2012; Brandt, 2007; Bardzell *et al.*, 2012). Though progress in design research is indeed amplified beyond publications when prototypes, frameworks, and artefacts allow new paths for observing phenomenon (Stappers *et al.*, 2014, p. 166), RtD and similar practice-based research lack "methodological soundness and scientific recognition" (Findeli *et al.*, 2008, p. 72). Findeli *et al.* (2008, p. 73) present the relationship between theory and practice as the culprit for this. Where on the one hand the claim is for practice to be an important aspect to the building of theory, it becomes significantly more challenging to define practice as a repeatable and redistributable process.

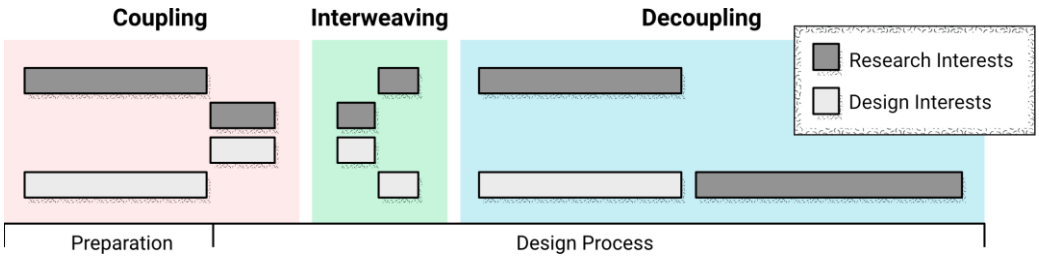

Figure 15: Basballe and Halskov (2012) see the RtD process as a sequence of dynamic stages interweaving design and research practices that start with gathering information and ordering them in a way that areas of interest overlap to focus on individual areas of design and research.

Basballe and Halskov (2012, p. 65) attempt to break down the RtD process as three dynamics that appear in sequence through every project: coupling, interweaving, and decoupling (Fig. 15). Their opinion is that every RtD project undergoes an initial coupling stage that involves framing levels of constraints to be exercised throughout. This is followed by an interweaving of research and design interests which are intended to influence each other as processes and validations of methods

are exercised. Finally, the project enters a decoupling phase where the design researcher focuses on a specific area of interest extracted from the process; this could be either design or research, depending on what is of interest and at what stage the decoupling occurs. Thus, in appearance RtD is very similar to a regular design project executed by practising design (Godin and Zahedi, 2014, p. 1677). On that, addressing the problems in design research Friedman expresses:

> *"One of the deep problems in design research is the failure to engage in grounded theory, developing theory out of practice. Instead, many designers confuse practice with research. Rather than developing theory from practice through articulation and inductive inquiry, some designers mistakenly argue that practice is research." (Friedman, 2008, p. 154)*

Designers, practitioners, researchers, and participants of design research alike experience the interplay of practice and theory differently. The bane of RtD in this regard is the fact that it is an applied research paradigm. The earlier stages of RtD are often referred to as *'the fuzzy front end'* due to its association with different levels of creativity, analysis, making, dissecting, and processing. This presents RtD as a non-linear approach compared to the logical linear approaches required for forming many methodologies (Stappers *et al.*, 2014, p. 174).

In his original document, Frayling (1993) distinguished RtD from the other research categories, particularly considering art and design. Where the goal for researched design is understanding the design over knowledge, RtD instead, must be about understanding knowledge over the design. Godin and Zahedi (2014, p. 1670) argue for the contention here, that in RtD knowledge and understanding is the result of exercising design-practice and making that is embodied in the design artefact.

Godin and Zahedi (2014, p. 1676) further give a compelling definition of RtD in that it can be defined "by what it is not". They argue that the artefact is not the goal of an RtD project, rather, it is and should be the generation of knowledge. Secondly, they claim RtD may not provide a level of predictability that is oft required for traditional research; though, that is also a contention associated with other avenues of design research. Therefore, classifying RtD as a methodology at this stage is too early as the field itself is not mature enough. At the same time, the practice of *design* is inevitable within design research, ergo, an essence of RtD is present in almost all forms of design research. As an ideological stance within design research, it makes more sense to execute RtD rather than proclaim it as a bonified methodology.

5.4 Conclusions

The above definitions of both design research and RtD intend to highlight their unique potentials in executing the object of design. The mapping presented by Faste and Faste (2012) of research as a kind of design towards a definition of hands-on researching through the application of design methods, suggests that RtD artefacts inhibit a cyclic generation of unique knowledge. Artefacts or concepts that emerge from this process are enriched through a broader understanding

of ideologies embedded in the given problems and from those acquired in the process of understanding those problems. Though towards the end of the last section I refrained from classifying RtD as a methodology, for the purposes of this research it is utilised as a methodological framework for the reasons defined in this chapter.

Building upon all presented above, this research attempts to represent RtD as Gaver (2012) defines it. His opinion is that RtD should be "appreciated for its proliferation of new realities" (2012, p. 941), and ability to annotate the artefacts it creates. Explaining what research should expect from RtD, he goes on to say that artefacts created by design are embodied with the myriad choices taken by their designers, which would otherwise be impossible to acquire in non-practice-based formats (such as writing). This makes the design artefact, and the information extractable from them, "indispensable to design theory" (2012, p. 945).

Regarding the contention between theory and practice, Gaver (2012, p. 939) contrasts designs concern with finding the ultimate solution or particularly with sciences association to the 'truth'. By doing this he raises a point, that when practising design the search for the ultimate truth is extracted from the artefact as annotations. Compared to science which relies on the presence of facts, these annotations build a case for design theory that explain and reference "features of 'ultimate particulars', the truths of design" (2012, p. 939).

As this research contends with understanding concepts of an unorthodox nature through philosophical inquiry into the phenomenon of human to non-human interactions, an iterative RtD process of design research is most applicable. It is capable of enriching the discussion of designing for IoT through the application of philosophical discourse and practice-based design research.

Gaver's expectation of RtD is of mutual collaboration between academics, designers, and researchers. Whereas as a research approach, perspective, or potential methodology, it is afforded a level of elaboration between practitioners that is both critical and discursive. That said, the level of research conducted in and around RtD contend to its benefits outweighing the potential conflations in arguments. Findeli *et al.* (2008, p. 82) argue for design research to be transdisciplinary to be able to nourish the design project. RtD has been known to exercise the object of design clearly and effortlessly through processes of "composition and integration", making it suitable for both early stages of forming nascent theory, and developing later comprehensive constructs (Zimmerman *et al.*, 2010, p. 317).

This research takes on a transdisciplinary approach at combining applied design knowledge and practices with theories of philosophy and technical understandings of IoT. In that sense, the framework presented by RtD as a research methodology allows for an expansion of knowledge into different areas of design, philosophy, and technology. Though an overarching methodology in this research, it becomes more enriched when the freedoms of an attitude of playfulness are incorporated as the next chapter highlights.

CHAPTER SIX

PLAYFULLY DESIGNING FOR THINGS

"The creation of something new is not accomplished by the intellect but by the play instinct"

— CARL JUNG

6.1 Introduction

Design is a discipline heavily involved with the practice of making. This making could be of physical objects or artefacts intended to interact with their surroundings, embody intentions and meaning, and enact the object of design by bringing together elements pertaining to the concerns of design. With the interest of this research lying in the overlap of IoT, design, and philosophy—each topic having been explored separately in the previous chapters—I can now begin to combine these core elements to form accompanying methodologies to allow the making of designed artefacts for this research.

The previous chapter introduced an overarching ideology of RtD which remains predominate throughout this entire manuscript. The approaches described in this chapter are intended to act as internal methodologies existing within a larger methodological framework, capable of crafting and presenting arguments for different philosophical concepts and their relationship with IoT. This chapter explores how an attitude of *'playfulness'* is manifested as a pertinent element to the design process utilised in this research. This binding agent intends to bring together the discussions introduced in the previous chapters to create unique project-specific toolboxes that help in designing the different artefacts produced during this research. Each toolbox borrows something from IoT, Design, and Philosophy, echoing Law's concept of "method assemblages" (Law, 2004, p. 13) to form purposeful arrangements of concepts which collectively aid in the crafting of philosophically charged artefacts for discussing more-than human design.

First and foremost, it is necessary to retrace our steps to the first chapter. I mentioned the presence of *play* as an important factor in not just my life but also this research. For the ideas that will be discussed here to gel together, we will need to cover one fundamental aspect of design that I as a design practitioner exercise: *design for me is inherently playful*. In the coming text I will be defining the act of play moving towards a discussion of playfulness as a medium for innovation and creativity. This is done by analysing relevant literature to create an understanding of playfulness as a key ability of designers and the design process. Towards the end I present a combined methodological framework consisting of philosophical concepts, ludic design, and speculative design under an umbrella of philosophical carpentry.

Here carpentry alludes to a manner of crafting to enact philosophical concepts such as those this thesis relates to and stems from amalgamating a speculative design approach with philosophy. The concept of ludic design discussed later in this chapter is an attempt at engaging ones curiosity through the practice of design and speculation that these carpentered artefacts invoke. This notion of engaging curiosity echoes views by DeKoven (2013) of playfulness as an attitude that invokes curiosity through the act of play, becoming an important element in this discussion to understand the need for carpentry and ludic design as methodologies better. The toolboxes or method assemblages I mention are related to this manner of crafting through philosophical carpentry rather than to be seen as design 'tools'. But before entering a discussion for either, an initial argument between Design and Play needs to be established.

6.2 Defining Play

The word *play* (like design) is associated with multiple definitions depending on the context in which the word is used. The common understanding of play is as an activity associated with pleasure, that is not serious, may involve elements of make-believe, and is not necessarily productive in the context of 'work' (Bateson and Martin, 2013; Sicart, 2014; Bogost, 2016; Van Leeuwen and Westwood, 2008; Rieber *et al.*, 1998; Pellegrini, 1995). This understanding has played a role in belittling the act of 'play' when compared to utilitarian activities.

Bateson and Martin (2013, p. 2) define the biology and psychology of play as exhibited by certain criteria. In their opinion play may be defined as: a rewarding spontaneous behaviour for an individual; an intrinsically motivated behaviour which presents a goal in itself; an act that presents a protected space for the individual to enact specific actions; and, a comparatively exaggerated behaviour which may be performed repeatedly. As an inquiry into play theory, Pellegrini (1995) catalogues play in four formats which include play as power, play as progress, play as fantasy, and play as self. The suggestion is that these different formats present an argument for the persuasive abilities of play as an activity in an anthropological context.

In the research literature collected by Pellegrini on play, play as power concerns with the declaration of winning and losing where sufficient power is suggested through the course of play-activities, as is evident in sports. Play as progress concerns with a view where play leads towards different outcomes, where one such may be learning (Rieber *et al.*, 1998, p. 30). Play as fantasy relates with play's ability to effectively involve creativity and the imagination (1998, p. 30), and, play as self suggests play as an act that is directed towards personal value where the activity may enhance one's quality of life (1998, p. 30). These findings and research all view play through the ontogenesis of both humans and animals, seeing it as an integral proponent for development from childhood into maturity (Van Leeuwen and Westwood, 2008).

Biological and anthropological definitions of play aside, colloquial understandings of play also exist such as a theatrical 'play'. The tradition of research into play has surrounded the works of Sutton-Smith (1997), Huizinga (1955), Caillois (2001), and Suits (1978) among others. These works all look at play through its role in history, cataloguing its anthropological, psychological, and at

times philosophical impacts. Where these pieces of literature into the foundations of play have their merits, aside from particular introduced concepts, for this research I will be restricting myself to more contemporary understandings from the works of Sicart (2014), Bogost (2016), Salen and Zimmerman (2004), and DeKoven (2013, 2014).

6.2.1 What is Play?

Sicart (2014) attempts to define play through all that it is (and isn't) in relation to the human experience. Where he recognises play as a behavioural reaction to certain stimuli in an act facilitating understandings of pleasure, he disagrees with a clinical definition of the term as being sufficient to explain its breadth. True, play has significant cultural meaning association, but inherently play is an activity that provokes challenging conventions (2014). His views set aside the scientific definitions of play as a mechanism for inducing endorphins in humans and animals, and instead, looks at the relationship between the players and the act of play in this manner.

The picture Sicart paints of play is of a "dance between creation and destruction, between creativity and nihilism" (Sicart, 2014, p. 3). His attempt of defining play in its various forms produces an expansive list of definitions, some of which are:

- Play as a contextual activity that involves a tangle of people, things, spaces, objects, and cultures (2014, p. 6);
- Play as an activity contesting creation and destruction (2014, p. 9);
- Play as a "carnivalesque" act attempting to balance chaos and order (2014, p. 10);
- Play as an appropriative behaviour that is fluid, capable of taking over the context it is presented in; thus unpredictable (2014, p. 11);
- Play as an autotelic activity, presenting its own goals and purposes (2014, p. 16);
- Play as an activity of negotiation, in constant flux on defining and redefining its boundaries and influences (2014, p. 16);
- Play as a disruptive activity due to its appropriative nature, as it attempts to break down convention and the state of given affairs (2014, p. 14);
- Play as a creative act, creating itself through the many rules, objects, locations, and stimuli it invokes enforcing participants to act (and react) creatively (2014, p. 17), and
- Play as an intimate act provoking and forging sentimental, moral, political, and deeply personal emotions, memories, and associations (2014, p. 17).

Irrespective of how one may define play considerable literature exists attesting to the importance of play as an activity in human experience (Bogost, 2016; Juul, 2005; DeKoven, 2013; Sicart, 2014; Rieber *et al.*, 1998; Coulton, 2015a; Bateson and Martin, 2013; Pellegrini, 1995; Bissell, 2011; Blanchard, 1995; Van Leeuwen and Westwood, 2008). Within any discussion of play is the distinction between play as observable behaviour, and play as an underlying mood, or *playfulness* (Bateson and Martin, 2013, p. 2). Like play, playfulness has colloquial understandings as well, but the term generally concerns with an emotional attitude towards things, people, and situations (Sicart, 2014, p. 21). Sicart defines the difference between play and playfulness where the

former is an activity consisting of finite sets of actions performed for specific purposes, and the latter a means of "projecting characteristics of play into non-play activities" (2014, p. 22). He further defines it as a means for appropriation, making the world it occupies ambiguous:

> *"Playfulness assumes one of the core attributes of play: appropriation. To be playful is to appropriate a context that is not created or intended for play. Playfulness is the play-like appropriation of what should not be play…Playfulness re-ambiguates the world. Through the characteristics of play, it makes it less formalized, less explained, open to interpretation and wonder and manipulation. To be playful is to add ambiguity to the world and play with that ambiguity." (Sicart, 2014, pp. 27–28)*

6.2.2 Playgrounds for Play

For Sicart (2014, p. 1), play becomes a state of mind or being, full of unique context and emotion that subjects an individual (or group) into an altered state where the world it occupies may be tampered with or appropriated. These states are contexts where play happens, traditionally as games but these can also take the form of less conventional understandings of time and space where the possibility of play may exist (2014, p. 28).

The altered state of play suggests the presence of a space where play is executed; in other words a playground (Fig. 16). Games are a form of playgrounds in this manner. Dutch anthropologist Huizinga (1955, p. 10) coined the term "magic circles" to explain one of many playgrounds devised in the act of play. These playgrounds are spaces apart from normal life (Liebe, 2008; Consalvo, 2009), accompanied by their own rules, ethics, and narratives. Caillois (2001, p. 9) appropriated Huizinga's magic circles within his definitions of play and described the activity as being separate "within the limits of space and time, defined, and fixed in advanced".

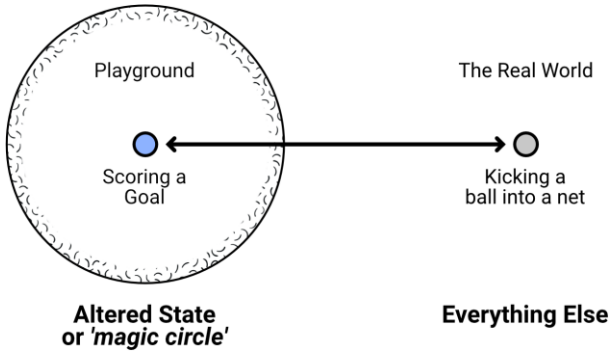

Figure 16: This illustration adapted from Nagy (2017) argues of how playgrounds may be altered spaces with their own contexts where 'play' is executed.

Modern understandings of the magic circle differ. Some claim it doesn't exist in the form Huizinga suggested (Consalvo, 2009; Liebe, 2008), while others suggest the circle is not created by the game but the players in their captivation of play (Moore, 2011; Salen and Zimmerman, 2004). Further still, Juul (2008) suggests a reframing of the concept to clarify proof of its existence. The contention asserted by many is that as a metaphor the magic circle suggests a strict boundary between the realm of play and that of non-play (Copier, 2005; Calleja, 2008; Taylor, 2007). Juul

(2008, p. 63) argues against this notion suggesting instead of viewing it as a puzzle piece, allowing games to fit into given contexts without arguing for any differentiation between games, play, and playgrounds.

Taking another perspective is Bogost (2016), who suggests that playgrounds exist in all walks of life in different forms. Giving the example of how children are capable of turning any mundane activity into an act of play, he presents a case for the precedence of play in our lives through hidden playgrounds waiting to be played in. Arguing against considering play the opposite of work, he calls for seeing it as "experiences that set aside the ordinary purposes of things" (2016, p. 6). His definition of the magic circle is of facilitating play to create meaningful experiences, allowing play to act as a means of dissecting the world:

> *"By refusing to ask what could be different, and instead allowing what is present to guide us, we create a new space. A magic circle, a circumscribed, imaginary playground in which the limitations of the things we encounter—of anything we encounter—can produce meaningful experiences" (Bogost, 2016, p. 11)*

This argument presented by Bogost allows for play to be seen as more than amusement; a point echoed by others (Juul, 2005; Sicart, 2014; Coulton, 2015a; Montola, 2005). Claiming the gravest mistake one can make about play is to consider it as amusement or a diversion, Bogost (2016, pp. 18–19) instead argues that play is a structured activity where one plays with something under specific guidelines. Pleasure, or whatever form of it, is simply a by-product of the activity.

This concept is accentuated further by DeKoven's (2014, p. 34) argument of infinite play, where playfulness is seen as an attitude requiring ones "presence" and "responsiveness". For DeKoven play transforms activities to redefine consequences. The playground in Bogost's and DeKoven's view becomes a hybrid physical and conceptual space that radiates into the material world, concerning itself with the things occupied within it, and captivating those executing play. "A playground is a place where play takes place, and play is a practice of manipulating the things you happen to find in a playground" (Bogost, 2016, p. 22).

I should point out the differing stance between Sicart and Bogost on this matter as the reader may see an inherent contradiction here. Where Sicart (2014, p. 1) literally sees play as a "mode of being human", Bogost (2016, p. 92) argues for the opposite where "play is in things, not in you." For the purposes of this research I mention both for specific reasons, *(a)* as a person who employs playful appropriation coming from my own experience of playfulness as an attitude I see as aligning with Sicart's notion of play within the human, and *(b)* as a design practitioner who enjoys making and approaching problems from a playful vantage point and/or *playing* with things I acknowledge Bogost's notion of play within things designed or otherwise. That said, I feel that Bogost presents a playful attitude as can be seen from the artefacts he creates such as *Put Words Between Buns*[24] and

[24] For more information, see: http://bogost.com/projects/buns-life/.

Cow Clicker.[25] From his description of how *Cow Clicker* came to be what is apparent is that besides a playful artefact there is the playful individual behind it. As I intend to steer this discussion towards philosophical carpentry in the end, a concept introduced by Bogost (2012) as well, his definition of playgrounds and play within things is important to this discourse as the manifestation of playfulness in the design process arose through considering RtD as a playground. For now I shall put aside this discussion around my opinion towards play, though I will return to it later in Chapter 10.

6.3 Design and Playfulness

Returning to the matter at hand you might be wondering, where does all this fit into the argument for design? When seen in the right way, design and play have many similarities. I've been juggling between different terms so far and though they may be close together in a discussion of play they may also represent different things when discussed in the context of design. The argument I present is not for games and toys to be considered as the focus of design processes, there is ample literature for those discussions (Lindley, 2004; Walz and Deterding, 2014; Winn, 2009), rather the stance I take is for acknowledging playfulness as an attitude invoked in the design process that may fuel design practice. References I make to toys and games in this discussion are not in place of design tools per say but as part of the process of creating play-like activities that help break down the barriers for discussing complex ideas.

Returning to the topic of playfulness and design, the view of play and its metaphorical playgrounds as presented by Bogost (2016) can be translated into the act of design and the design artefact respectively. Parallels can be seen by skimming through the above definitions of play described by Sicart (2014) to attributes one may associate with a *playful designer*. For instance, both activities indulge creativity, attempt disruption, and are manipulative. Design is as much an act of creation as it is an act of understanding the context of its creation, making it a contextual activity similar to play. Designers negotiate with their given wicked problems to find potential solutions. The act of play is in effect an act of negotiating oneself between the many rules, systems, contexts, and appropriations presented (2014, p. 90). As explored previously, design involves problem-solving and many aspects of play revolve around the crafting of creative solutions, as is often the case with 'serious play' (Rieber *et al.*, 1998).

Furthermore, game design is often compared to systems design (Sicart, 2014; Salen and Zimmerman, 2005), as it requires the mapping of choices and variants for making actions. After all, "playing a game means making choices" (Salen and Zimmerman, 2005, p. 60). Salen and Zimmerman (2004, p. 304) believe, that the intention of play is not to work comfortably within its own structure, rather, to be in constant movement developing new structures and formats through play. This framework and the notion of games and play as choice-making activities is very similar to that of design reasoning, where designers situate problems in different 'frames' to better view them (Dorst, 2011, p. 528). DeKoven (2013, p. 30) describes of how the 'playful path' is a "many-

[25] For more information, see: http://bogost.com/games/cow_clicker/.

branched, multi-dimensional" path; perspectives echoed in design approaches and methodologies. Acknowledging their importance for designing interactive systems, Carroll (2014) defines design archetypes that are present in games. These he says offer a means for "articulating critical abstractions" (2014, p. 199) within contexts of human interaction.

Bateson and Martin (2013) go into further detail around the connections between playfulness, creativity, and innovation. Their detailed study suggests that through a playful mindset or approach alternative perspectives or potential cognitive abilities and use of tools may emerge that could present solutions to current or future challenges that may be executed "for [their] own sake" (2013, p. 77). Continuing on that point they argue that playfulness in an activity may foster "divergent thinking" (2013, p. 85) and interconnecting of thoughts traits that designers often employ when solving wicked problems. I go into further detail on this later in the chapter by considering the cognitive process of design and where playfulness and its effects fit in.

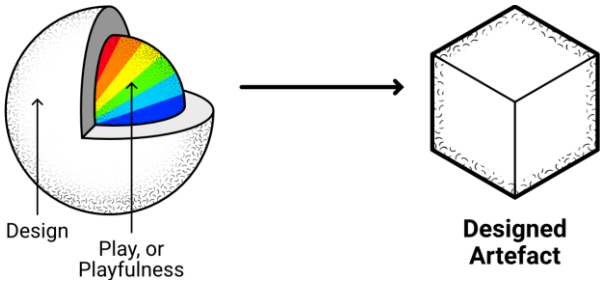

Figure 17: Playfulness may be an inherent attribute of design practices as they often involve playful appropriation or similar attitudes to reach a designed artefact or solution to a wicked problem.

This list of similarities could go on, but my intention here is not to say design is the same as play. Rather, what I would like to approach is the idea that *design involves play*; more specifically playfulness (Fig. 17). That when design is executed with this inherent ludic ability at the forefront as an attitude of playfulness, the nature of design changes into being provocative, challenging, and speculative.

6.3.1 Returning to Playfulness

To understand this, let's return to the earlier discussion and define what an attitude of playfulness is further in light of this research. I've defined playfulness as an attitude, a core behaviour associated with play-like activities and for the most part it has been around the writings of Sicart (2014). This attitude of playfulness is meant to engage with specific contexts and objects—similar to play—respecting core values, goals, objects, and any associated contexts (2014, p. 21). To that can be added that playfulness is often described as a psychological and emotional attitude towards things, people, and situations (Bateson and Martin, 2013; Bogost, 2016; Sicart, 2014). And, that play can take a disruptive approach at playfulness, through a notion of 'dark play', intended to break through conventional contexts (Stenros *et al.*, 2007; Sicart, 2014).

Bogost (2016, p. 104) stands in defiance of this liberated idea of play as Sicart puts forward in favour of play as an act of submission. His argument is that play exists in the "working of a system"

(2016, p. 114), in all the pieces that make up our lives. He asserts play as a paradox entailing freedom yet constraints (2016, p. 116). Where Sicart defines playfulness as another way of looking at something through freedom, Bogost reminds us that play requires limitations. The activities within an attitude of playfulness are not play but play-like. Through playfulness they inherit play's abilities.

As explored in the previous chapter designers work within limitations to craft unique solutions to wicked problems. What I am inferring is that the design process may include an attitude of playfulness that affords this intermingling with the limitations of any given design problem. Norman (2002) stressed the importance of meaningful relationships being considered in design processes. The act of designing is the crafting of an experience (Sicart, 2014; Norman, 2002; Nam and Kim, 2011), often when done for an artefact this involves the infusing of emotional value (Nam and Kim, 2011; Norman, 2002). Designs association with emotional value is something Rose (2015) explores through his enchanted objects, specifically the importance emotion plays as a stimulant in designed artefacts. And as play is an inherently personal activity riddled with unique emotional value (Sicart, 2014; Bateson and Martin, 2013; Suits, 1978; Salen and Zimmerman, 2005; Juul, 2005; Bissell, 2011), this view makes playfulness a means to apply one's personal expression into the world through the act of play and design, as Bogost puts it: "Play is impossible without restriction—not doing what you want, but determining what is possible to do given the meager resources" (Bogost, 2016, p. 119).

When seen in the context of design, playfulness becomes a way of gripping a design problem and imagining an artefact that is personalised, has emotion, is disruptive, and still full of designerly intent. In a manifesto promoting the neogenesis for play in our lives, Zimmerman (2014) argues for changing perspectives towards the acceptance of play in an ever-growing complex world of information and systems. His position is that games[26] fit naturally in a systemic society, as machines inputting, outputting, manipulating, and exploring information. Since games are a facilitating medium for play, playfulness becomes an active ingredient in this stance. The manifesto continues to urge the inclusion of playfulness in design approaches, as his opinion is that it acts as an engine for innovation and creativity (2014, p. 21). Furthermore, this view he believes is necessary for addressing problems of a new age which require "playful, innovative, and transdisciplinary thinking" (2014, p. 22) to create, analyse, redesign, and transform systems into newer better versions of themselves.

Bogost's (2016, p. 114) stance of play as "not an act of diversion, but the work of working a system" takes on an object-oriented approach at viewing play-like activities as removing oneself from human perspectives to discover the world anew. Giving examples of machines that have 'play' built-in to them affording them the functions they do, he suggests that as users of machines we enter into specified playgrounds such as with the manipulation of a guitar or the turning of a steering wheel to allow that *'play'* to happen. The things around us are thus inherently imbued in a

[26] Zimmerman's stance revolves around games as play because his area of interest is in game design, mostly video games.

playfulness that we have yet to tap into. “Every playground has two basic properties, which are two sides of the same coin: boundaries and contents” (Bogost, 2016, p. 21).

The act of design is to understand the core attributes and influences of a given problem. These include, but are not limited to materiality, logic, cultures, economy, aesthetics, satisfaction, etc. If there should be a takeaway from the previous chapter on RtD, it should be that the world surrounding the designed artefact is as much present in the artefact as it is around it. Design is as much an act of understanding given problems in respect of revealed and hidden attributes, as much as it is about crafting an alternative viewpoint or solution to those problems.

6.3.2 Ludic Design

What I’m nudging the discussion towards is the notion of *Ludic Design (LD)*; a form of design with an explicit interest towards playful and “curiosity-driven” engagement (Lupton, 2018, p. 6). The term ludic is from the Latin *ludus* meaning ‘to play’. Huizinga (1955) and Caillois (2001) made strong assertions for play’s central role in human culture, and though, *Homo Ludens* is considered a standard reference for game design literature (Rodriguez, 2006; Salen and Zimmerman, 2004; Crawford, 2003), it’s forgivable to think *ludic* design and *game* design are the same. Though game design involves the manipulating of ludic elements, they are very different. Where one strives to create an experience that is intended for its purpose of achieving play, vis-à-vis a game or similar product, ludic design intends to create meaningful experiences that are inherently playful.

Ludic design forms one part of a combined methodological framework that I intend to introduce in this chapter asides the above discourse for an attitude of playfulness. The discussion so far has been towards viewing this approach at manipulating the presence of playfulness within an activity or artefact to illicit alternative interactions and results. The term ludic design, and the appropriation of Huizinga’s *Homo Ludens*, was introduced by Gaver (2002) through a series of design experiments exploring the ludic capacities of design for HCI (Gaver *et al.*, 2004, 2003; Sengers *et al.*, 2005).[27] Where humans are generally characterised in light of the ability to think and achieve, taking in the perspective of Gaver (2002) humans may further be characterised as playful through curiosity and their affection for exploration, inventions, and wonder.

Gaver’s interest is in HCI and the role technology plays in our lives. His opinion is that where IoT-enabled objects are introduced into our homes with the intention of them bringing ease and functionality, the homes we occupy are not solely for utilitarian purposes (Gaver *et al.*, 2004, p. 886). We play in our homes engaging in mundane seemingly futile activities such as reading books for pleasure, admiring our gardens, arranging furniture, etc. These activities in his view are not merely entertainment or wasting of time, rather when seen and used in a creative manner they may present novel opportunities for understanding and development.

[27] These experiments were part of a six year collaborative interdisciplinary research between different institutions in the UK funded by EPSRC, called *Equator*. The project explored different ways in which digital and physical realities could be interwoven into everyday activities and amassed a portfolio of thought provoking designed artefacts and probes.

To make sense of the role ludic design plays as a methodology it would help to understand how design cognition works in this context and where curiosity and creativity intermingle with innovation through playfulness. To further solidify the premise I intend to present between play and design the interconnections between design cognition and playful activities may be plotted in lieu of the earlier references to the works by Bateson and Martin (2013) among others.

6.3.2.1 *Design Cognition*

Gedenryd (1998) plots a history of design as a cognitive activity comparing it to other models of cognition to unearth how designers attempt to design. Most of this I've explored in the previous chapter with design as a process, so what follows is built upon that. What Gedenryd manages to do is equate design on a cognitive level to programming and planning saying, "design consists in developing a plan for *the implementation* [of design], by translating the given goal into a specification of what should be done" (1998, p. 49). His argument explores the reciprocal relationship design establishes between a problem and its solution(s).

The ideation stage of any design process is intended to promote creativity in generating concepts for later evaluation (Yilmaz *et al.*, 2015). This often happens with (and without) the use of tools such as sketching or prototyping (Yilmaz *et al.*, 2015; Purcell and Gero, 1996; Gedenryd, 1998). Defining how constraints exist for a designer, Gedenryd (1998) goes on to explain that asides any contextual constraints of a problem designers impose *their own* flexible constraints allowing the viewing of problems pragmatically. This presents constraints as an instrument for a designer which they execute through the many tools at their disposal. The presence of limitations and its effect on creativity is not an unknown concept (Bateson and Martin, 2013; Sicart, 2014; Bogost, 2016; Norman, 2002). In fact, the limitations presented by a problem often create possibility spaces as Bogost (2016, Chapter 6, para. 26) argues for quoting Norman's concept of "affordances" and "constraints" that act as tools when designing for user-centeredness.

On the role played by sketches in design and development, Gedenryd (1998, p. 149) gives the example of graphic design raising the point that in a design process sketches act as a means for informative inquiry. They interact with the designer on a cognitive level. Being unfinished and rough allows sketches in graphic design to act as a medium for inquiring about the problem at hand:

> *"For graphic designers as much as architects, sketching is the way in which they work on a problem…designers make sketches to 'familiarize themselves' with their problem" (Gedenryd, 1998, p. 149)*

He goes on to familiarise other methods and tools (such as thumbnailing, roughs, prototyping, etc.) used by designers with their inherent ability to achieve specific goals in cognition. This connection he makes is to define the theoretical concerns present with how designers extract information from the world they exist in (Fig. 18). Cognition comes from the world the designers and the design cohabit, enabling "interactive cognition" (Gedenryd, 1998, p. 157). A designer is not solely concerned with the object of design, but all in the vicinity of the design.

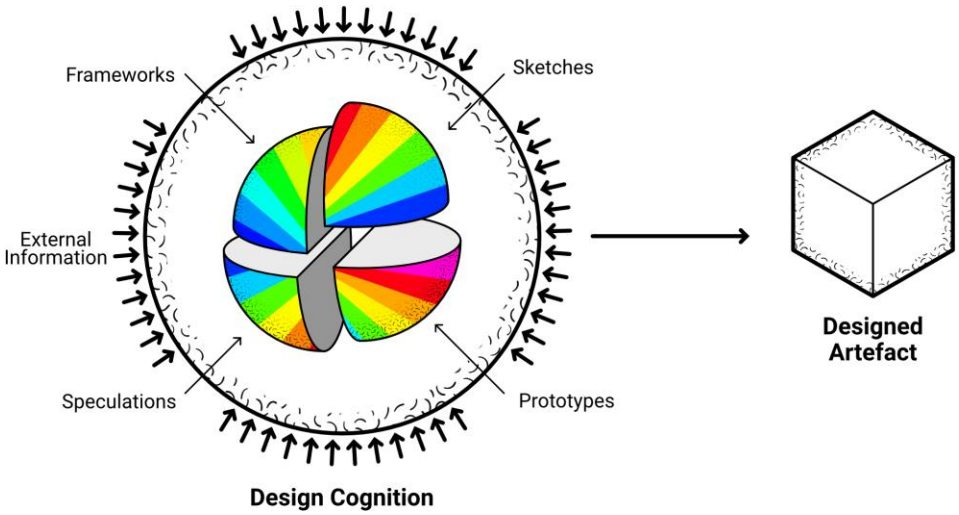

Figure 18: Design Cognition enables interaction of design knowledge (often playful such as sketches) with external influences within the design process that collectively influence the designing of solutions or artefacts.

Having said that, he raises a point of contention at how the word design when taken to account for something that is *designed*, is far from the idea of the function associated with the design; 'designer clothes', 'this design', etc. When designing, often the function is the focus of a design followed closely by form. What he's saying is that the artefact created by design is not the genuine goal of the designer, rather it is a means by which designers achieve their goals (Gedenryd, 1998, p. 155). The artefact created is intended to interact with the situation it is presented, creating a future instance where the designer is capable of reaching their intention: the solution (1998, p. 156). This is most clearly seen in the formulating of prototypes, which he claims have similar properties to sketches in that they intend towards desired future states in a tangible form. Another way of viewing this is, sketches, artefacts, prototypes, etc. are all *playgrounds where designers playfully design*. Seeing this from the vantage point of Bogost (2016) they are things imbued with a sense of play afforded through their unique constraints yet simultaneously invoked sense of freedom.

6.3.2.2 *Curiosity-driven Design*

Now let's return to the topic of ludic design and where notions of curiosity fit into this argument of playfulness and design. What should be understood is that its focus is towards meaning-making rather than tackling technical, social, psychological or other issues (Mivielle, 2015; Gaver, 2002, 2009; Gaver *et al.*, 2004; Back *et al.*, 2017). This is a core ideology that Gaver utilises in his different experiments and design probes. They are to engage with curiosity in order to define specific meaning. That said, the artefacts created under this banner are of an obscure nature for this very reason, as emotion (Gaver, 2009) and ambiguity (Gaver *et al.*, 2003) become important assets for the designer.

A definition of ludic design starts with understanding ludic engagement and the functions that befall such an interaction. As such, it fits within the proximity of different genres of application without belonging to any of them, for example toolmaking, communication, art, etc. (Gaver *et al.*, 2004, p. 888). These all are part of what constitutes ludic engagement but individually are not

enough to define it. Nevertheless, Gaver *et al.* (2004, p. 893) present their opening position towards ludic design as not being specifically *for* anything, rather capable of offering insight into a range of possible meanings for human exploration. They sum it up into three core values that ludic design need possess:

1. The ability to promote curiosity, exploration, and reflection at the foremost. Allowing those engaged to appropriate their own meanings from given activities rather than have meaning imposed on them
2. Be non-utilitarian to fully encompass traits of a playful activity instead of one where those partaking may be distracted by its practicality, and
3. Remain open and ambiguous devoid of defined narratives to enrich an experience that is more accepting of interpretations on a wider spectrum of meanings stemming from different cultures and ethics.

Bateson and Martin (2013, p. 44) argue for creativity as being a response to experiences which subsequently leads to innovation. By-products of engagement such as changes in mood, situational flexibilities, present limitations, and other psychological effects may inhibit the potential of genuine creativity (2013, p. 80). Ludic design's format of engagement creates an artefact that is not privileged to any particular activity or goal (Fig. 19), yet remains engaging and playful allowing it to become something thought-provoking (Sengers and Gaver, 2006; Gaver *et al.*, 2004; Back *et al.*, 2017). To quickly explore this further, we can look at the *Drift Table* a design probe executed by Gaver *et al.* (2004) as part of the *Equator Project*.

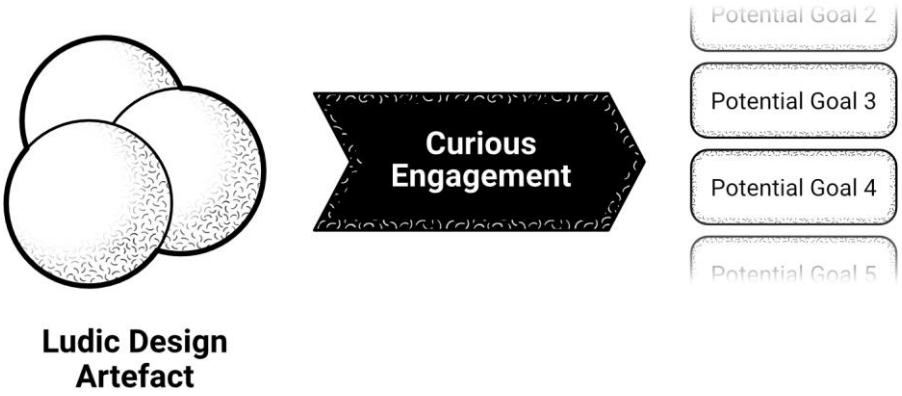

Figure 19: The curiosity-driven engagement of ludic design artefacts make them exploratory endeavours as their ambiguity aids in fostering alternative potential goals.

The Drift Table's central premise is the feeling of drifting over a landscape. As a designed artefact it looks like a small coffee table on wheels with a circular digital viewport in the middle. The viewport shows an ever-drifting landscape of the United Kingdom and the only way to control the direction or speed of drift is by placing things on the different corners of the table. This interaction is not as intuitive as scrolling on a tablet or pressing a button, instead it is exploratory. Furthermore, the table gives limited access to those engaged as to where they are in the landscape. A screen on the side points out geographical locations, and a micro-size button beneath allows it to

be reset to its current location. Although, these are designed in a way to imply that its users should not feel the need to exit its reality. The table thus presents the feeling of experiencing the familiar in an unfamiliar way, allowing those engaged in this experience to be taken aback by the things they rarely noticed.

This rather poetic reimagining of a coffee table is perhaps the most oft-cited design probe in the discourse of ludic design, and for good measure. When seen in light of design cognition and the discussion of playfulness above, artefacts such as the Drift Table become equivalent to the playful sketches done by designers in the design process. It is a means to a goal, conducted in a manner that is playful and engaging not only for those involved in its use, but also in the process of its execution. In the study conducted by Gaver *et al.* (2004, p. 898) the long-term use of the table in a domestic setting was also explored. The observations acquired from this, and other similar probes, help towards further exploring the potential in designing for ludic pursuits both for average users and for design practice.

6.4 Designing Curious Philosophical Artefacts

Ludic design is helpful in regard to this research for understanding a level of curious engagement with the unknowns that this work attempts to tackle; more-than humanness. However, the philosophical arguments that the previous chapters have touched upon require an approach that is capable of dissecting them further in a microscopic manner. How does one attempt to design artefacts that can explore the object-oriented philosophies for design knowledge?

As what is being dealt with exists in an unknown space hence the need for speculative philosophical approaches such as OOO, the next part of this combined methodological framework is of a similar speculative nature. Like-wise as I am also dealing with future-focused technologies based on contemporary concepts these are yet to be understood or materialised, a Speculative Design (SD) approach may be incorporated to understand near-future possibilities where these solutions may exist and build on the combined methodological framework of this research. This section explores SD and the need for speculation in this research moving towards a combined method for designing curious philosophically charged artefacts

6.4.1 Speculating over definitions

A true definition of SD overlaps between different design practices which include critical design, design fiction, design probes, and discursive design (Auger, 2013, p. 12). Each of these practices as Auger (2013) points out, involve elements of speculation that place the designed object apart from the world it originally inhabits to allow for freedom of movement and narrative. A requirement in our current situation of understanding object-oriented perspectives. As such, SD employs the use of fiction to present alternative viewpoints to the same designed object. Dunne and Raby (2013) are most accredited with the term SD as having explored the potential of using design as a form of critique akin to design as communication or problem-solving. This critical approach towards design takes into account designs interest as a future-oriented task, and as such SD has been

oft associated with research in design futures and futurology (Dunne and Raby, 2013; Lukens and DiSalvo, 2011; Coulton *et al.*, 2016).

Futurists often refer to activities that occur in futures in a taxonomy of states (possible, preferable, probable), depicted through a model of the "futures cone" (Voros, 2017, p. 7) (Fig. 20). Voros (2017) traces back a history of the cone to an appropriation of how Hancock and Bezold (1994) defined futures and even further back. The adaptation by Voros (2017) though, is more commonly referred to in modern depictions as it incorporates a broader taxonomy. These alternative future states are considered subjective views relating to past and present events therefore concepts are subject to change over time, for example space travel.

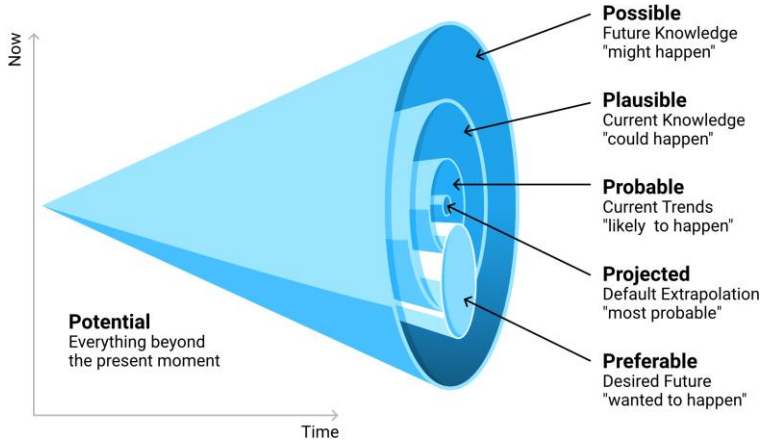

Figure 20: Futures Cone adapted from Voros (2017) presents a means of charting activities of the future which may fall under different portions of the cone.

This is not to say SD 'only' contends to matters of things to be. Though the term brings with it visions of science fiction dreams and impossible futures—think jet packs and flying cars—it is equally a means of exploring "alternative presents" (Auger, 2013, p. 12), or "lost futures" (Coulton *et al.*, 2016, p. 5). As Auger explains:

> *"...alternative presents are design proposals that utilise contemporary technology but apply different ideologies or configurations to those currently directing product development. This method is similar to the historiographical practice of counterfactual histories and the literary genre of alternate histories, but rather than focusing on asking 'what if' of historical events and imagining the effect on here and now, it shifts the emphasis onto artefacts." (Auger, 2013, p. 12)*

Auger continues to express SD as a methodology capable of bridging how one perceives the world around them in relation to the fictional settings presented by the speculation (Auger, 2013, p. 12) Rather than throw an artefact into a distant future of which we might be incapable of relating with, the suggestion is to alter one's goal. Striving instead for the creation of 'near futures' with approximated more tangible speculations. The point is to distance a speculatively designed artefact from science fiction, rendering it in the plausible or probable portion of the cone. As a methodology,

Auger further attempts to define different modes of interacting with SD to formulate arguments which hover around satirical commentary, provocation, and disrupting normality (2013, p. 12).

This supplementary definition stems from the experience of many SD artefacts, such as those explored by Dunne and Raby (2013), where one can't help feeling they are alien. This is because most exploration of SD has to do with "unreality" (2013, p. 12) and the aesthetics involved. These artefacts are as much artisanal and philosophical visions as they are designed. Conjecture is to blame for this for what the term 'speculative' implies: not real, yet to happen, etc.

Furthermore, SD is also argued to be about the present (Gonzatto *et al.*, 2013, p. 40) relying instead on past experiences and future speculations projected onto a discourse about the 'now'. On this, Coulton *et al.* (2016, p. 6) contend, that when considering future possibilities, the influence of the past cannot be ignored as prior events may be responsible for lost futures. As such, any speculative design process needs to incorporate a designers present perspectives and past influences. They urge for SD practices to not be considered neutral acts, rather, present them in lieu with Buchanan's view that all design may be considered "as rhetoric" (Buchanan, 1985, p. 5). Ergo, SD and its related methodologies may be seen as open-ended conversational approaches towards speculation, lessening its association with critical design.

6.4.1.1 *Designing the Mundane*

Where the goal for SD becomes the designing of a critical future-focused view of a situation (influenced by the past or not), the artefacts created are none-the-less *art-like*. Fantastical shapes, odd angles, vivid obscurities, that all intend to highlight themselves as being apart from their less speculative counterparts. They succeed in crafting a fiction capable of diegesis, yet they also succeed in alienating themselves from the world they exist in. They are playful and indeed curious, but far from mundane.

Putting the above views and supplementary definitions of SD aside, Coulton and Lindley (2017) argue instead for world-building through *Design Fiction* practice. In this holistic approach towards SD, they present a case for multiple artefacts contributing to a worldview that surrounds the designed object. This speculated design is no longer existing in a vacuum, and instead becomes something that relates to its surroundings:

> *"While speculative designs may well conjure qualities of an alternate world via art-like artefacts, Design Fictions use any media they can to give life to fictional alternate worlds, worlds within which the artefacts that define them make sense." (Coulton and Lindley, 2017, p. 4)*

Fictional artefacts and their worlds created through design fiction—specifically those with commercially targeted inclinations—they see akin to vapourware imagined for potential technologies. The fictions themselves, in turn, make what they call "vapourworlds" (Coulton and Lindley, 2017, p. 5) a play on the idea of vapourware. These are specific environments designed solely for prototyping commercially minded speculation in a manner where they become relatable.

The many design fiction artefacts that are created, end up as entry-points into different perspectives facilitating these *vapourworlds*. That said, this ideology of world-building may be extended to other non-commercially focused endeavours of design fiction as well (Coulton *et al.*, 2017).

A key strength of design fictions is in their ambiguity as they take the form of imagery, film, physical or digital artefacts as opposed to text (Blythe and Encinas, 2018, p. 34). Mundanity thus becomes an important asset for a design fictions ambiguous nature to be realised. Examples of this can be seen in artefacts created by *Near Futures Laboratory* and others (Bleecker, 2009, 2010). The goal becomes to blur the lines between reality and fiction through diegetic prototyping, creating a world that is cohesive yet artificial (Coulton *et al.*, 2019, p. 15) capable of inquiry, critique, vision, disruption, etc.

On world-building for fantasy, Tolkien (1947, para. 34) described the process as "sub-creation", dependant on the world it is influenced by; our own. The grass may be purple in this secondary fantasy world, but there is grass. No matter how fictional a world may become, a core relationship remains with its source (Blythe and Encinas, 2018, p. 85).

In this argument for playfulness, technology, philosophy, and design, speculation attempts to bring them together by weaving linkages between crafted curiosity and intentional philosophical concepts within a designed artefact. Be it elaborate artefacts like the *Living Room of the Future* (Coulton *et al.*, 2019), the curiosity-driven *Drift Table* (Gaver *et al.*, 2004), or *Enchanted Objects* (Rose, 2015), they become speculative imaginings of lost presents and potential futures. Entry-points in a world full of possibilities and playful potential. With all that has been said and done we can now focus on combining these concepts to create a collective methodological framework for crafting artefacts that engage in philosophical arguments around IoT.

6.5 Carpentry

It's taken a while getting here, but the arguments presented thus far were necessary to connect the dots towards my appropriation of carpentry as a combined methodological approach for the design research conducted here. As with most things discussed so far, when I refer to 'carpentry' things are not as it seems. By carpentry I don't mean woodworking in any way. Rather, it is philosophical crafting akin to a *'kind of'* carpentry that I speak of. How it is utilised here was presented by Bogost (2012) in a chapter of his book *Alien Phenomenology, or What it's like to be a thing*. Where the book's main focus is on a phenomenological approach of viewing objects as actors in their own right, while discussing carpentry Bogost argues against the need for writing as a sole means for scholarly productivity; particularly when philosophy is an active ingredient in one's research.

Carpentered artefacts are to paraphrase Bogost (2012, p. 100) philosophical lab work. Though he agrees that when philosophers come together, the outcome automatically becomes a written product of sorts. The point of contention he puts forward is for researchers of science who although do their research on the tangible world and manufacture or devise things for tangible application, their findings are still subjected to the typical academic rigour of writing scholarly articles to prove

themselves. The artefact, chemical, product, etc. created or discovered by the researcher becomes less scholarly without in his opinion.

This is not to say that Bogost is against the creation of scholarly articles and academic papers. On the contrary, he agrees with the reasoning to have a standardised approach towards the quality, transparency, ethics, and validity of academic knowledge generation. What he finds an issue with is in having an "obsession" with scholarly writing over other methods (Bogost, 2012, p. 89). The reasoning being his opinion that *(a)* academics are bad writers, and *(b)* on a philosophical ground writing is dangerous.

Bogost's reasoning is quite easily understandable, academic writing is full of obfuscation and jargon intended to be ambiguous and "faceless" (Rothman, 2014, para. 2), which may prove a hindrance to those outside of research. The later reason though requires some explaining. When Bogost (2012, p. 90) says writing is dangerous for philosophy, he is referring to how it is "one form of being" out of the many different ways in which we interact with our world. His stance is against the assumption that our language is the only way through which we relate to our world. This assumption hinges on the idea that we are evolved humans, and language differentiates us from other animals making it our strongest tool in understanding the world.

This view in his opinion is an ancient one. He quotes Bryant (2010) in this regard, saying that if the world we live in were only understood through the semiotics of what we can put into language, then the contributions of the non-semiotic world (such as, lightbulbs, optical cables, climate change, etc) would forever remain unknown to us (Bogost, 2012, p. 90).

The consequence of this approach towards language over other methods, he asserts, is a "fixation on argumentation" (Bogost, 2012, p. 91), so much that one's curiosity becomes less charged and the need only becomes to explain oneself. Quoting Richard Rorty he goes on to explain how for philosophers the act of "doing philosophy" (2012, p. 91) is an act of contesting arguments through weaknesses; often done through writing and publishing one's opinions. The successful philosopher thus becomes like a sniper with a keen eye for weaknesses, only their weapon is writing skilfully.[28]

6.5.1 Getting your hands dirty with philosophy

As a recourse, Bogost's suggestion to *improve* scholarly discourse is adopting an alternative approach towards making things that *'do philosophy'*; potentially supplemented with writing. He compares the knowledge accrued through reading/writing and that from crafting/making/doing as "two sides of the same coin" (Bogost, 2012, p. 92). Quoting Crawford (2009) on his departure from academic philosophy to the world of auto-mechanics, Bogost (2012, p. 92) explains how philosophy

[28] Ironically, I discuss this in my unorthodox PhD thesis a document riddled with tangential arguments which I've been attempting to weave together into a cohesive discourse. Though the artefacts created in this research come under the umbrella of carpentry and should be scrutinised as to their sources of knowledge generation, given how academic research is conducted, I could consider the writing of a thesis in the typical scholarly manner collateral damage to doing a transdisciplinary PhD. At the same time, being an unorthodox document, I attempt to do some justice to Bogost's unorthodox approach towards philosophical research.

may be seen as a "practice" as much as a theoretical application. "Like mechanics philosophers ought to get their hands dirty" (2012, p. 92).

This view sees a philosophical discourse embedded in an artefact created with the intention of it being a product of philosophy. An approach he calls *Carpentry* as the "practice of constructing artefacts as a philosophical practice" (Bogost, 2012, p. 92). The term carpentry, Bogost derives from an amalgamation of meanings. The first coming from the meaning of carpentry as a form of woodcraft or construction. The second, he takes from Harman (2005, p. 20) as a philosophical account of a "carpentry of things", a concept Harman borrows from Alphonso Lingis. The idea is that objects that exist are involved in their realities fashioning each other and the world around them.

Furthermore, since this is a discussion around OOO, carpentry may be seen as anti-correlationist allowing for a broader perspective towards the world, as he explains himself:

> *"Carpentry might offer a more rigorous kind of philosophical creativity, precisely because it rejects the correlationist agenda by definition, refusing to address only the human reader's ability to pass eyeballs over words and intellect over notions they contain…philosophical works generally do not perpetrate their philosophical positions through their form as books. The carpenter, by contrast, must contend with the material resistance of his or her chosen form, making the object itself become the philosophy." (Bogost, 2012, pp. 92–3)*

He gives examples of philosophical arguments that make better sense as textual accounts. But at the same time, there are many aspects of philosophy which contend better through the act of recreating arguments in a tangible medium. His comparison of carpentry to philosophy in this regard, is on par with the act of scientific experiments to science.

In Chapter 4, while discussing OOO I briefly introduced the idea of ontography. In *Alien Phenomenology*, Bogost (2012, p. 19) expands on the perspective of ontography as a record of "things within". This recording of objects can then be defined further by their "collocation" to not only the things within the ontograph but also those around it (2012, p. 38). The idea is not foreign as it mirrors the concept of flat ontologies expressed by Harman (2018a).

Harman (2010b) and later Bogost (2012), examine Bruno Latour's lists of objects as a way to present the idea of an ontograph in the most basic of ways. Latour's lists, or as Bogost calls them *litanies*, force one to create obscure relationships between words and phrases which otherwise would not be paired together, such as:

> *"A storm, a rat, a rock, a lake, a lion, a child, a worker, a gene, a slave, the unconscious, a virus." (Bogost, 2012, p. 38)*

This prompted Bogost to build the *Latour Litanizer*,[29] a program that fetches random titles of articles from Wikipedia and assembles them to form a list of 'objects'; an ontograph of Wikipedia articles. The assembly of disjointed information removes the reader from the process of selecting the article and instead presents it as raw information. The subsequent *litany* is now free to be scrutinised for the various relationships the titles may (or may not) have amongst each other.

Carpentry thus becomes an attempt at enacting philosophical arguments in a way that may do justice to the deep musings of philosophical discourse in order to make sense of them better, perhaps even in a contemporary setting such as with the *Litanizer*. It invokes elements of curiosity to encourage speculating over the philosophical concepts it embodies while simultaneously retaining an air of playfulness through its execution which Bogost is an advocate of.

As a maker of software and game designer, Bogost's medium of getting his hands dirty with philosophy becomes crafting games and programming. As a design researcher exploring more-than human design methods for IoT my approach becomes crafting physical/digital design artefacts capable of rendering philosophical arguments around IoT.

6.6 A combined methodological framework

At the start of this chapter and in Chapter 2 I referenced the creation of bespoke toolboxes capable of enabling the carpentry of the coming artefacts of this research. I would like to reaffirm a point that though these are called toolboxes, they are not design tools in reality but a play on the use of 'carpentry' as a methodology. What Bogost (2012, p. 100) suggests is seeing carpentry as "philosophical lab equipment" capable of assembling philosophical concepts in a form where they may be scrutinised. He proposes its use in general philosophical application as a way to experiment and further create the *alien phenomenologies* he speaks of in his book. These are deliberate probes intended to prove, disprove, or disrupt philosophies.

[29] For more information, see: http://bogost.com/writing/blog/latour_litanizer/.

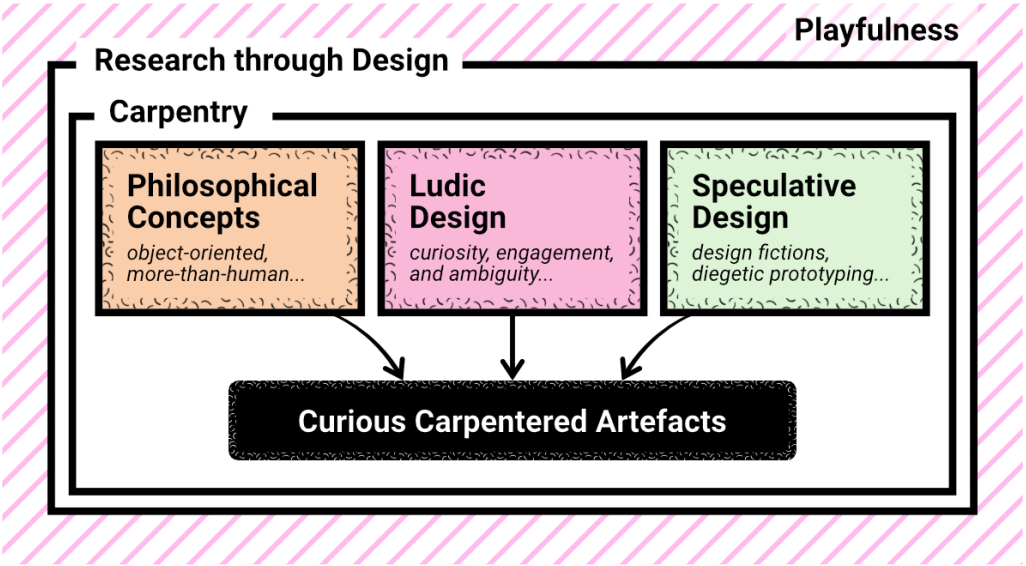

Figure 21: In light of the method assemblages from Chapter 2 a combined methodological framework may be imagined that incorporates an iterative process of examining philosophical discourses through playful appropriations and speculative design that feed into the carpentering of bespoke philosophically charged artefacts.

My intention of creating bespoke combinations of concepts coming from philosophy, design, and technology is an argument for the playful approach carpentry affords as a methodology. The artefacts crafted in the coming chapters were all done through carpentry in an iterative process of RtD that involved examining concepts through affordances of curious engagement and speculation (Fig. 21). These concepts do not strictly align with the terms associated with Bogost's vision of carpentry which he describes as a means for enacting OOO. They are important to this specific practice of exploring more-than human futures for technology proposed by my RtD approach, by encouraging alternative thinking and explaining how play manifests in my practice of design.

In this chapter I've explored play from multiple vantage points because as a playful practitioner I see play in both myself and the world around me. Bogost understands carpentry to be playful as he understands playfulness. Though his definition of play is at odds with Sicart and others, it was necessary for me to include those arguments because that is how I see play as existing in both people and artefacts. For the purposes of this research and myself I see playfulness manifesting in the act of carpentry as, *(a)* a vehicle that allows me to explore speculative concepts of more-than humanness and IoT relevant to OOO, and *(b)* a practice-based activity that affords playfulness within the things that I create. LD and SD are required to carry the argument for IoT and the more-than human by encouraging engagement. As a human I can only design things from that perspective, yet this research takes on the challenge of designing from a non-human perspective. Both LD and SD allow that to happen through their loosely defined worlds. Artefacts such as the Drift Table allow one to exit their own worlds into curiously ambiguous ones. Carpentry here holds LD and SD together with philosophical musings through an iterative design practice. And all of this is only possible by acknowledging a manifested playful attitude towards what future human-computer relations may imply.

As a programmer Bogost's interest is related to HCI and thus many of the examples he gives are related to machines and programming. On this he suggests that HCI is a correlationist field as its concern is with the relationship between humans and computers; the focus being an obsession with "human goals and experiences" (Bogost, 2012, p. 107). When allowed to break free from this human-tether, HCI evolves into something more. The example Bogost gives for this is the *Tableau Machine* (Romero *et al.*, 2008), an attempt to create a sentient home aware of its occupants. How this attempt is different from other like attempts at AI's inclusion in an occupied space, is in how the information is relayed back to the human. Rather than have it as directly legible information, it is returned as abstract art. The depiction becomes a relationship of spaces and the interactions taking place within them. Though these interactions have no meaning as they are not assigned any legibility. It takes on the form of an "alien perspective" on our world from an artificial intelligence (Bogost, 2012, p. 106).

Though not intended in this manner nor directly related to this research, I reference the *Tableau Machine* here because as a carpentered artefact it can translate into the methodological framework devised above. As described by Romero *et al.* (2008, p. 373) the intention for the artefact was to understand technology as an alien presence in the domestic environment. The anthropological studies it references explores the fascination between humans and technology through obscure HCI products. It incorporates an application of technology that is both current yet future-focused, speculating about the potential present among contemporary technologies. Furthermore, the results of the artefact are presented as purposefully ambiguous playful abstractions that contribute to a wider audience of design, technology, and anthropology.

Carpentry itself as Bogost (2012, p. 104) presents it is not proposed as a medium for engaging in ambiguity or curiosity, rather one for unpacking reality and making things more visible such as in the case of Ben Fry's *Deconstructulator*.[30] Though he agrees that when removing the HCI confines of the *Tableau Machine* it becomes something more. Romero et al. suggest the information presented by the *Tableau Machine* to be a way to view the social dynamics of a space. Irrespective of how it may be viewed, as with the *Latour Litanizer* the result requires speculation to be directed. The artefacts ahead attempt to do this unpacking of a non-anthropocentric reality in their own ways utilising a combined understanding of carpentry as a philosophical inquirer, future-focused visions of SD, and a playful appropriation of HCI through LD. Through his understandings of carpentry and the examples he presents, Bogost suggests the merger of different disciplines with philosophy to form unique perspectives coining the possibility for a philosopher-programmer or philosopher-mechanic. With my appropriation of carpentry I perhaps am proposing a philosopher-designer; a notion seconded by Lindley *et al.* (2018, p. 232).

[30] For more information, see: https://benfry.com/deconstructulator/.

6.7 Conclusions

This concludes the methodologies section of this manuscript. Throughout this thesis I've been introducing a new concept in each chapter and have had to do so to reach this point where these concepts may be weaved together for the purposes of this research. IoT and alternative approaches at designing for objects that function within it is the locus of this argument, but in order to approach it concepts that put aside prior prejudices such as object-oriented philosophy must be tapped into. Designing for post-anthropocentric perspectives that go beyond human interaction requires elements of speculation about near-futures where these solutions could make sense, or may exist for scrutiny. Designing an artefact through the lens of philosophy becomes a matter of not only understanding the philosophy, but also knowing which combination of things works for the object of design. The *Tableau Machine* could just as well return information in a series of words, tags, or numbers. But the fact that the response is in the form of art makes it ambiguous and thus speculative in nature.

Furthermore, the amalgamation of these different concepts and approaches within a framework of design requires an open mind towards playfulness, in order to facilitate enough freedom for these different concepts to intermingle. The design process utilised throughout this thesis is one of play and feedback. Carpentry allows for that playfulness to act out in a manner that works for both philosophy and design purposes. This intermingling is important as a rigid approach of HCD for technology would not necessarily allow for object-oriented views to exist, just as an overly philosophical approach would not present a strong enough case for its application. An iterative RtD process is thus necessary to reach that level of balance where these concepts may converge. LD though might seem like a footnote in all this I argue on the contrary, the coming artefacts attempt to slowly reach that level of curious engagement that I believe is needed to accept a post-anthropocentric approach at design for IoT.

As a designer-philosopher for the following artefacts created in this research, it became important to assign the correct philosophical (and design) approaches. In the next section, I will attempt to 'do carpentry' by exploring three different artefacts designed as part of this work into the use of philosophy to explore alternative approaches to designing for IoT. The combined methodological framework will be represented in each chapter to show how the different concepts and approaches are able to intermingle together in a manifested attitude of playfulness. I again refrain from calling them design tools, and though I might continue the rhetoric of a toolbox in the coming chapters I use it only as a homage to carpentry as a methodology.

DOING CARPENTRY

CHAPTER SEVEN

A MODEL FOR A PHILOSOPHICAL VIEW OF IOT

"The trick to forgetting the big picture is to look at everything close up."

— PALAHNIUK (2003, CHAPTER 3, PARA. 73)

7.1 Introduction

Having built a foundation for this research in its different areas of concern (IoT, Philosophy, Design) and established the applicability of RtD and playful speculation through carpentry as core methodologies, we can now begin crafting our artefacts. In total this research presents three artefacts each exploring a carpentered approach at viewing IoT through a lens of philosophy, each imagining alternative approaches towards the design of IoT systems. Metaphor plays a key role in understanding these artefacts, and after the previous chapters there should be an established familiarity with its presence in this thesis. I wish there was a better way to represent but since metaphors are a common occurrence in philosophy as an explanatory asset (Pepper, 1982; Johnson, 1995) it was difficult to divorce this work from its use.

In Chapter 3, I gave an introduction to why IoT was important, its place in this discourse with philosophy, and the potential use of constellations (Lindley and Coulton, 2017) as a metaphor for viewing how IoT systems function. In order to use this lens in practicing design this first artefact attempts to grasp the concept of what a philosophical approach at designing for IoT could be like, by presenting a potential framework around which such discourse may take place. This framework intends to guide the carpentry of further artefacts that may be understood in this manner, devised through a model of how IoT objects interact and where those interactions may happen. The act of creating this framework may itself be considered an attempt at carpentry for creating a means to understand the alien phenomenologies existing among digital interactions within IoT. As such, the model at the end of this chapter may aspire to be a secondary major contribution of this research allowing a potential representation of seeing IoT through a philosophical lens. It also is our first step towards addressing the first sub-question of this thesis:

> ***SQ 1.*** *Is it possible to highlight potential problematic effects emanating off IoT products and services approaches through an object-oriented lens?*

In order to address this question a base understanding of interactions occurring within IoT and between objects on and not on the Internet must be established. For the purposes of taking a non-anthropocentric perspective, this needs to be approached through relevant philosophical discourse

or object-oriented-ness, and as explained in the previous chapter, this weaving of philosophical discourse within technology and design is done through an assemblage of methods (Fig. 22).

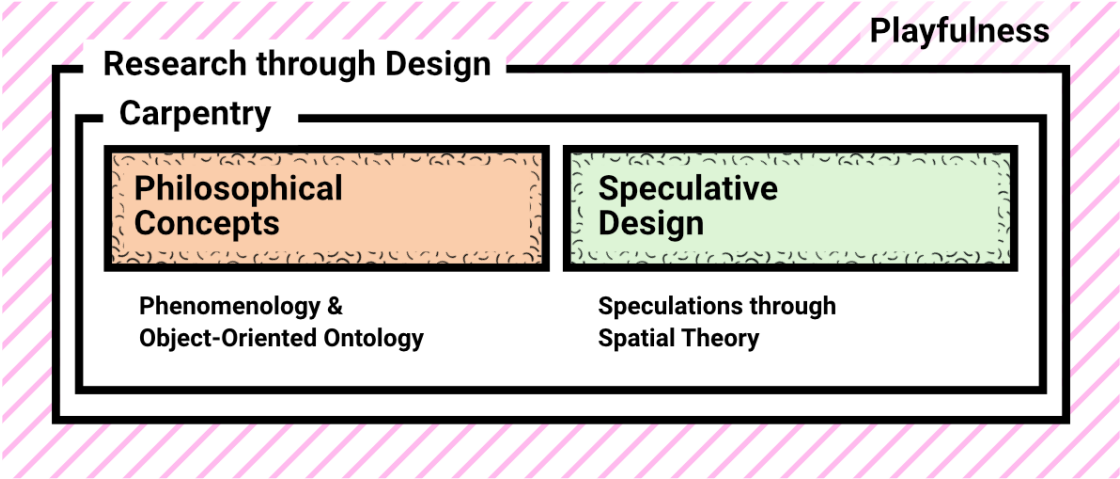

Figure 22: The method assemblage for the carpentry of this artefact explores playful appropriations of object-oriented philosophies and the use of speculation through an understanding of spatial theories.

Therefore, in this chapter I will be making a comparison between concepts from philosophy and spatial theories coming from geography and architecture. The reason for this is because IoT interactions occur in both physical and non-physical locations such as a living room and a digital wallet. This comparison is then applied using a philosophical perspective of phenomenological configurations and how they are understood through digital technologies and digital spaces, coming from a review of relevant literature and case studies. This presents an opportunity for exploring IoT's ontology from human and non-human-centred perspectives in the different manners of interactions capable within it. As such, ludic design discussed in the previous chapter will not be explored in this artefact as this is more to establish a core understanding through playful appropriations of philosophy for further curious explorations in the subsequent chapters. Towards the end this artefacts contribution towards manifesting playfulness within the design process is also touched upon in light of the evidence presented in this chapter.

The first portion of this chapter defines the logic behind how the framework is established followed by a detailed definition of the different elements that create the final model. The model itself becomes the presented artefact in this chapter. To begin I will define philosophical arguments used throughout building a case for seeing IoT interactions as phenomenon existing within multiple spatial configurations.

7.2 IoT as a spatial phenomenon

An earlier definition of IoT I gave was of an amalgamation of heterogeneous physical objects connected through the Internet. The Internet itself, I explored as a 'space' where unique non-physical interactions occurred. Colloquially when we refer to the Internet it takes the form of a *place* that was or will be visited. In this regard, we have seen both the Internet and IoT through phenomenology. To define a structure for our philosophical lens of IoT to sit upon, we need to go back to basics. For

that I will be doing two things, *(a)* presenting a means for dividing digital/non-digital spaces in light of philosophical texts, and *(b)* mapping the rules that may define interactions that occur within these spaces.

The discussion here is an expansion of the discourse presented in Chapter 4. What we know is that phenomenological research attempts to understand the experience of things and events through the "perspectives and views of physical or social realities" (Leedy and Ormrod, 2016, p. 84). It is in all respects a "first-personal mode of presentation" for any given phenomenon, defining unique meanings of things present in our experience (Smith, 2016, p. 140). As Cole (2013, p. 160) describes, OOO explores how objects "should be recognised for their indifference to us", focusing on the things they do "behind our backs" (2013, p. 160). This view sees the individual experiences of objects as actants moving in and out of their own made assemblages.

So, how does phenomenology fit into this development of a framework? The idea of crafting models of realities is not alien to philosophy. When understanding phenomenon, a core axiom is presenting the relation between our senses and the experience with reality.

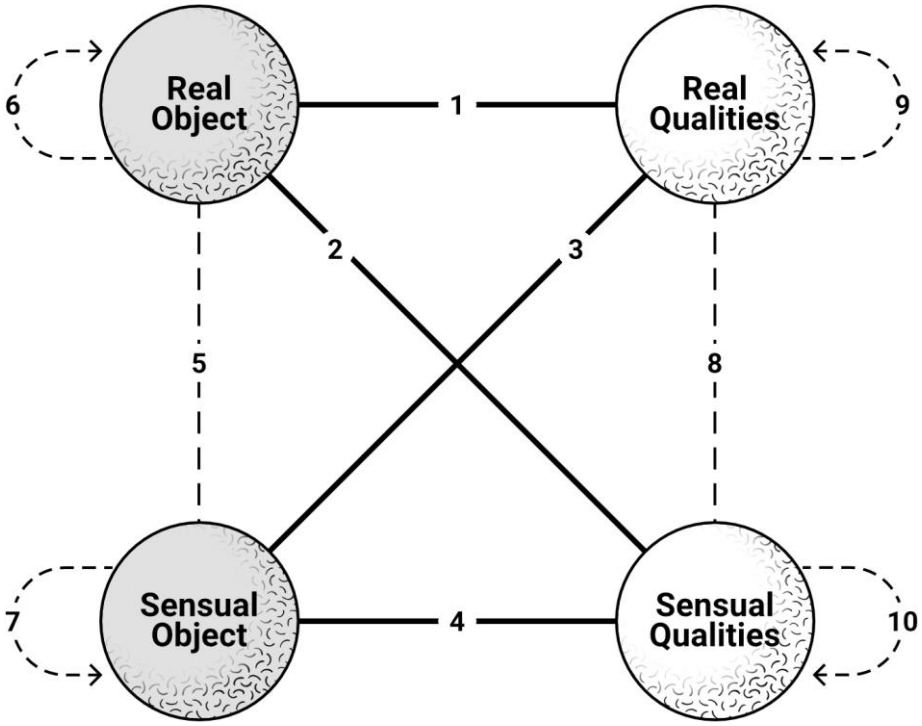

Figure 23: Harman (2011b) presented the four-fold quadruple object model for understanding phenomenological perception and relations. Each line represents a possible means for causation defining a specific ontographical relationship.

While explaining the philosophical grounding of this research, I ended Chapter 4 on OOO giving an introduction into my core philosophical approach. Expanding on that further in *The Quadruple Object*, Harman (2011b) presents OOO coupling Heidegger's tool-analysis with Husserl's phenomenological work presenting a framework for defining phenomenological experience. Harman's four-fold model (Fig. 23) sees the presence of two kinds of objects having two kinds of qualities: *Real* and *Sensual*; or *Real-Objects (RO)* with *Real-Qualities (RQ)*, and

Sensual-Objects (SO) with *Sensual-Qualities (SQ)*.[31] This premise argues that objects may not exist without their defining qualities, and it is the interaction with our senses that creates the different modalities a phenomenon may have. This is very much Harman building upon the older model of experience which only viewed primary and secondary qualities for objects (Harman, 2011a; Smith, 2016).

Harman defines RO as those objects that withdraw from experience having RQ which subsequently may only be understood via scrutiny. In the same note, SO are those that rely on experience to exist with SQ, being similarly experiential. This creates several possible combinations between pairing the different objects and qualities. The history of phenomenological research argues for the presence of rifts or tensions between the different combinations of phenomenon and Harman's model is no different (Harman, 2018a, 2011b; Bogost, 2012). It is the presence of this tension between the real and sensual that crafts OOO. Harman (2018a, p. 150) defines this rift as "vicarious causation", taking hints from the medieval Islamic and European philosophical concept of *Occasionalism*.[32]

As an example of a rift in causation, he presents an old occasionalist argument for cotton and fire: "Fire does not burn cotton—it is merely the occasion for God to burn the cotton" (Harman, 2010a, p. 5). What Harman is appropriating here is fire and cotton as real and sensual objects with real and sensual qualities. While intermingling fire does not contact all properties of cotton: smell, softness, etc. They are irrelevant to the flame instead cotton only encounters heat. This should not matter with cotton being non-human, but through the OOO lens there is no prejudice between humans and non-humans. Therefore, the simple fact Harman presents is that objects cannot exhaust the reality of other objects when their natures collide. The interaction between fire and cotton is happening on a level we are unable to view unless we see out from within, in other words through an object-oriented perspective. Harman's view is this interaction happens on the interiors of the objects. In effect he asks, what are cotton and fire personally experiencing?

I should mention here that Harman's accounts do not argue for occasionalism, rather they argue for OOO as a perspective in viewing causation. OOO cannot agree to an occasionalist world view (Harman, 2018a, p. 150). The overarching argument and connection I am presenting here certainly are for causation of a kind, vis-à-vis interactions in IoT. What should be taken from this is the use of OOO to create foundations for a framework that allows for things to be laid bare for scrutiny and possibly define them through spatial references of their insides and outsides. Before making the connection between the end model and viewing IoT in this manner, we must tackle the second part of this equation and understand what I mean by these spatial configurations.

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[31] The representation and usage of the four-fold model by Harman (2011b) here is done on a lower level understanding of object-oriented philosophy. This manuscript nor my expertise in philosophy are not sufficient to do justice to the amount of knowledge the four-fold model provides, and for that reason I will not be covering it in its entirety. For a detailed understanding of this model refer to works by Harman (2011b, 2018a) the original source.

[32] Occasionalism is a medieval Islamic philosophy, also present in early modern European works, which follows a rhetoric that the presence of God is a necessity for causation in order to allow two objects to interact with each other.

7.2.1 The division of space

There have been moments when I've entered a room and thought, *"This is a big space!"*, or perhaps gestured to a friend in a movie theatre to say, *"There's a space over here"*. Like many I've also encountered the idea of 'personal space' through proximity, such as in a crowded train. These are colloquial uses of the word *space* and although the concept involves intuitive use in our daily lives, a definition of space has seen philosophical contention for years (Tuan, 1977; Cresswell, 2008; Wollan, 2003; Casey, 2001). However, one thing that all sources do agree upon is that *space* is different from what a *place* may be.

Yi-Fu Tuan is often quoted as a key figure and influence in the study of human geography and in defining an argument for *space* and *place*. Space is described by Tuan (1977, p. 34) as "an abstract term for a complex set of ideas", which he says comes from how "people of different cultures differ in how they divide up their world, assign values to its parts, and measure them" (1977, p. 34). His definition assumes space in relation to an experience one has with their body and those of others that are intimate in nature, allowing one to arrange space in a manner that it "conforms with and caters to [ones] specific biological needs and social relations" (1977, p. 34).

Architecturally space is seen through an idea of dimensionality, where it can be measured, yet Tuan is eager to point out that "spatial dimensions such as vertical and horizontal, mass and volume are experiences [also] known intimately to the body" (Tuan, 1977, p. 108). This allows Architecture to traverse the boundary between *space* and *place* and interweave spatial theory with phenomenology.

7.2.1.1 *Insides and Outsides*

Both terms Tuan (1977) argues denote common experiences but they expand on each other's definitions. "Place is security, space is freedom: we are attached to the one and long for the other" (1977, p. 3). A home thus becomes a *place*, differentiating it from being just any space because of the meaning associated with it. Tuan's exploration of spatial theory is more towards the study and experience of Geography as done by the human actant. But, this idea of a *kind-of spatial theory* can be appropriated to encompass non-physical locations as well:

> *"Consider the sense of an 'inside' and an 'outside', of intimacy and exposure, of private life and public space. People everywhere recognise these distinctions, but the awareness may be quite vague." (Tuan, 1977, p. 107)*

The insides and outsides which Tuan refers to are in relation to private and public aspects of spaces and ones interaction with them. The level of interaction a person might have within an open town square compared to their own house would be very different, as different amounts of trust would be associated with these 'inside' and 'outside' spaces. This space/place relationship transcends into digital environments equally with the "conceiving of cyberspace as a social space" (Slane, 2007, p. 86).

Social media may be seen as a prime example of present inside and outside interactions in digital spaces. On social networks audiences are imagined and interacted with in varying degrees to the extent where audiences are flattened into one singular unit in a phenomenon of "context collapse" (Marwick and Boyd, 2011, p. 122). This means it becomes harder to juggle between the different manners of interactions we would want to facilitate within these digital spaces. For example, interacting with family and friends. The reference of private and public by Tuan (1977) becomes very apparent in these spaces because of an inherent need for security. A physical diary and a web-log may thus be considered 'insides' in a manner rather than outsides. In this same light when considering OOO and the above four-fold model the inner workings of objects may equally constitute to existing within an inside-space of the object, even a digital space inside a digital object.

I should make clear that when I say 'digital space' I refer to a non-physical location represented by signals of data (digital) and accessible only through mediums such as a computer or similar device. The Internet may be a digital space more easily understandable, as it can only be interacted with through a capable digital interface. The reason I say this is because many IoT interactions don't necessarily occur over the Internet and may happen on the device themselves. Furthermore, the categorisation of *cyberspace* by Slane (2007) restricts it to a network of devices which for the purposes of this framework I must expand upon and also include an individual object-oriented perspective.

Having said that, Slane (2007, p. 85) is of the opinion that cyberspace (or digital space) can be seen as being constructed through social contact and its meaning derived from "the uses to which it is put". This subsequently also means that digital spaces are capable of "multiple simultaneous incarnations" (2007, p. 85) and with each incarnation a subsequent private/public aspect may be further imagined. Therefore from the above context, social may be taken liberally to include not only person to person interaction but also *thing to thing* interaction where digital terminals and objects would be included.

Our IoT devices operate in *'the cloud'*—a common way of expressing the operations of Internet-connected devices. The phrase embodies a physicality for an abstract construct such as the Internet. Verbs such as 'browsing', 'surfing', 'streaming', and 'going online' are used to express interacting with Internet-related material; websites, applications, devices, etc. Yet in truth, the Internet and IoT are a series of abstract algorithms operating on computers that execute an illusion of interaction. When you surf you feel the water and acknowledge the physics of the world the water, surfboard, and yourself exist in. The Internet posits the notion of entering a physical space much like entering the world of a book or surfing. Both the Internet and IoT are experiential but not necessarily similar to physical experience.

The social aspect referred to above may thus be viewed from an object-oriented stance and imagined as being between digital and non-digital objects. Furthermore, by exercising insides/outsides of these objects within this object-social context, we enter a means of arguing for

the private/public[33] aspects of these objects. Things that are not visible/tangible/approachable against those that are. If taking a further aggressive stance towards the object-perspective, this may be seen as a context-collapse of the social interaction of objects within the spaces they occupy.

7.2.1.2 *A digital configuration of space*

This is an argument in perception stemming from years of empirical studies and observations by philosophers around space, time, and the precedence of objects residing within; some of which I've explored in previous chapters. The simplest view is one of *Natural Realism* described by Maund (2003, p. 1) through perception as a method of acquiring knowledge of an "objective world" consisting of physical objects and occurrences with them. For instance, a red apple can be perceived sweet only if that knowledge exists a priori for the perceiver along with related knowledge such as it being an apple, red, etc.

The physical objects or *'things'* in IoT are perceived as objects of the physical world, and for the most part our interactions are predicated by our prior knowledge of interacting with them. Therefore, we *anticipate* an interaction from an IoT-enabled lightbulb to be similar to a non-IoT one. As seen with the constellation metaphor this is not necessarily always the case as the pressing of a physical button might lead to a chain of interactions happening beneath our level of perception. No amount of physical intervention may then alter that reality. As an example, take a *Phillips Hue Bulb* an IoT device whose colour of light can be changed by its app or a physical dial. It does not matter which is used for in truth the change happens through digital interactions. As non-digital human objects we interact with both the digital spaces of these IoT devices as well as the physical spaces in which they exist, making our interactions multidimensional happening inside and outside.

By seeing these interactions in digital/non-digital[34] spaces existing as a phenomenon, we may attempt to make sense of their complexity using philosophical references in tandem with real-life examples. The question phenomenology begs us to ask is, "What is it like to do or experience [something]?" (Muratovski, 2015, p. 79) opening a platform for empathising with these objects and see from their perspective what these *inter-spatial interactions* are like (to us, and *them*).

Returning to Harman's four-fold model we can now juxtapose it with the formulated division of digital and non-digital space (Fig. 24). As there may be no precedence between human interaction and non-human interaction through OOO, the four-fold model may be extrapolated for digital objects. Rather than consider their internal qualities which equate to phenomenological experience, what we are concerned with here is their spatial location to define where these interactions occur and their specific ontologies. Where Harman's model acted upon individual 'objects' and

[33] I should point out that private here does not refer to any information relating to the 'privacy' of an IoT-enabled network or device. True, privacy is a common topic discussed around IoT but here private is taken in a much broader sense to facilitate the crafting of an open-ended framework that fits our purposes.

[34] Though prior published versions of the model explore it through digital/physical references, for simplicity I will not be referring to it as digital/physical here on as that brings about alternative definitions which I would like to avoid. The terminology was altered because this artefact deals with multiple terminologies intermingling, and the simpler I can keep it the better I believe. That said, most of the usage of non-digital objects/spaces to come in this text is in relation to physical spaces and objects.

experience, this version tackles objects and their locations but specific to an understanding of the digital/non-digital.

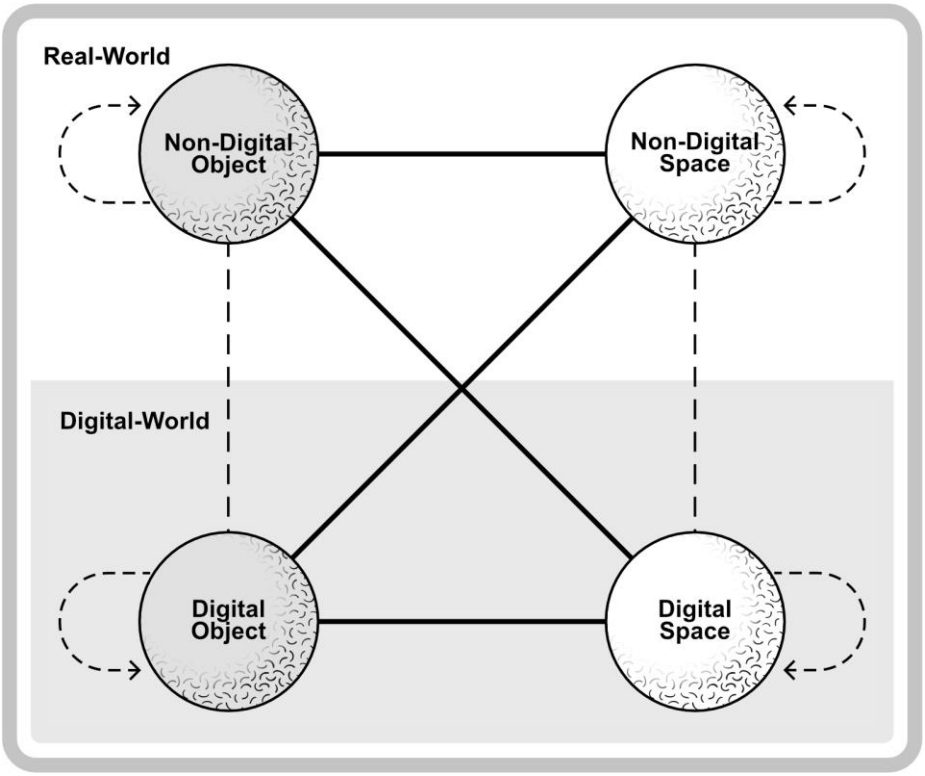

Figure 24: The appropriated four-fold model for digital/non-digital spaces suggests causality on the insides and outsides of digital/non-digital objects with the possibility of them occurring in tandem in both Real and Digital-Worlds.

The actual space occupied by all our elements is now divided through concepts coming from the above defined perspective of spaces by Tuan (1977), of containing a sense of an 'inside' and an 'outside' presenting two realities. One becomes the non-digital reality that we have around us in which we interact (Real-World or RW), the other being a digital one where interactions through/with digital objects occur (Digital-World or DW). Within them exist both kinds of objects and spaces which exhibit a number of possible interactions. I remind you that the four-fold model is for understanding phenomenological experiences while this utilisation deals with a spatial categorisation of experiences. This juxtaposition captures a possibility of digital interactions existing within non-digital spaces, for instance when you receive a notification on your phone while on the street, or when an IoT lightbulb is switched on in the bedroom using a phone from another room. This model represents a way of categorising these broader experiences through both phenomenology and spatial theory.

The idea of digital being present alongside the non-digital has been discussed by some seeing it as a "virtuality continuum" (Milgram *et al.*, 1995, p. 285), whereas others consider a space in which "both the real and the virtual [digital] coexist" (Coulton, 2017, para. 1). Digital worlds are also seen as literal places that, besides being interpreted as heterogenous global networks, may also be viewed in terms of "space, landscape, and localities" (Rymarczuk and Derksen, 2014, para. 1).

Monk (1997) presents Descartes' mind/body split as a way to view the physical world through psychological realities such as the digital. These realities have no spatial configurations akin to physical spaces as their locations are "metaphorically 'in the mind'" (1997, p. 46). Concepts such as augmented reality or virtual reality might be easier to understand in this context. This logic may be similarly utilised to fathom the realities of digital experiences such as IoT that interweave between the physical and the digital. Therefore, the division of space can be justified through a philosophical embodiment of the virtual space as a similar yet altered parallel space to the physical residing within it.

7.2.2 Reconfiguring Insides and Outsides as Heterotopia

The above model now facilitates a phenomenon of IoT occurring through a kind-of spatial theory, it has a structure but lacks specific context. A more detailed characterisation of the inside/outside would help in grounding this framework better. At the moment this model explores individual interactions between unit entities (digital/non-digital to object/space). In most IoT interactions there occur moments where multiple modalities may exist, such as a digital object in a non-digital space interacting through digital space. Specifying how these spaces interact may solve this and propose further possible combinations. To do that though, I will need to return to philosophy.

Michel Foucault once said: "what is interesting is always interconnection, not the primacy of this over that" (Foucault, 2000, p. 362). In his essay *Des Espace Autres* (Of Other Spaces) Foucault (1967, para. 7) introduced the concept of the *Heterotopia* (Greek for *'other place'*), exploring how our lives are "governed by a certain number of [unalterable] oppositions". These oppositions he sees as universally understood arising between different formats of spaces. Examples he gives are of between family and social spaces, or cultural spaces and useful spaces. Perhaps most significant for this work is the opposition he derives between private and public spaces (1967, para. 7).

The crux of his essay is simple: the spaces we occupy follow certain rules. That said, his definition of what *space* constitutes is rather broad and consequently perfect for our needs. He explains these spaces as sacred idealisations calling them heterotopias or placeless places because of their tendency to deviate from the norm. Foucault (1967, para. 9) goes on to assert that our lives are not in "voids" where the "individual and thing" may reside, rather the lives we live he contests are within sets of relations between unique moments we occupy. In his words these are "simultaneously mythic and real contestation of the space in which we live" (1967, para. 13). My intention thus of utilising the concept of heterotopias here is to formulate a series of rules that the spaces defined in the above framework may enforce.

7.2.2.1 *How are heterotopias formed?*

In *The Badlands of Modernity*, Hetherington (2002) approaches concepts of societal modernity considering Foucault's writings on power and politics. He expands on the notion of heterotopia as:

> *"Heterotopias are places of Otherness, whose Otherness is established through a relationship of difference with other sites, such that their presence either provides an unsettling of spatial and social relations or an alternative representation of spatial and social relations." (Hetherington, 2002, p. 8)*

His definition explains how these spaces are created saying that they "bring together heterogeneous collections of unusual things" (Hetherington, 2002, p. 43) as a deviation from the norm. More importantly his discussion focuses on how what matters in a heterotopia is seeing the relationship from an alternative perspective.

This approach makes it safe to imagine unique interactions that may exist within the overlaps of an inter-spatial interactivity model for IoT, as residing within a heterotopia—or a series of heterotopias. Hetherington (Hetherington, 2002, p. 8) goes on to explain a grounding factor of these places of Otherness wherein they occupy "unsettling juxtapositions" of objects. Each contesting established orders of thought, creating alternative hierarchies of an unsettling nature as they "appear out of place" (2002, p. 50). This aspect allows us to view interactions in these spaces in a manner of urgency and thus challenging their meaningfulness towards the actors and the act.

Although the concept of heterotopia has most commonly been used to define alternate physical spaces as those referenced by Foucault himself—such as the cemetery, a festival, or the library—it also is used to define more abstract structures. Examples of abstracted spaces given by Foucault (1967, para. 30) are of the rug as a manner of garden, or a boat in water which he calls a "heterotopia par excellence".

What this asserts is that heterotopia exhibit rules which define the actions that may take place within them. The insides/outsides of our defined spaces and objects in the altered model above may thus be further worked upon to exhibit their own unique rules if imagined as heterotopias. Rymarczuk and Derksen (2014, para. 7) discuss how the boat as heterotopia analogy may be seen as a reflection of cyberspace as a placeless place. They point this out from the fact that digital spaces often involve networks where terminals are connected to operate in a unified manner, even though being separate entities in different locales and times. They echo the point of view by Young (1998) where cyberspace can have further heterotopias residing within it (Rymarczuk and Derksen 2014, para. 7). Furthermore, arguments have been presented suggesting smart cities (Wang, 2017; Handlykken, 2011) which are essentially IoT-enabled utopias, and the Internet (Warschauer, 1995; Ďadulescu, 2012) as modern imaginings of heterotopia.

7.2.2.2 *Principles of Heterotopia in action*

Along with defining this idea of heterotopia, Foucault (1967) established six principles to explain this further. As a philosopher historian Foucault's explanation of heterotopia relates with society, power, and history. His broad approach at defining the characteristics of heterotopias make their concepts easily transferrable.

To begin he affirms that all cultures display the ability to create (or have created) heterotopias. The form of these are varied and depend on causal relationships to the space they inhabit, the culture they are tethered to, and other factors.

Second, society plays a role in altering "established heteortopias [to] change or adapt novel functions and new meanings" (Rymarczuk and Derksen, 2014, para. 5). Foucault (1967, para. 20) explains this with an example of the cemetery which evolved to be a city of its own from prior ideas of sacredness to a "dark resting place" for our loved ones.

Third, is how a single real space may be juxtaposed by several alternate spaces each with an apparent incompatibility to the original. Rymarczuk and Derksen (2014, para. 45) have expressed this to be a defining characteristic of heterotopias, wherein they allow a merger of spaces to exist; such as in our case, a merger of private/public or inside/outside.

The fourth principle establishes a concept of *heterochronies*, a thought that these places of Otherness are moments in time or using Foucault's words "linked to slices of time" (Foucault, 1967, para. 23). This means entering a heterotopia forces a break in traditional understandings of time. For instance, Foucault's examples of when entering a cemetery, library, or museum, describe how time is constantly built up in these spaces. Time has no limit in them in how they horde objects and artefacts that are 'timeless' in nature.

Fifth, heterotopias have a manner of "opening and closing" allowing them to be at once isolated as well as be permeable (Foucault, 1967, para. 26). A way of picturing this is through metaphorical gatekeepers entrusted with responsibilities to allow certain things to enter and exit the heterotopia. Digitally this can be imagined through payment, registration, and identification protocols.

Finally, heterotopias do not exist on their own and instead have a function that is related to what is around them. The definition Foucault (1967, para. 27) gives of this, is of seeing two extreme poles contesting each other in a bid to expose the space they occupy. Creating instead an illusory space that ironically defines the heterotopia as a compensation for the flaws of reality (Rymarczuk and Derksen, 2014, para. 6).

To shed light on this rather broad and vague final principle and accumulate the other principles in one example, Rymarczuk and Derksen (2014) present *Facebook* as a digital heterotopia. The online website/service requires actors—or in its case *users*—to follow certain rules of conduct. In order to immerse themselves in this digital world they must agree upon set terms through Facebook as the gatekeeper. This also strips away their claims to the information they provide. Rymarczuk and Derksen (2014, para. 12) critique this aspect of the service saying that leaving the space entirely is rather difficult. Since publication later updates of Facebook have added a deletion option though the design of the feature arguably discourages such activity. Furthermore, this does not remove already present interactions done with other users, such as posts or messages which essentially aligns to the fifth principle of heterotopias. Moving on they affirm that Facebook shows the "distinct regime of time" (2014, para. 15), that Foucault (1967, para. 24) describes in his fourth principle comparing it to museums that "accumulate time". This makes Facebook a *heterochrony* akin to a

library, but instead of books a library of personal moments and data. “Facebook collapses past life, present life and afterlife into something very other” (Rymarczuk and Derksen, 2014, para. 35).

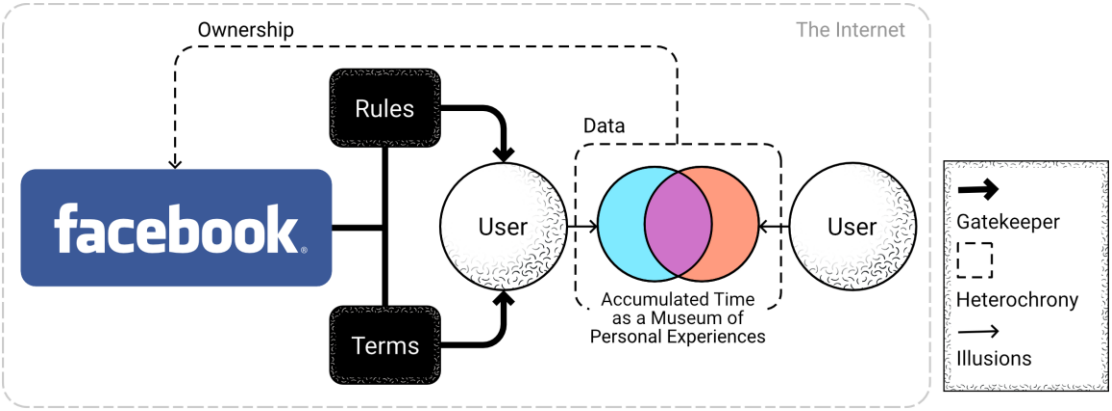

Figure 25: The digital entity that is Facebook may be viewed as a heterotopia as it facilitates and oversees the accumulation of time through the lives and data of its users.

They converge on the third principle by explaining how *Facebook* views privacy, wherein the public domain is viewable to both *Facebook’s* owners and those constructing their social spheres. These create larger bubbles or networks, and though individuals are divided into seemingly personal spaces, what distinction should be present between private and public is blurred. This is because, the entity that is *Facebook* in its online presence as a whole “is not an undivided space” (Rymarczuk and Derksen, 2014, para. 50). Finally, the sixth principle is a discourse on the illusion that *Facebook* gives of connectivity which they present in the manner of performance. An attempt to return power through “inauthenticity”, having its users “rejoice in the fact that it gives them the ability to present themselves to the world” (2014, para. 54). *Facebook* thus becomes a heterotopia existing within another heterotopia of the Internet (Fig. 25).

This adaptation of the principles of a heterotopia applied to a digital entity such as *Facebook* is a prime example of the above discussion of reframing digital spaces as possibly housing phenomenological insides and outsides. A spatial configuration enforced by heterotopic rules to guide the interactions possible within those spaces. With all of this information in hand I can now begin to craft a model for a philosophical view of IoT that inhibits the ability to see IoT interactions through a configuration of inter-spatiality.

7.3 Crafting a Model for a Philosophical View of IoT

The toolbox is now laid out and contains philosophies of phenomenology and an understanding of spatial theory combined with the ability to define spatial rules through heterotopias. In this section I will attempt to adapt all of these findings together to reimagine the above adaptation of Harman’s four-fold model. Just like when a personal diary becomes a heterotopic space of relevance to its owner, so too does a smart phone. And while online services such as *Facebook* can be seen as heterotopias, it is with the ability of ontography afforded by OOO that we can lay bare these interactions happening within the heterotopias of IoT. To explain this, I left out one example of

Foucault's heterotopias till the very end. It is the most compelling and the inspiration for this model. In it, Foucault describes the interaction with a mirror:

> *"The mirror is, after all, a utopia, since it is a placeless place. In the mirror, I see myself there where I am not, in an unreal, virtual space that opens up behind the surface…a sort of shadow that gives my own visibility to myself…But it is also a heterotopia in so far as the mirror does exist in reality, where it exerts a sort of counteraction on the position that I occupy. From the standpoint of the mirror I discover my absence from the place where I am…The mirror functions as a heterotopia in this respect: it makes this place that I occupy at the moment when I look at myself in the glass at once absolutely real, connected with all the space that surrounds it, and absolutely unreal, since in order to be perceived it has to pass through this virtual point which is over there." (Foucault, 1967, para. 12)*

What Foucault poetically describes is a parallel space which appears to have utopic traits since you see yourself as an illusion. Essentially, the space of the mirror which involves the reflection exists because there is something in the space *in front* of the mirror. A second example he gives in this same note is of a telephone-line. When speaking onto a telephone we acknowledge the existence of the other through their *voice-on-the-line*. Though the other is not physically present with us, their voice is enough to give the illusion of their presence. The voice-on-the-line thus occupies a heterotopic space. In both examples, neither space can exist without the other. This can further be explored through IoT as a heterotopia when considering our devices. The act of seeing your activities on a smart phone, such as while using *WhatsApp*, can be presented as a parallel to the *voice-on-the-line* example.

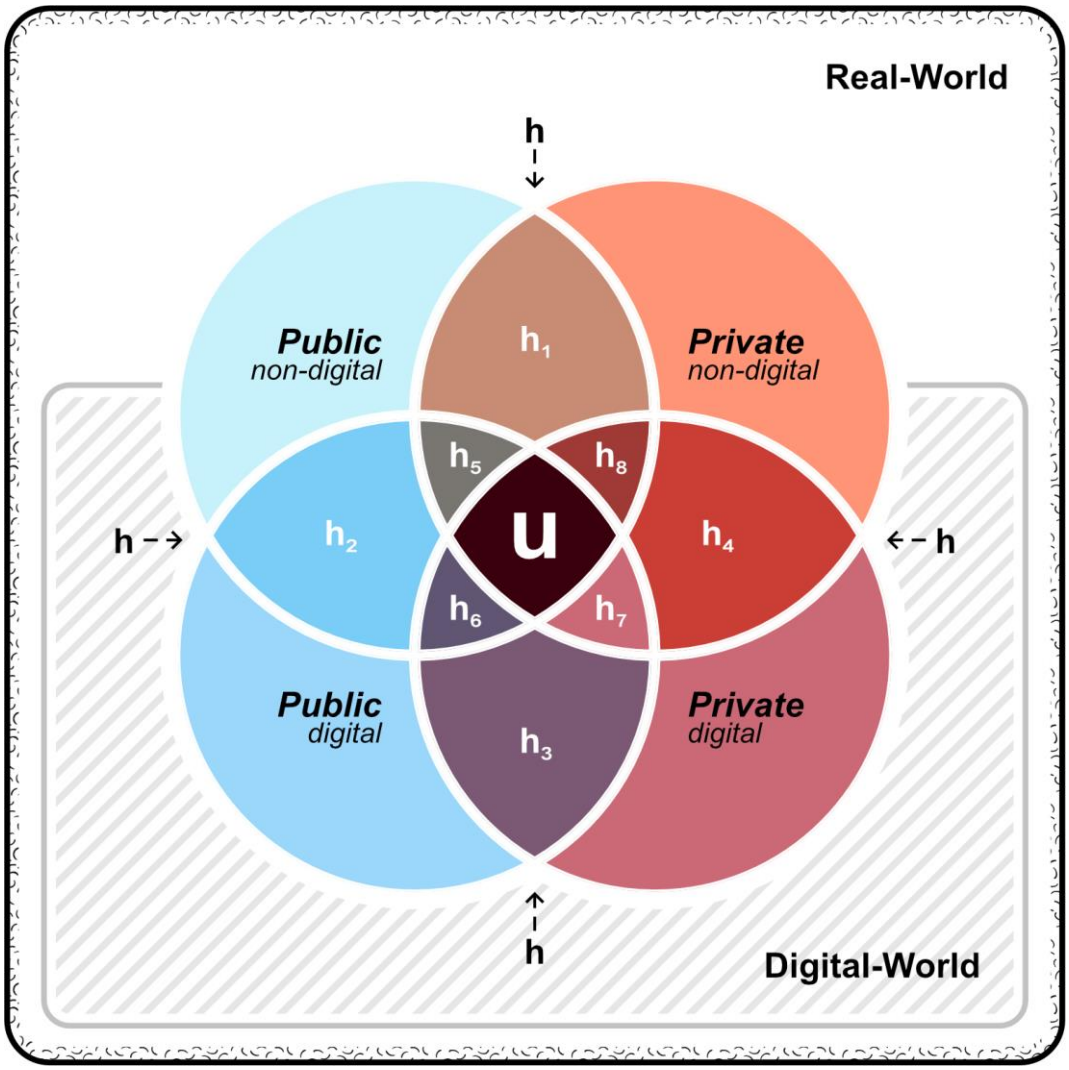

Figure 26: Model for a Philosophical View of IoT.

Thus, the following model now can be crafted (Fig. 26). It incorporates two spaces coexisting as one within the other each with its unique rules and regulations encompassing individual spheres of privacy and publicness. Our original adaptation of digital/non-digital objects/spaces is transformed to acknowledge the social nature of interactions occurring in these spaces by considering them as private/public or inside/outside bubbles. Though they still exist within the RW and DW larger ecology, they now converge to create overlaps collectively making a series of heterotopias. The overlaps created can be characterised as relating to Private–Non-Digital (P_rND), Public–Non-Digital (P_uND), Private–Digital (P_rD), and Public–Digital (P_uD) forming unique and albeit complex heterotopias (h_1 through h_8).

Private–Non-Digital (P_rND): One of the two divisions of RW, it encompasses ideals and information that are most intimate to us forming our inherent acknowledgement of non-digital internal or private workings of spaces and objects within. For instance, the physical space of a bedroom could be considered a non-digital private space. Being a personal perspective it is hence of more importance to the individual to acknowledge it as such, but to function as a true 'private' it requires an understanding of a corresponding opposite.

Public–Non-Digital (P_uND): Opposing general notions of privacy it defines the private as much as it defines itself. An open reality that exists around us, governed by culture, society, government, policy, to name a few. The public exists as a platform of interaction that is open and valid for all to interfere/intersect with. Carrying on the example of a home, a communal living room could be accepted as a non-digital public space, and in a larger perspective a park where one can be easily seen and interacted with.

Private–Digital (P_rD): First of the two counterparts in DW, it incorporates rules that are defined by the individual to replicate their real notions of privacy. In Varnelis and Friedberg's words, "the always-on, always-accessible network produces a broad set of changes to our concept of place" (Varnelis and Friedberg, 2008, para. 1). They refer to the mobile phone as a "telecocoon" discussing how the device facilitates pseudo-private encounters in otherwise public spaces through distanced intimacy (2008, para. 22). Therefore, creating the counter existence of the private in DW. A personal smart phone can be considered as a private digital space within a non-digital object.[35]

Public–Digital (P_uD): Second of the two counterparts this facilitates the public sphere through digital interfaces. Interfaces here does not necessarily relate to physical interfaces such as smart phones rather those existing within the public ether. These are interactions that occur between digital objects within their digital spaces, think wireless transmission of data. The DW thus allows for a continuum of those interactions between P_uND through to the digital. Alternatively, the inclusion of a non-digital object allows for an extension of this space into RW. As DW is a subset of RW this is anticipated. A television set can be seen as a digital public space experienced through RW.

Heterotopia 1 (h_1): The first overlap to occur is between Private Non-Digital and Public spheres. Here the interactions are those that happen in our daily physical lives influenced by non-digital elements in the world around us. As an aid to understanding the concept better, I will be using an example of fitness tracking to illustrate the differences within the model. An actor could imagine the physical steps taken inside a building as being a non-digital private interaction that in truth is also a public interaction as the steps could be visible to others in the same non-digital space. This is because of the earlier configuration of private/public through inside/outside. Remember that public refers to the tangible concepts such as physicality whereas private refers to intangible hidden elements such as digital data. To the actant, walking alone indoors may appear as a private interaction though with the gatekeeper of this space being the building and not in control of the actant, this space becomes less private. By taking a step they have others potentially be aware of it. Furthermore, an amount of time is accumulated to take each step and observe it, hence the acts are *heterochronic*. Each step is taken has an illusion of displacement which, in this instance, conform to the laws of physics and subsequently remove one from their initial stance (standing or moving) towards another.

[35] Though it might sound strange to call a smart phone a 'non-digital object', that holds true to the framework established in this chapter. The smart phone enables interactions with the digital space, though itself it is an amalgamation of different non-digital materials such as glass, metal, silicone, plastics, etc. Furthermore, it exists not in the world of binary data that digital interactions concern with but in the non-digital world of atoms and molecules.

Heterotopia 2 (h_2): Moving anti-clockwise around the model, the next overlap is seen between P_rND and P_rD. Using the same example of fitness tracking, this form can be seen when an actor uses a physical tracking device such as a *Fitbit* to represent real steps in an alternate state, in this case numeric data. Although the information is the same (they both represent physical steps) but due to the fact they are within two different spaces (RW and DW), they are visible in different ways. Variations of the Private clash together creating an alternate reality of privacy which exists only in DW, hence it is in many ways similar to the illusion in Foucault's mirror; one version looks at the virtual version of themselves, and grounds the visibility of the other in their respective realms.

Heterotopia 3 (h_3): Next, we see an overlap between P_rD and P_uD. The interaction here should abide primarily by rules in DW with little influence from RW. Continuing with our example, the steps saved to the fitness tracker are now allowed by the wearer to be stored on an online server. The reason this is a P_uD interaction is because the server may be operated by other entities who could prescribe policies and regulations to oversee this information.

Heterotopia 4 (h_4): The next overlap is between both iterations of Public. Many interactions tend to exist in this space which are free to access through open data creating a publicly viable connection between the non-digital and the digital. Looking back at the steps taken example, imagine a wearable device that doesn't share data with its wearer, but instead saves it immediately to a public server. A service such as *If This Then That* (IFTTT)[36] could then be used to parse this data and initiate some action. For example, the step data is sent from the device then parsed into an online spreadsheet. Another way of considering this is through the example of an IoT lightbulb. The bulb is connected to a digital interface allowing you to turn it on or off via a mobile device. By placing the bulb in a room that can be operated through a public link on *Facebook*, anyone with the link can access it digitally and change the status of this physical bulb. The bulb exists as a physical object and has a digital presence accessible through the mobile device making it exist there as an alternate of itself. When turning the bulb on from the mobile, there is no direct physical interaction being made with the bulb, yet a very physical alteration occurs in the state of the bulb wherein it turns on. This makes this interaction a very public one where even though physical contact is not happening a very visible physical change occurs.

Heterotopia 5 (h_5): The inner overlaps of the model are where more complicated interactions begin to appear governed according to unique orders. The first of which occurs as a P_rND–P_rD–P_uND interaction. As this occurs primarily in P_rND it would be more influential, but the interaction would have traits of the other spheres. Let's take a look at our steps being saved from our *Fitbit*. What if that data were to be synced with another device of a partner? This would allow them the ability to scroll through digital data shared with them and vice versa. Although the information here is present in different versions (real steps and numeric iterations) the presence of another individual and their physical device can be taken as being in both non-digital and digital spaces simultaneously.

[36] An online protocol that allows you to interlink IoT services and devices through simple algorithms or *if-this-then-that* statements.

Heterotopia 6 (h_6): Here we see a P_rD–P_rND–P_uD overlap with things primarily grounded by the P_rD but influenced by others. This can be imagined very similar to our example in h_5 by substituting the second device with a website where all data is synced and shared with a wider community. The use of social media can also be imagined here. The fitness tracker saves physical data it interacts with and sends that to a server, which subsequently interacts with social networks such as *Facebook* sharing the information publicly. The movement of this information from RW to DW and then again into DW but as a very different version of itself shows how simple data collection can be repurposed in different spaces exponentially. Every jump changing the data to reaffirm according to the nature of the other space it inhabits.

Heterotopia 7 (h_7): In a P_uD–P_rD–P_uND overlap a more digital approach of trust can be observed. The IFTTT protocol earlier imagined saving data on a spreadsheet can be reconsidered. This time though, instead of saving to a personal spreadsheet the data is visualised on a public device; perhaps on a digital display in an office. This display informs all employees about how many steps have been taken in the office, but only by the employees. Considerable trust must be given to the office servers with their personal data and devices to be able to accomplish this.

Heterotopia 8 (h_8): Finally, in a P_uND–P_uD–P_rND overlap one can see non-digital dominating the digital. A way to picture this interaction would be with a door that can monitor people going in and out of it using wearable RFID tags. The data is coming from a physical source and returning to a physical source by being displayed publicly. But what makes this unique from h_7, is that here the data is taken directly from the physical source and not through any virtual channels. Alternatively, and to make it more interesting, the P_uD can be a source of information that could be syncing an individual's data according to their interaction with the door. Imagine a shoe with an RFID tag, it moves between the door and registers the wearer subsequently syncing fitness data that is tracked by the shoe. This in turn, is returned to physical output (like the same digital display), only this time through direct physical interaction.

The complex list of overlaps above, map out the many heterotopias occurring within an IoT-enabled space. Jumping between RW and DW, the information must morph and accommodate to the new rules and hierarchies the heterotopias enforce. This overlapping model leaves one space in the middle though, where much more complex interactions take place. Taking from the mirror analogy of a utopia this space has been marked *u*, and here is where a *digital private-public* yet simultaneously *non-digital private-public* interaction takes place.

To imagine this, deep levels of permission and trust need to be facilitated. That can only happen if the different interactions allow for major alterations in the nature of information handling. Therefore, some creativity is required. Imagine a scenario where your fitness data is tracked to your *Fitbit*. That in turn, sends data to a server which allows access to physical devices to relay that information when and where they wish. Now picture going into a gym and seeing a wall light up with your specific information. Your steps are being tracked and shared with you, but very openly. Others can see and possibly interact with it openly as well (perhaps via social media channels).

Ignoring any personal concerns one might have with the public display of their gym performance, such an interaction can only take place when levels of permissions have been allowed over different spaces. These permissions will have to overlap with different policies, regulations, terms, and conditions, etc. By making this interaction between user-device-service-institute and so on, new heterotopias are dynamically created where the rules differ and thus the device must operate in that way. Any change happening in any of those rules reverberates through the entire constellation of tracking fitness through a *Fitbit*.

7.4 Discussion and Conclusion

The previously crafted model explores a kind-of spatial configuration for understanding the interactions that occur within IoT-enabled systems. It compares the phenomenology associated with OOO with spatial configurations coming from the field of human geography. It creates a series of spatial definitions that allow for interactions that occur within digital objects to be seen as phenomenological insides and outsides opening them up for scrutiny. It affords an open-ended approach at making visible the interactions of IoT through these philosophical concepts. That said, two questions can now be approached, *(a)* has this model answered the sub-question posited at the start, and *(b)* how has this model manifested playfulness within its design process?

Regarding the first question this model does not immediately answer that question but creates a trajectory towards answering it. This model in many ways extends the works of Boyd (2008) around concepts of "context collapse" (Marwick and Boyd, 2011, p. 122) and "social-mediated publicness" (Baym and Boyd, 2012, p. 322). Where her work focused on defining human interaction patterns occurring in social networks such as *Twitter* and *Facebook*, this model approaches a social networking of things by facilitating a similar discourse through heterotopias. Boyd's (2008) concept of mediated publics comes from the notion that social media complicates and blurs audiences and ideas of publicness affording alterations to public engagement within those spaces. Her argument is that in order to navigate these mediated spaces we must alter our behaviours allowing new controls and skills to form.

The model approaches a similar construct by suggesting phenomenological object-spaces for digital objects and their interactions. These spaces are mediated just as Boyd's view of social networks because through the object-oriented lens an object-geography is imagined. A social context collapse of digital/non-digital objects and their digital/non-digital spaces. To the digital objects the non-digital objects exist as equal to them on a level plane afforded by OOO. Because of this our interactions and the ways in which we must navigate them must be reimagined.

Furthermore, it also extends the on-going debate in understanding object-oriented-ness or the 'insides' of objects coming from previous chapters. Through their various efforts both Harman (2010c) and Bogost (2012) have debated the possibility of quasi-interactions and spaces exploring new theories of causation and imagining alternative perspectives of being. Though not encompassing all manners of objects and spaces, the carpentered model affords viewing the digital-objects through an object-oriented perspective.

Therefore, could this model highlight potential problematic effects within IoT? In some respects yes, through a playful appropriation of philosophical concepts using carpentry this model argues for an alternative perspective towards viewing IoT, and seeing the IoT object/device/thing as the 'client' in this design problem. *"What does this IoT toaster want/need as a client?"*, could be one way of viewing how this model helps understand the potential problematic effects within IoT because it attempts to lay bare an ontographical view of IoT interaction.

Regarding the later question of how a playful attitude has manifested here, this model as artefact takes vast liberties with how philosophical discourse is conducted. In many ways this entire manuscript does that, by equating concepts as things that have play imbued within them akin to Bogost's (2016) view of play existing within things. Rather than the things being toasters, cars, screwdrivers, grass, etc., here the things become philosophical concepts such as sensual, real, heterotopias, space, and so on to approach a phenomenological understanding relevant to this research. Granted no physical *'thing'* has been *'made'* here instead this chapter explores the making of a conceptual framework upon which further making may be conducted. In that sense playfulness as an attitude exists in the design process for seeing these philosophical concepts as possible *play-things*.

In Chapter 2 I expressed how while presenting a piece of my research at a conference to both philosophers and designers, I was met with a remark that this research would not bode well within philosophy circles but works for design. This model was that particular piece of research presented that day and remarked upon. It facilitates a designers playfulness with otherwise ominous philosophical constructs as if they were akin to *Lego®*.

It can be argued that this framework is still an anthropocentric perspective over an object-oriented one as I have used certain examples relating to human interaction in the model. The reason that was done was to create a relatable reference point for further non-human examples. True the heterotopias all exhibit information coming from gathered *human* related data (footsteps), it can still apply to non-human data. By substituting the *Fitbit* with a lightbulb existing on its own in its space a more object-oriented perspective may be achieved. The reason I keep the *Fitbit* example is because in the end we as humans share in these digital spaces as well. These objects are designed with the intention of being used by humans after all, so in a Catch-22-esque manner the human cannot be completely removed from this equation (at least not in this instance).

A design question this model may ask is whether it's necessary for an interaction to occur when it does? Alternatively, it effectively allows a way of characterising digital and physical interactions as relations. These relations are explored through varying levels of permissions defined by their heterotopic natures. The carpentered model thus places a philosophical lens above IoT-enabled systems, revealing IoT in phenomenological terms through spatial theory. What can be noted here is that the closer one gets to the centre of this inter-spatial interactivity model, the greater the complexity of interactions occur (Fig. 27).

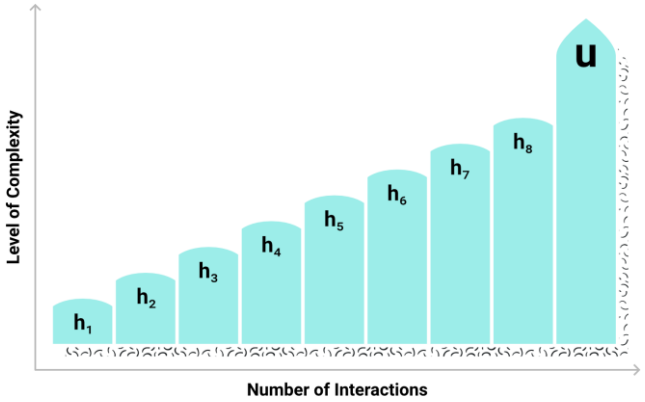

Figure 27: Interactions become more complex as we close in on the centre of the model.

The increased levels of complexity, which includes increasingly diffused relationships of trust, play a role in questioning the meaningfulness in how these interactions happen and are designed. The complexity that ensues from the ever-expanding interconnectivity of IoT means that a lot of information is either lost, ignored, or deliberately obfuscated. When various previously clear relationships of trust are being altered, is the interaction still worth it to the actor? Are there any measures that can be taken to renegotiate this trust, or, indicate that it has changed?

The social geography imagined of objects allows for a framework upon which discussions and further artefacts around the notion of mediated spatial configurations for IoT interactions may rest. The coming chapters attempt to utilise this framework to understand this notion further. For now, using the above model in conjunction with philosophical constructs such as OOO, a path for using philosophy as a potential tool to help in design research for IoT may be imagined by presenting a novel means of dissecting the inevitable messiness associated with digital and physical interactions.

CHAPTER EIGHT

PLAYING WITH THE IOT

"Instead of deriving an understanding of play from a particular object or activity, like war, ritual, or games, I see play as a portable tool for being"

— SICART (2014, P. 2)

8.1 Introduction

Now that we have a framework for viewing IoT systems and interactions as occurring phenomenon of spatial configurations, we can begin to apply it towards understanding interactions in IoT further. The inter-spatial interaction model from the previous chapter allows us to view IoT through a lens of philosophy presenting an opportunity for detailed scrutiny. From a design perspective we can ask whether certain design choices are required when dealing with a specific manner of interaction, and in this process attempt to address the sub-question (SQ1) from before. The model also reveals the convoluted nature of IoT interactions through its different heterotopias in a context collapse of thing-geography. An object-oriented perspective of the relations of objects echoing the constellation metaphor proposed by Lindley and Coulton (2017) in a detailed and open-faced manner. All that said, to answer SQ1 as a model it must be applicable for design intervention and practice, and to that effect in this chapter I will be presenting a journey of the development of a board game inspired by the inter-spatial model.

Why a board game you might ask? Certain reasonings became apparent when approaching the next steps from the model. Establishing the framework required a playfulness with philosophy that came from engaging in carpentry. In order to exercise the end model as the phenomenon it characterised IoT to be, an equally playful experiential approach was needed. A board game thus became a potential means of enacting it. In this manner, the artefact presented in this chapter attempts to address two of the sub-questions from this thesis. The first is SQ1 relating to how an object-oriented lens may be used to highlight potential problems in IoT, the second is SQ2 which states: *How does an attitude of playfulness occur in this research through design activity?*

The latter question was lightly touched upon at the end of the previous chapter, but is more directly illustrated through this artefact. Earlier steps post-designing the model were to create a tool that would allow designers to understand their design approaches towards IoT more fully. A question I ask of this research is how to allow designers the ability to objectively view the design of IoT? The model allowed that to happen in a systemic breakdown of interaction design by proposing a flat ontology of interactions, but an application of the model in a more easily conveyable manner was

still required. This is why I refer to this chapter as a journey. One that taught me about game design and playfulness as much as it did about how well the model reflected IoT, and whether it could help in understanding design choices for IoT.

In that light, I can consider the crafting of this artefact also represents carpentry. It allowed me to exercise the philosophical concepts this research argues for in the context of IoT but in a manner where the philosophy can be scrutinised as much as enacted.

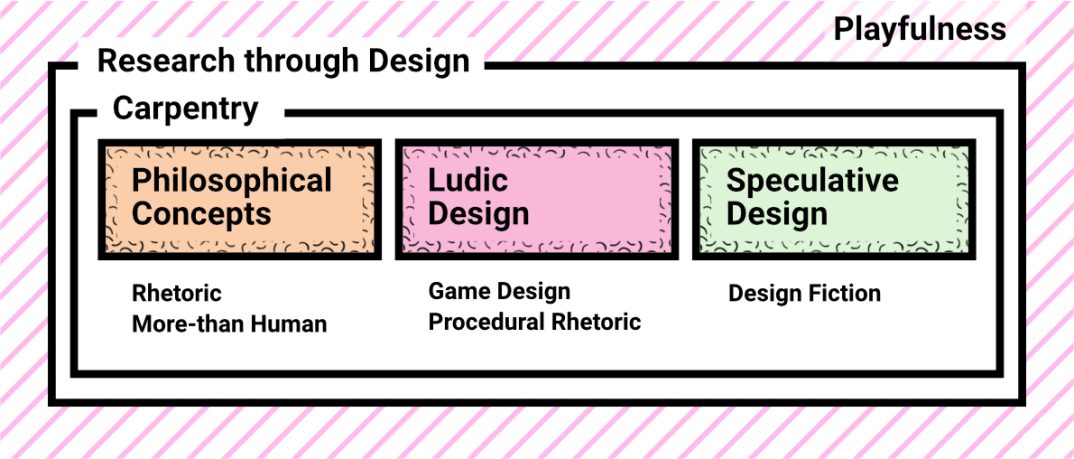

Figure 28: The method assemblage for the carpentry of this artefact explores playful appropriations of philosophies of rhetoric and the more-than human, combined with concepts coming from game design and speculative fictions, that feed into experiencing the inter-spatial model through gameplay.

Unlike the previous artefact that was more directed towards establishing a philosophical framework, the method assemblage exercised in this chapter introduces ludic design and play in a more direct manner (Fig. 28). As I'm not a game designer myself a level of understanding was required to begin the design process. This chapter is thus presented in two sections, the first explores the logic that went into design choices. By referencing relevant literature I define how rhetoric is a key component in this artefact as the game attempts to explain the workings of the model through gameplay. This is supplemented with the core methodology of this artefact of RtD approaching a way of using Game Design (GD) as an extended methodology. Ludic design advocates for curious-engagement (Gaver *et al.*, 2004, p. 888) and to achieve that this artefact explores the use of gameplay as a driving mechanism for engagement, ambiguity, and curiosity. This is crafted into the artefact through speculative fictions that create the atmosphere of play combining our three method assemblages of philosophy, ludic design, and speculation under the banner of carpentry. The game was designed over a series of iterations which create the second section of this chapter where I walk through the various design choices, obstacles, and realisations that arose in the iterative design process. Finally, this chapter ends in a discussion as to how successful this approach was through gathered notes and reviews from playtesting, as well how well this process captured playfulness as an attitude.

8.2 Creating a foundation for approaching Game Design

The model from Chapter 7 laid bare layers of an IoT interaction nudging at OOO's view of the proximity of objects proposed by Harman (2011b), and, its strength in exploring causal 'rifts' (Harman, 2018a, p. 161). In the previous chapter I refer to this as a thing-geography where relations between things are presented. These notions might not be too outlandish to explore through philosophy, however, when attempting to incorporate it in design practice the necessity becomes understanding it on more than a philosophical level. Persuasion is a common literary tactic utilised in philosophy with most philosophical discourse resonating an agenda of persuasion. This is a good time to return to the idea that Design is *also* an argument for persuasion. When Buchanan (1985) refers to design as *rhetoric*, he is referring to this very notion of design as an act of persuasion. Designers attempt systemic justifications of their ideas; or, their 'designs'. Hence, rhetoric becomes an important aspect of not just philosophical practice but also design practice.

When considering a history of rhetoric, and its relationship with philosophy, considerable research is present (Frogel, 2005; Worthington, 2008; Garver, 1982). In antiquity the roots of purposeful rhetoric can be found in the practice of eloquent oration and systemic speech; the Greek's being mostly accredited with its systemic formulation (Worthington, 2008). Accounts of rhetoric move between the Sophist practices of taking contradictory stances through *dissoi logoi* (double argument) to the Aristotelian approaches of persuasion ranging across centuries (Day, 2008, pp. 382–6). Looking at synonyms of the word 'rhetoric' one finds its comparison to *bombast*, *grandiloquence*, and *hot air*, contributing to negative connotations in the contemporary usage of the word as *"rhetorically speaking"* or *"it's all rhetoric"*.[37] None the less, Aristotle's *Art of Rhetoric* is considered a fundamental pillar in any study in the area as its reach spreads through antiquity into contemporary philosophical practice (Fortenbaugh, 2008, p. 107).

8.2.1.1 *Modes of Rhetoric*

Aristotle's perspective of rhetoric differs from his earlier counterparts, in that it becomes an argument for persuasion rather than political oration.[38] Aristotle thus defines rhetoric as "the capacity to consider in each case the possible means of persuasion" (Fortenbaugh, 2008, p. 107). Rhetoric becomes the art of argumentation rather than stylised verse. The rhetorician sees the potential for persuasion in every instance presented.

Though Aristotle's *Art of Rhetoric* is considered a "problematic" read (Fortenbaugh, 2008, p. 109), it sheds light on three base modes of rhetoric: *logos* (logic), *pathos* (empathy), and *ethos* (credibility) (Rapp, 2010). Even though Aristotle believed the art of rhetoric could only be used in practices of law, politics or ceremonial speeches (Frogel, 2005, p. 27), these modes of rhetoric have established themselves in philosophical discourse as canon. Though there is much more to say on

[37] Roots for this practice could be in Plato's negative evaluation of the perception of rhetoric as argued in his *Gorgias* against rhetoric as an artform; mainly for how it was used at the time by its interlocuters (Frogel, 2005, p. 12).

[38] Being flawlessly skilled in their craft does not mean a doctor may never fail to cure someone, similarly, a well-versed orator does not necessarily captivate or persuade an audience.

the topic of rhetoric and the different modes beyond these (Rapp, 2010), our discussion is restricted to the basics.

In the three modes, *logos* is considered the most important dealing with rational arguments which take on the form of syllogism's; or as Aristotle called them *enthymeme* (Fortenbaugh, 2008, p. 110). Enthymemes are more than linear arguments, Aristotle's definition of them is of understanding something without being explicitly told (Harman, 2018a, p. 91).[39] The other two modes of rhetoric, *pathos* and *ethos*, look at emotional appeal and character respectively. A fourth mode also exists, though less used directly when explaining rhetoric. None the less, it plays an important part in our argument; this mode is *kairos* or time. It refers to the opportune time and place to make an argument that affects its persuasiveness, in other words, context.

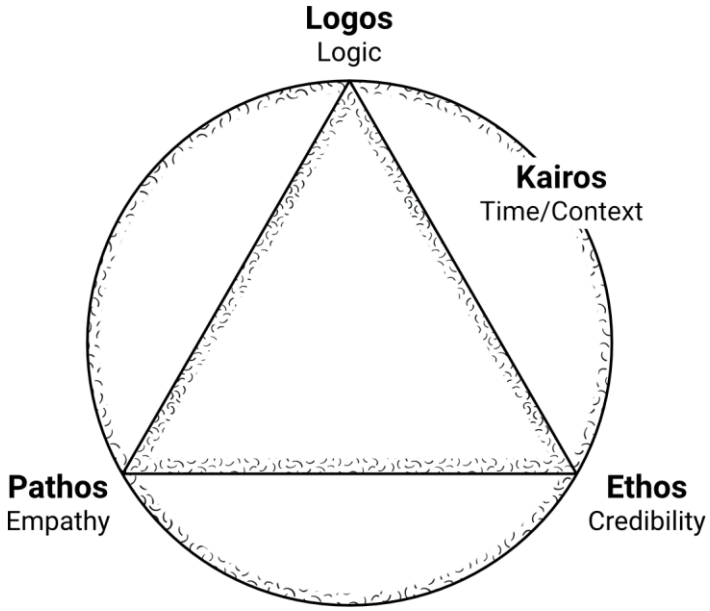

Figure 29: Modes of Rhetoric according to Aristotle's Art of Rhetoric appropriated from Coulton (2015b).

Collectively, these modes create a model for establishing rhetoric (Fig. 29). The different relational modalities form rhetorical or literary devices.[40] Having dealt with this additional philosophy, the relation of rhetoric and play can now be explored.

8.2.2 Play and Rhetoric

Rhetoric need not be considered with philosophical prose and speech alone. As pointed out with Buchanan's (1985) design as rhetoric, other approaches also exist such as animal rhetoric (Kull, 2001), visual rhetoric (Kim and DiSalvo, 2010), and even a further encyclopaedic list of types of rhetoric (Sloane, 2001). Bogost (2007, p. 46) presents a further area of intrigue by suggesting all

[39] Harman's (2018a, p. 91) OOO finds an important use for enthymeme in its philosophy by explaining how humans understand phenomenon with little 'provided' information. This concept of enthymeme will be further explored in the next chapter.

[40] In light of the rhetorical model, a 'metaphor' is a rhetorical device or a figure of speech. However, when used in the opportune context may carry significant weightage. An exhaustive list of such devices can be found here: https://literarydevices.net/.

systems entailing procedures or "unit operations" as exercising rhetoric. Though his argument is primarily for computer software it opens a possibility for rhetoric existing in play-like activities, where he and others argue in favour of games as being one such activity (Coulton, 2015b).

As explored in Chapter 6, play embodies activities fuelled by curiosity to present innovative opportunities for creativity. While on the subject, a relation between games and play must first be clarified. Chapter 6 introduced us to games as playgrounds where play is executed, yet the colloquial use of the word *game* implies something very specific. Wittgenstein famously believed that the definition of a game was not possible due to the diverse human activities that can be classified as 'games' (Costikyan and Davidson, 2018, p. 179). Generally, when speaking of 'games' the understanding is an activity for amusement, but as already explored the act of play does not necessarily revolve around amusement. Serious games are one such example where the focus is not amusement and often educational purposes (Abt, 1970; Breuer and Bente, 2010). Hence, certain *game-like* activities don't necessarily fall within the logic of play-for-amusement.

The inclusion of 'game-like' activities to illicit a notion of play is commonly known as the practice of *gamification* (Zichermann and Cunningham, 2011) and oft used in different scenarios for facilitation purposes. For example, when games are used within a research context, they tend to emerge through a process of rendering *game-like* elements within the confines of already present ideas or references. The many design tools available that use play-like systems from cards and board games to facilitate design workshops and design research come to mind.[41] Arguments have been made for the persuasive powers of gamification, but this approach has faced controversy as it can be deemed as manipulative and only effective in very simple situations (Coulton, 2015b; Deterding *et al.*, 2011). Therefore, the artefact must go beyond the limitations of gamification and incorporate a more robust notion of play that allows for an exercise of rhetorical persuasion.

8.2.2.1 *Procedural Rhetoric*

Games and play have a history of being used for propagating ideas highlighting a means of "persuasive play" (Grace, 2012, p. 77). Bogost (2007, p. 28) proposes it as a way of revealing underlying processes and concepts to a player in a means to embody a quality of persuasion which he calls "procedural rhetoric". Certain *advergames* utilise persuasive play with a purpose of brand promotion over gameplay (Cauberghe and De Pelsmacker, 2010; Bogost, 2007; Jayaswal and Malati, 2017).[42] Though such games are commercially driven other persuasive games have been successfully used to reveal underlying systems that affect people's lives.

Games offer a space where players can "explore alternative ways of being" (Coulton and Hook, 2017, p. 111), enter philosophical environments for opening "new and interactive horizons of thought" (Gualeni, 2015, p. 85), or encounter social dilemmas through balanced cooperative and

[41] Roy and Warren (2019) have gathered a list of 155 card-based design tools as a way to document the use of play-like elements in design research.

[42] An example of an advergame is *Pepsi Man*. Popular in the 90s, the game had players control a human embodiment of the *Pepsi* brand, subsequently presented with numerous references to the *Pepsi* product during gameplay.

competitive actions (Zagal *et al.*, 2006, p. 30). A game such as *Darfur is Dying*[43] further reveals a potential of games that is not limited to entertainment but also for social impact through imagining "games as artefacts" (Grace, 2012, p. 2). Bogost's (2007) comparison of games to the art of rhetoric suggests the purposeful embodying of procedural rhetoric within a game may afford it a power of persuasion. Whether it be to persuade players to compete against each other, collaborate for a universal goal, or personal/social growth. This lays a foundation for attempting *Research through Game Design (RtGD)* by employing procedural rhetoric for a persuasion-by-play of the arguments presented from the inter-spatial interaction model.

8.2.2.2 *Research through Game Design*

Strong similarities exist between RtD and GD owing to their similar iterative processes. Salen and Zimmerman (2004) discuss the process of GD as a design process defined through play where they emphasize the presence of prototyping and playtesting to inform design decisions. Earlier in Chapter 5 I presented RtD in par with practice-based research and as Faste and Faste (2012, para. 23) referred to it as "embedded design research", whereby it incorporated a designers' knowledge of the world as much as its own purpose owing to the fact that it involved practicing design as a discipline. This perspective is apparent in GD's iterative process as Salen and Zimmerman (2004) argue that the questions related to the design of a game may only be answered through playing it: "Through the iterative design process, the game designer becomes a game player and the act of play becomes an act of design" (2004, Chapter 2, para. 4).

In the case of GD, the artefact is oft in the form of unstable versions of a game approaching a 'stable release'.[44] To *et al.* (2016) further present a perspective of the game design process as a transformational framework involving iterative cycles that go between delineating goals and designing through prototypes and testing. This is an approach similar to one suggested by Herriot (2019) for RtD. In terms of GD's use for research, arguments can be found touting benefits for participatory design to practice-based design (Coulton and Hook, 2017, p. 99) and even in sociological and anthropological studies (Gobet *et al.*, 2004). Coulton and Hook (2017, p. 99) praise the use of RtD as being "highly suitable" for academic research for games due to an under-representation of practice-based design research within academic games literature. They continue their discussion into how game design research may indeed offer "insights for design research" (2017, p. 97) more generally.

For these reasons I present a possible iterative framework for the design of this artefact as a game (Fig. 30). Adopting traits of both GD processes and RtD it allows for the artefact to enter a series of iterations fuelled by background research, testing, and feedback all feeding into a final

[43] In *Darfur is Dying*, players take on the role of a refugee during the war in Darfur. They are tasked with finding survival amenities such as foraging for water all while hiding from the violence of war depicted. The game is intended to give a window into the life of a refugee during war. The game can be experienced here: http://www.gamesforchange.org/game/darfur-is-dying/.

[44] Physical games such as board games see these versions as *editions*.

design. In addition it allows a possibility for re-framing the defined design parameters for each iteration through feedback and analysis.

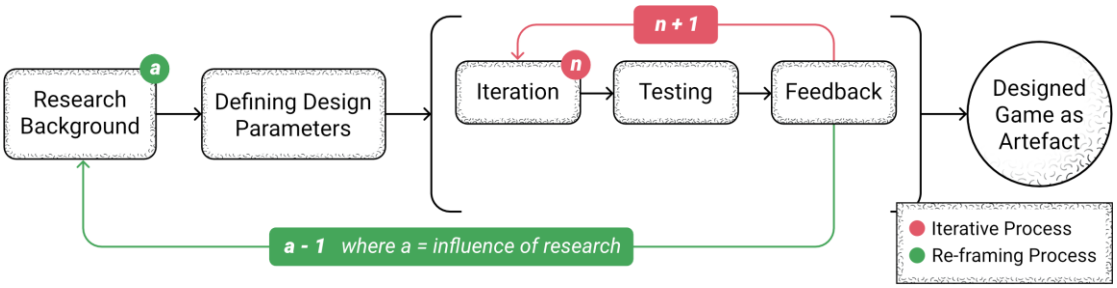

Figure 30: The RtGD process used in the carpentry of this artefact involves taking an iterative approach similar to RtD, but incorporates an additional step of re-framing research backgrounds and design parameters through the iterative process.

In order to manifest the inter-spatial interaction model in a manner that it could be easily processed (preferably by/for designers), this iterative RtGD process was embarked upon that would allow for the carpentering of a game that presented a unique procedural rhetoric coming from the model. The later re-framing of parameters to design decisions and goals was an important step, because for this process a scaffolding for undergoing an RtGD approach had to be established. The initial parameter to be set was just *how much of the core philosophy of this research should be embedded within the rhetoric?* This step was a later addition and understood from feedback as a necessity for this artefact. Games that utilise philosophical arguments as part of gameplay, such as *The Stanley Parable*,[45] do so without overwhelming players with their philosophical discourse. Here, the initial imperative was to present philosophical rhetoric as emerging from an academic research perspective for the purposes of informing design decisions in IoT. Furthermore, when designing a game for play, entertainment is an important factor, therefore, the second point of questioning was *could this be a research artefact as well as an entertaining game, or are these concepts mutually exclusive?*

Due to how the artefact transformed in this research journey the RtGD process takes from the framework described by To *et al.* (2016) of tandem game design. Where their process shifts between a delineation of goals and the practice of designing a game, this echoes the efforts that went into creating this artefact where a balance between research intent and playability had to be achieved, ergo the re-framing step in the process. As will be explained in detail ahead this essentially meant that the procedural rhetoric embedded in gameplay needed to exist in a space where it retained enough information about the research concerns (i.e. a philosophical object-oriented perspective of IoT), as well as be acceptably playable as a game.

Finally, the decision to opt for a board game over a video game came from the IoT model itself. Most of the carpentered artefacts by Bogost (2012) tackle the idea of alien phenomenology through

[45] The *Stanley Parable* by Dave Wreden is a walking simulator game. Players are presented with an office space which they must traverse with no prior explanation of how to play the game. A narrator acts as a higher presence, and players are given divergent pathways. In many ways the game is not a game at all, and as a philosophical artefact has been heavily discussed (Fest, 2016).

the digital with the physical aspect of device(s)/service(s) having little importance.[46] As the model intended to act as an overlay for exploring *both* physical and digital interactions, a digital game would have been limiting. Furthermore, the physicality of playing with tangible pieces and the ease of depicting spatial configurations afforded by board games helped directly build upon the intended procedural rhetoric. With a foundation now established for approaching GD for the purposes of exploring our inter-spatial interaction model, this next section will walk through the process of designing the game through its different iterations.

8.3 Carpentering the Internet of Things Board Game

Having no prior experience designing games, the process of carpentering a board game for this research was to put it lightly a learning experience. For the *Internet of Things Board Game*, each iteration was evaluated with feedback coming from playtesting as well as personal critical reflections fed back into the RtGD process. In total there were 14 iterations of the game (at the time of writing this thesis). That said, the distinctions between iterations can often blur and for clarity of discussion they are grouped and discussed individually where possible in the coming sections as certain iterations involved more drastic changes than others due to the re-framing process. In the tradition of board game design the process is my journey towards a *first stable edition*.

[46] The *Latour Litanizer* from Chapter 6 for example, may very well exist entirely in code and never be presented on a webpage.

Figure 31: Iteration 14 of the Internet of Things Board Game laid out in its entirety for 4 players.

I present the game in its current most form in (Fig. 31) as a typical 4 player set up for play. As the focus of this chapter is the carpentry of this artefact over the artefact itself, for brevity every asset of the game is not fully explored here but a summary of gameplay is presented instead. Steps taken and lessons learned from earlier iterations are described in more details which lead to the final iteration. Details pertaining to the final iteration presented in Fig. 31 and a list of definitions and terminology associated with GD are presented as part of Appendix B and Appendix A respectively. Also provided is a time lapsed playthrough of the game viewable online. Without further ado, what is the Internet of Things Board Game?

The Internet of Things Board Game in its final iteration has players collaboratively work at securing non-digital spaces where insecure digital interactions may be occurring. Players move between game tiles depicting spaces such as living rooms and kitchens where they collect IoT-enabled objects capable of interacting with digital spaces through commonly understood protocols such as Wi-Fi and Bluetooth. The game employs a fictional backstory to situate play where a data

hungry corporation is attempting to extract data from average users. The players are part of a coalition working against the corporation in order to create their own secure spaces where they are in control of their data. Each player has their own set of skills which they use in conjunction with the IoT-enabled objects they carry with some objects affecting their skills. The game attempts to disrupt the order of play by forcing players to assess the levels of risk their actions may have undergone through a phase-based play. Players first play out actions then are instructed to assess those actions using a dice roll. Various factors allow for players to navigate this assessment successfully, but if they fail certain consequences are faced. The game actively attempts to stop players from creating secure locations by dropping tokens identifying vulnerabilities and threats in the network. All the while as players create further interactions in-game they facilitate spatial configurations of digital/non-digital spaces depicted by connected physical game tiles. The game is won after a certain number of spaces have been secured, and being a collaborative game it can be lost if a number of different situations arise such as too many vulnerabilities and threats in the network.

Though this research does not entirely concern itself with data privacy and ethical practices in the design of IoT systems, it is still a relevant factor associated with IoT as many design concerns in this topic tend to pivot around this discussion. Also, as SQ1 asks the question of problematic effects emanating off IoT, the most commonly associated of these are in the area of privacy and security. The constellation metaphor also references itself as a means for understanding how to view interaction in IoT as independent yet interdependent with Lindley and Coulton (2017, para. 6) highlighting the privacy and security of IoT systems. For these reason this game explores this specific angle. Through the different phases of play the game intends to sketch out the inner workings of an IoT-enabled or similar network. With the different vignettes and storytelling elements exercised throughout, it also paints a picture of the users within these systems, their requirements, and the effects of these interactions occurring within the different spatial configurations they and their devices occupy. More on this later in the chapter.

This final iteration of the game could not have been possible without the different versions that came before it in the RtGD process. To explore this I will be presenting the iterations as three phases: exploration, reflection, and redux. As the names suggest, the phases look at specific aspects of this journey. To further aid an overview of the salient features imagined and directions taken during the carpentry process is also presented ahead in (Fig. 32).

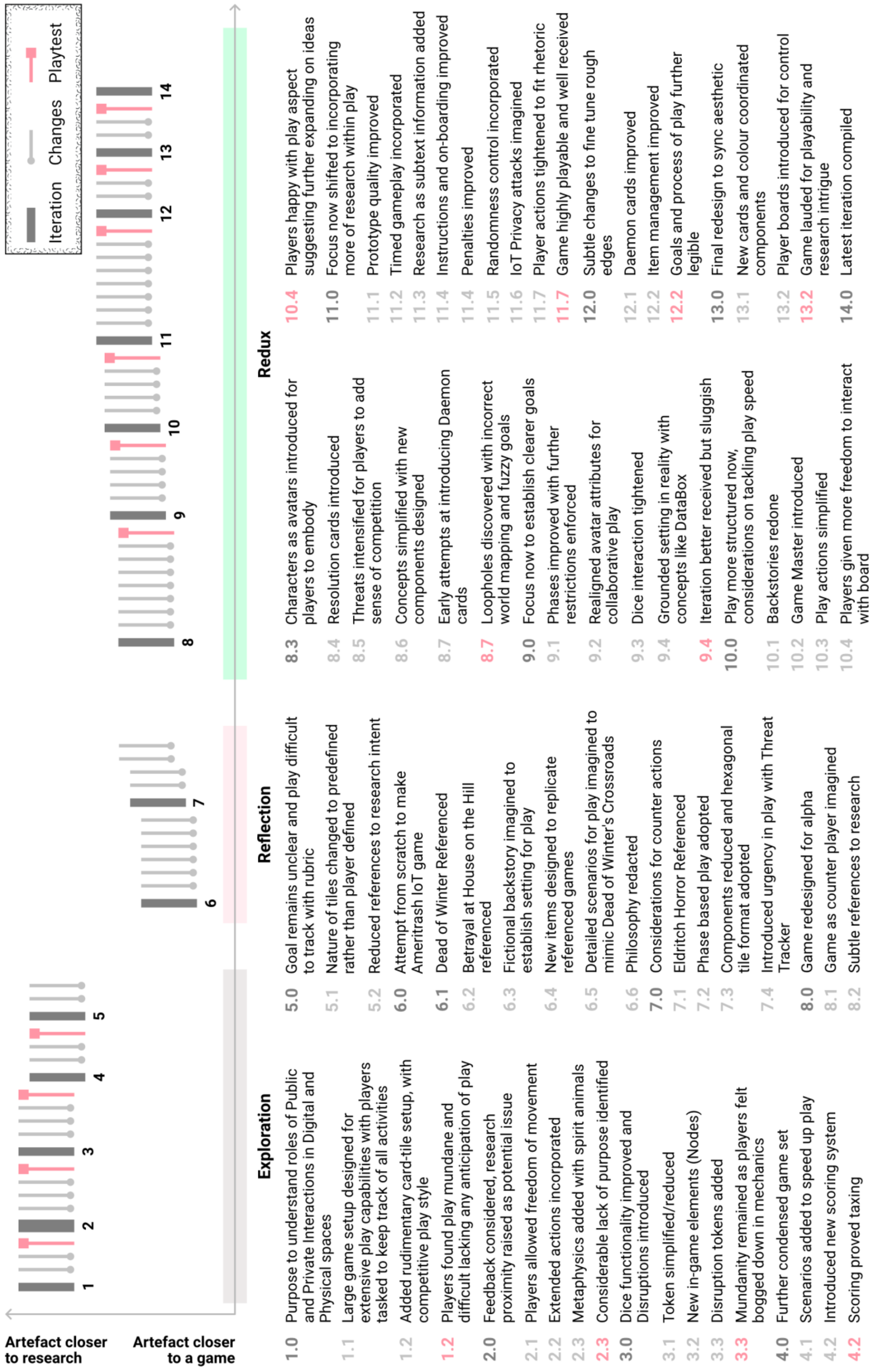

Figure 32: Overview of carpentry process with a progression of iterations and playtests.

8.3.1 Exploration Phase

The carpentry process started by understanding the medium being designed in. A number of elements are required to make up a board game the most common being a play area or board, cards, tokens, and perhaps dice. From the start, the game was kept as close to the initial research intent as possible i.e. the philosophical rhetoric explored through in-game actions. The understanding here was for the model and its concepts to be most accurately represented in gameplay. Which is why early adaptations used common terminology from the model. These early iterations make up the exploration phase of this process.

8.3.1.1 *Iteration 1*

The first iteration was barebones starting with fleshing out the premise and rules of play—later iterations would alter these parameters as playtests were conducted. This first iteration also adopted the private/public aspect of the model as a grounding premise with the intention being to 'make sense' of these concepts through gameplay. It and subsequent early iterations were heavily dependent on rigorous notetaking as a game mechanic. Variables established for gameplay were taken directly from the research model with game mechanics acting as vessels to facilitate the philosophical discourse.

Figure 33: Iterations 1 through 5 used a similar setup more geared towards its research intent over play. The game pieces were designed as workable low-fidelity prototypes and repurposed through iterations.

A number of playable items were designed for this game a list of which is presented in Table 2. I will be expanding on them in the coming text and where possible present examples of how they were used during play. For this iteration there was no 'game board' instead plain black and white

cards were used with all the tokens and cards either written down, printed on stickers, or substituted for tangible pieces (Fig. 33). This is a common trait when prototyping for games which is often done on paper.

Table 2: List of game items/pieces designed for iteration 1 of the Internet of Things Board Game.

Name	***Amount***	***Description/Title***
Space tile	10	Black representing digital space
Space tile	10	White representing non-digital space
Local Nodes	14	"Smart Lock", "Bulb", "Smart Plug", "Smart Button", "Security Camera", "Smoke Alarm", "Garage Bin", "Curtains", "IFTTT Protocol", "Wireless Printer", "Social Media Counter", "Fridge", "TV", "Air Conditioner"
Global Nodes	6	"Wi-Fi", "Bluetooth", "Smart Assistant", "Nest", "Network Access", "GPS"
Player tokens	5 (x2)	Two pairs of player tokens for use in both spaces
Item cards	18	"Smart Phone", "Fitness Tracker", Smart Watch", "Google Glass", "Snapchat Spectacles", "Apple Watch", "Apple Account", "Social Media Account", "Heating", "Smart Belt", "Smart Mug", "Access Key", "Tablet", "Smart Watch", "Google Account", "Body Camera", "Satchel"
Interference cards	9	"No Wi-Fi Access", "No Bluetooth Access", "No GPS Access", "Fine Print" (x3), "Compromised", "Princely Affairs", "See Through"
Dice	1	Custom designed dice
Interaction tokens	~500	For keeping track of interactions in spaces
Connectivity coins	~600	Different demarcations

Space Tiles: Black and white cards or 'space tiles' were laid out in varying arrangements to simulate digital/non-digital spaces on a hand-drawn surface that constituted as the play area. The cards were laid out identically side by side leaving a space in the middle to show present connections of *Global Nodes* (see ahead) that allowed for interfacing between spaces such as through Wi-Fi. For the game the black cards represented digital spaces and white cards non-digital.

Players then labelled the non-digital spaces as tangible locations after deciding where the game was taking place. For instance, if it was in a home the spaces would be kitchen, living room, garden, etc. Players then marked them according to a self-established game rubric around how *Secure*,

Social, *Private*, and *Public* the spaces were.[47] Two aspects came from a direct categorization of spaces (digital/non-digital to private/public), while the other two (secure/social) came from attempting to understand the nature of those spaces and possibly define them as a heterotopia. Players would assign a baseline score to the variables making up the non-digital space. For instance a space such as the living room without any digital presence in it could be categorised as private/public or secure/social based on the fact that it did not have any access to the Internet. Perhaps there's a window there, access to other spaces, or possibility of tangible interactions overlapping such as sound and touch? These factors would affect the scores given to the space and understandings of private/public would be defined accordingly, subsequently also aligning the space within a specific portion of the model through phenomenology. Initially, this rubric was understood according to the space they represented. The intention was that they would change as different interactions emerged, and could represent thing-geography coming from the model. Hence, social/secure could also refer to social proximity of IoT objects in later stages of the game.

Nodes: These tokens allowed for connectivity within the game and between the digital/non-digital spaces. They came in two types, local and global nodes (Fig. 34) with the later affecting all players simultaneously and the former only that specific space they occupied. Among global nodes were Wi-Fi, smart assistants, network access, and Bluetooth among others. Local nodes consisted of objects or items that were found and placed in the spaces. Being digital objects they allowed for an interface with the black digital space tiles through the white non-digital space tiles. Therefore when the game starts until players establish nodes the digital space is relatively untouched.

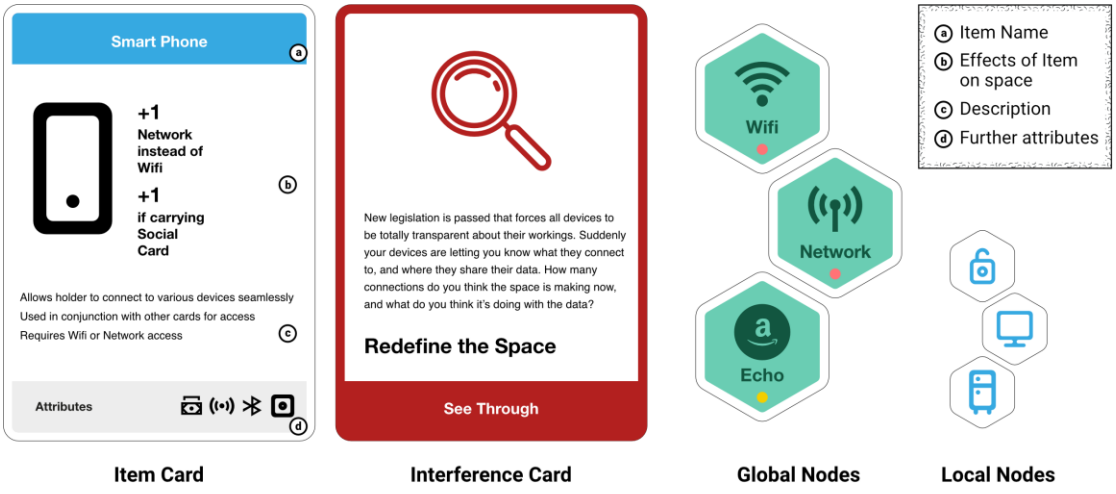

Figure 34: Item cards, Interference cards, and nodes made up the main interaction of players with the game. The effects and attributes of each card would further influence the spaces they were reveal in and as players moved around space tiles they would alter the status of each space according to items in hand.

Item Cards: These were spendable IoT-enabled items that players carried on them to enact various effects through the game. Each item card showed its effect on the space it occupied as well

[47] The classifications of this rubric were taken directly from the model but reiterated to suit the purposes of embedding within play.

as any additional 'chain' effects with a description of how the card interacted with the space and any other cards if applicable (Fig. 34). They also listed a number of attributes which they either required to function or were able to process. For instance, the *Smart Phone* item card showed a number of icons in its attributes highlighting that it had a camera, Bluetooth, Wi-Fi, and a digital wallet. It also mentioned that it required Wi-Fi or network access to function.

Interference Cards: The second set of cards were interference cards (see Fig. 34) and were designed to act as interruptions in play. Several cards were imagined and when prompted players had to exercise them. These included reassessing the space they were in, removing crucial global nodes, returning any collected coins, and so forth.

Dice: All actions in the game were governed by a custom 3D printed dice. Each side represented a different action players could take from picking out new items, dropping local and global nodes, to being forced to draw an interference card.

Movement, Assessing Spaces, and Getting Tokens: After selecting player tokens to represent them in the game, players moved in tandem.[48] As the black and white cards were mirrored hence movement was shown mirrored in these spaces as well. This was to drive the point of spaces being linked even though they might appear separate. Players were then awarding connectivity coins for each interaction they conducted in the game as a scoring mechanism. Interactions were made at the end of a players turn before they had to reassess the spaces they occupied. This usually happened because the game either had new nodes in play or players had cards on their person which affected their surroundings.

Assessments were made by understanding the properties of the heterotopias acting upon the space. This was not an easy feat but generally understood by players as reassessing the private/public/social/secure rubric of the space. Therefore, some base questions they could ask were:

- How 'public' can this space be considered?
- How 'private' can this space be considered?
- How 'socially active' is this space?
- And, how 'secure' could this space be considered?

Players also dropped interactivity tokens in the space if they had cards that made them do that leaving a breadcrumb of sorts throughout the game. Finally, players kept track of their scoring through the interactions they made on a score sheet. Certain interactions warranted multiple scores while others didn't.

Play continued in this fashion with players rolling a dice and either collecting new cards making them drop more interactions in the game, forming more nodes, or acting out interreferences. Combinations of cards would often create chain connectivity, subsequently creating chained disruptions as well.

[48] In this early attempt, the tokens were themed as spirit animals to create a metaphysical connection between real and digital spaces. Among many aspects of the initial designs this did little to aid the rhetoric and was quickly redacted.

The main objective was for players to move around the 'board' in both digital/non-digital spaces simultaneously, dropping local nodes to make *connections* which acted as currency. By dropping tokens on the cards in digital spaces players would denote an interaction within specific heterotopias to simulate real-life interactions within IoT, while the end of turn discussions on the different ways their actions may have affected the spaces encouraged players to understand the spatial configurations the game proposed. That at least was what this iteration intended to do.

8.3.1.1.1 *Playtesting and Feedback*

Playtests for this first iteration were done over two sessions with some recurring and fresh participants. As the game was designed to be played with 2–4 people both sessions were done with 3 players each with a total of 6 participants coming from diverse backgrounds but each related to design research or practice. Age groups of participants were between 20–40 and each were asked initial questions regarding their experience with playing games for research and their understanding of IoT and/or philosophy. As principal investigator I joined in on the playtests in the capacity of a game master[49] facilitating the game.

Immediately players were not enjoying this first iteration as it was unable to capture player attention or interests. A recurring complaint was a lack of purpose and excessive complexity, it just wasn't easy to understand or play. *"The coins don't seem to do anything, so why am I collecting them?"*, was one comment echoed among participants. The interferences didn't appeal either as there wasn't much variety in actions or possibilities. Players didn't feel like they were 'playing' the game rather they were simply acting out a mundane task.

On the assessment portion of play, players agreed with it feeling like a chore and didn't look forward to it at the end of their turns. Though they appreciated the logic of digital/non-digital spaces being represented in this mirrored manner they didn't see it as anything but that: a representation of collected actions in a networked space. What they did find interesting was how the game allowed them to visualise their steps in the spaces through breadcrumbs of interactions. But in the end, it didn't warrant much interest from players as they all agreed it didn't feel like a game.

8.3.1.2 *Iterations 2 through 5*

Iteration 1 though unsuccessful conjured up a large portion of the design for subsequent iterations. Beyond it minor alterations and later additions were made between iterations coming from player feedback. Table 3 shows a list of changes that came about in iterations 2 through 5. The main format of play remained the same though.

[49] Game masters are a common practice in role-playing games, their purpose is to keep players engaged by gradually revealing play.

Table 3: List of feedback received from playtests of iteration 1 and changes administered between iterations 2–5

Iter.	***Feedback Received***	***Change Administered***
2	Scoring was tedious	Assessment sheets added
2	Player tokens were confusing	Swapped tokens for non-themed alternatives
3	Spatial configurations imagined felt limiting	Included broader configurations for external spaces, gardens, parks, etc. Players also allowed more freedom with setting up their environment/play-area.
4	Lack of purpose to gameplay	Player specific scenarios with goals introduced (Fig. 35)
4	Not enough interaction of players with the game	New interferences imagined and added nodes for players to interact with.
5	Play too open-ended, cannot focus on the spatial configurations aspect of model.	Spaces reimagined as an interlocking tile system to direct the point of spatial configurations through play.
5	Game aesthetic unappealing for play	Design and aesthetics redone.

One major difference between these iterations and the initial was the inclusion of player-specific goals, abilities, and 'scenarios' (Fig. 35) to speed up gameplay which came about in iteration 4. The largest design change came in iteration 5 where the spaces were reimagined as interlocking tiles with their preestablished rubrics.

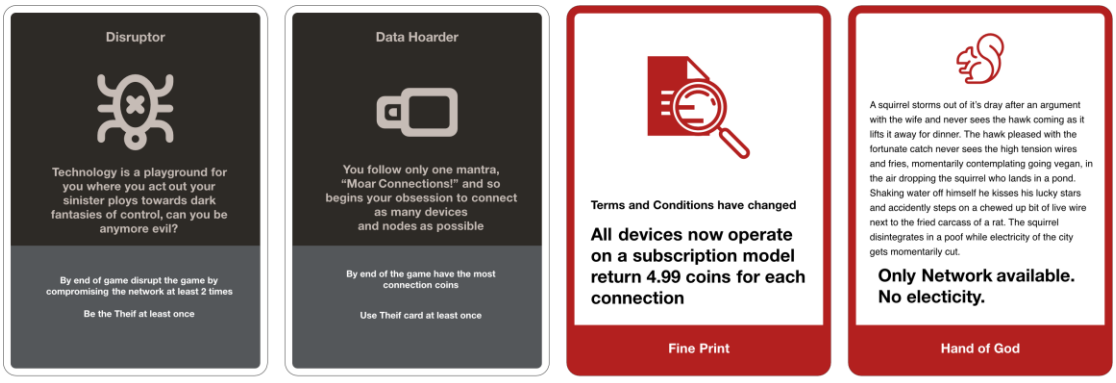

Figure 35: Among the changes between iterations 2–5 were the addition of Scenario cards that players followed throughout play and new interferences. Many cards were redesigned to incorporate a more 'player-friendly' vibe while still remaining true to research roots.

8.3.1.2.1 *Playtesting and Feedback*

Between iterations 2 through 5 a total of 3 playtests were conducted. Player sizes varied from 2-3 per session and for each I remained present as game master and principal investigator. Although these iterations tried to structure the game further by taking in player feedback regarding gameplay and how well the procedural rhetoric was communicated, the prevalent critique remained the same among participants. It lacked any sense of purpose and remained a mundane task rather than a

playable game. Complex terminologies used throughout the artefact were also questioned as they kept the game from being read as something to be understood rather than enjoyed as play. One comment from a recurring participant was that they went into each playtest expecting to 'play a game' but were always left wanting and felt they were conducting a research task instead.

The participants had experiences with playing board games and each stayed firm on their comment that the carpentered artefact did not play as a game and felt like a chore. One thing that again stood out from these iterations was still the fact that it allowed them to visualise IoT, though not very effectively. *"The game doesn't seem to have an end"*, was a returning comment from a few participants.

Around playtest 4 recurring participants had started understanding the purpose of the research better and reflected that into their experience of the game. Certain elements such as scenarios were suggested by participants in earlier playtests and they agreed that such additions did improve the playability, they still didn't do it enough to communicate the research rhetoric through play. Scoring was particularly criticised, and the addition of individual assessment sheets did little to aid playability or player interest in the game.

8.3.1.3 *Discussion*

Prior experience in participatory research influenced these initial designs. As such, the experience involved a lot of participation from the players, from the design of the 'board' to the rubric. This proved to be its downfall as players found the act of keeping track of every movement counter-intuitive to the 'game' aspect of the artefact.[50] Initially understood as a means of tracking score while simultaneously facilitating a procedural rhetoric, the experience provided no stimulus with each action ending in players dropping tokens whether they wanted to or not. Key elements of gameplay such as strategy were found to be missing, as players focused on keeping in-depth track of themselves a hindrance in ascertaining the core rhetoric of the game.

These initial iterations showed little promise to the research intent. The alterations that were made to address issues proved to be insufficient as further testing revealed that the influence of the research objectives were ultimately undermining the playability of the game. Players constantly asked the same question in different voices, *"What is the purpose of this game?"*.

A combination of weak goals, complex jargon, repetitive tasks, and the fact that it was designed as a competitive experience meant the rhetoric was lost with no insight for research. The only positive take back is that it was capable of visualising IoT. Subsequently, players saw it as neither a compelling research artefact nor a compelling game.

8.3.2 Reflection Phase

As the philosophical discourse intended to be explored through this exercise of carpentry was non-existent, iterations from the exploration phase needed to be reassessed. This is where the added

[50] Though role-playing games such as *Dungeons & Dragons (D&D)* use this methodology of participatory gameplay effectively, they encourage an immersive experience that was lacking in these initial iterations.

re-framing portion of the RtGD process was invoked to understand how to best reassess the design artefact and its research parameters (Fig. 36).

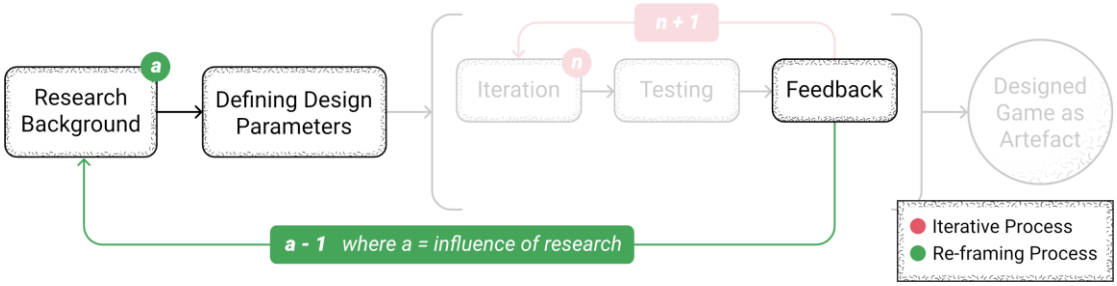

Figure 36: Up till this point the iterative portion of the RtGD process was exercised. After feedback from playtests it was understood that the defined parameters of designing this artefact needed to be reassessed, hence the secondary re-framing process was embarked upon.

Participants agreed the inter-spatial model was not effectively reflected through play. Understanding what the real obstacle was in this carpentry process became the next priority. References of the model needed to be present for it to be assessed but simultaneously also did playability since the artefact was intended to be treated as that; at least by participants. With players unable to understand the game as a competitive experience of a cooperative one the game left players confused. The scoring system gave the idea that the game was a competition, though comparing with IoT in practice competition did not seem to be a method that fit the operation of IoT devices which tend to work collaboratively. Hence, an alternative perspective was needed. As a result, it was decided to examine popular board games in a bid to find mechanics that better fit with IoT. Rather than go through an exhaustive list of board games, a few base parameters were established to pick out games that worked better.

Firstly, since the design was thematic the games referenced needed to be categorised as *Ameritrash*[51] or similar. Second, to consider an option of cooperative play, the games had to involve a level of collaboration/cooperation.[52] Third, they had to incorporate the use of physical spaces in some manner. The third criteria was not a necessity as board games generally do deal with spaces, but it was kept as a note to sift through games that were more relevant than others. The fact that the iterations allowed players to visualise IoT and the spatial configurations meant that there were definitely certain elements that worked. The problem was in its current format it was unable to explain the philosophical aspect of viewing objects and spaces in an object-oriented manner. Therefore, the following three board games (Fig. 37) were selected for reference and study of how to design games better:

[51] For a definition of Ameritrash see Appendix A.

[52] Though the two terms might feel similar, in GD they are very different. Zagal *et al.* (2006, p. 25) point this difference between cooperative and collaborative play like so: cooperative play in games takes on the form of the "prisoner's dilemma", where players must work together for their own intrinsic goals which overlap; comparatively, in collaborative play all players work together to achieve a unified goal collectively winning or losing.

- ***Dead of Winter* by Plaid Hat Games:** A zombie apocalypse worker-placement game that has players work cooperatively to survive a fictional apocalyptic landscape,
- ***Betrayal at House on the Hill* by Avalon Hill:** A cooperative game with a defector element where players navigate a haunted house, and,
- ***Eldritch Horror* by Fantasy Flight Games:** a collaborative Lovecraftian horror survival game highly dependent on storytelling and player interaction

Figure 37: Referenced modern board games Betrayal at House on the Hill (left), Dead of Winter (middle), and Eldritch Horror (right).

These games highlighted characteristics that could be considered prerequisites for producing engaging gameplay: elements such as the enforcement of rules, established goals, storytelling as a world-building tool, social dilemmas, balance of opposition, synergy between players, the presence of repercussions as well as a payoff for one's actions (Zagal *et al.*, 2006; Grace, 2012; Rocha *et al.*, 2008; Salen and Zimmerman, 2004). All three games fit perfectly within the defined parameters for the research particularly the use of physical space, having players move around the game through spaces such as rooms or metaphorical spaces such as items on hand and astral planes. This spatial realignment meant players had to think in multiple modalities and whether their actions could have ripple effects.[53] Immediately, connections were appearing of 'insides' and 'outsides' akin to references in the IoT model.

They each also involved an intricate array of characters that players could embody in the game. Bogost (2011, p. 23) discusses how world-building can create empathy when achieved through "vignettes" as brief descriptions or accounts of characters and events. Finally, all the games encouraged cooperative or collaborative play with elements of disruption. In the case of *Dead of Winter* and *Betrayal at House on the Hill,* it appeared through incognito defectors while *Eldritch Horror* utilised a more aggressive approach enforcing restrictions. Save the defector element, none of the disruptions hindered the core cooperative nature of the games.

8.3.2.1 *Iterations 6 and 7*

The learning aspect of this reflection phase presented a benchmark for crafting compelling gameplay. To simplify the process of further exploration, rather than designing prototypes like the

[53] An example of this realignment can be seen in *Eldritch Horror* where players encounter monsters through dimensional portals. To stop this insurgence they enter an in-game dream state called *Carcosa*; a reference to Lovecraftian literature. *Carcosa* does not exist as a place on the board, rather the Lovecraftian rhetoric is enforced through procedurality having players enter a playground of the mind enacted through cards in the game.

previous attempts manuals for play were designed. The manuals expanded on what IoT in the context of the game could represent, acting as a way to put down thoughts in a systematic manner that could, *(a)* be referenced later, and *(b)* present an opportunity to quickly tune into details of the game. Key areas that these manuals attempted to address were pathfinding, spatial dynamics, item collection, personal goals, counteractions, establishing crisis, and balance in play. As these iterations were done on paper playtesting was not conducted instead concepts were discussed with prior participants to understand their perspectives for whether such changes could benefit the process.

Several proposals for these key areas where the game needed improvement were planned out on paper. Each were then cross-referenced with their equivalent in the three referenced games to understand how they worked there. The shared similarities between the three selected games allowed for relevant game mechanics to emerge which could be used for further prototypes. Out of the list of attributes appropriated from the referenced games, the following were the most influential and highlighted for further iterations as many reflected elements from the model:

- A fictional backstory which re-framed the game's perspective, situating actions of players in a setting appropriate to IoT
- Physical tiles as spaces that helped in both navigation and for providing interaction points between digital/non-digital such as actions, items, and consequences;
- A reimagining of the aesthetics to gel better with the premise of IoT and the fictional backstory;
- Relevant establishing of crisis through play and their mitigation;
- A collaborative play format over a competitive one;
- Balance between players, so they may complement each other during play;
- Clearly established goals, either player specific or global;
- Player controlled levels of chance from accumulative dice rolls and deckbuilding while retaining elements of uncertainty to push play forward; and,
- Consequential actions through conditional cards mirroring the gatekeeper concept of heterotopias.

8.3.3 Redux

During the reflection phase focus was returned to the flaws present in earlier attempts. References to the model though present in the earlier iterations they were not presented in a 'play-friendly' manner hence not strong enough to translate through gameplay. As such, core concepts were lost to players. The fact that the research-centric attempts deviated so much from the intended rhetoric of the game, meant future iterations had to incorporate the philosophy in a redacted or simplified manner. A level of flexibility was required on how much of the research could effectively be incorporated to balance out the game's playability with mechanics either favouring rhetoric of play, or rhetoric of research. Finding a comfortable compromise was now the overriding goal for the design process and the basis of the next group of iterations.

8.3.3.1 *Iterations 8 through 10*

The questioning of research rhetoric versus playability culminated in iteration 8. Findings from the reflective and explorative phases were combined to create stable working prototypes that aligned better as playable games over research artefacts. Whilst some game mechanics were borrowed from the referenced games, others came from new combinations of mechanics across the three games, or where developed during playtesting. Table 4 references the changes in iterations 8 through 10 which focused on simplifying play, interaction of players, and pathfinding the most.

Table 4: List of changes administered and concerns addressed through iterations 8–10.

Iter.	***Change Administered***	***Addressed Concern***
8	Tile based navigation system	Pathfinding
8	(Redacted) Dice focused play	More control and freedom of choice
8	(Redacted) Rubric	Simplification of play
8	(Redacted) Spatial assessment	Simplification of play
8	Connectivity points between tiles	Spatial dynamics and configurations
8	Dice rolls as mechanic	Improved interaction and playability
8	Backstory	Situating play, rhetoric, and purpose
8	Character cards and abilities	Player specific strategies for collaboration
8	Secret objectives	Player specific goals
8	Crisis cards	Counteractions
8	First player token	Leadership
8	Wounds	Affects from play
8	Stacked spaces	Better reflection of spatial configurations
8	Redesign item cards	Clarity of purpose and use of cards
8	Improved aesthetics and pieces	Improved player connection with game
8	Threat tracker	End scenario and urgency of play
8	Securing of spaces	Clearly defined global goal
9	Round counter	Tracking of time and urgency of play
9	Threats and Vulnerabilities	Added elements of challenging gameplay
10	Revised character abilities	Better interactions between players
10	(Redacted) Secret objectives	Simplification of play
10	(Redacted) Round counter	Simplification of play

New game pieces were designed for the artefacts reflecting on previous design decisions. Play was established as collaborative with players focused on a universal goal of security giving a purpose to their actions. The game world was also generative now with new spaces coming into play as players explored revealing unique spatial restrictions allowing them to feel more present in the game.

Tiles were designed hexagonal[54] having players take advantage of free movement and interaction in multiple directions. A new inclusion was of connector points on each tile (Fig. 38), allowing players to create digital links between non-digital spaces by 'dropping' IoT devices. Acting primarily as a symbolic representation of spatial configurations from the model. Each connector point allowed players to place a link between spaces through digital interactions. These links were symbolic much like the phenomenological linkages asserted by the model.

Figure 38: The new iterations allowed players to more directly interconnect digital/non-digital spaces through connector tokens.

The earlier dice roll based play was redacted and a new phase-based play system was administered echoing similar approaches used in the referenced games. Players were also given new actions they could perform, providing them with a wider gamut of possibilities. As a countermeasure, a *Vulnerabilities* mechanic was introduced later becoming the core mechanic of play. This was crucial as it hinted towards the rhetoric of an imperfect IoT, whilst also furthering the philosophical rhetoric through suggesting present interactions and overlaps between spatial configurations. Cards that players had in hand were now accessible through the game so any actions that happened in the game area were mimicked on player cards to symbolise their IoT items as sharing in the workings of the network. This reflected the earlier black/white space title approach from previous iterations but in a manner more directly accessible to players.

Cards were still IoT-enabled devices and for the most part remained similar with aesthetic changes, but tokens were used to simulate connections in the physical spaces and on items in hand.[55] Upon facing a *vulnerability*, players rolled dice for each token present on their items. Failed dice rolls ended in special *Vulnerability Tokens* falling in connected and interconnected spaces mimicking the concept of ontographs within OOO, effectively removing the IoT-enabled device

[54] A common format used in many board games, often for ease of design and mechanics but also because of the logical potential a six-sided shape presents in play. Examples of such uses are *Catan*, *Twilight Imperium*, *Hive*, *Castles of Burgundy*, etc.

[55] This mechanic remained till the end and a detailed description of it is presented in Appendix B.

from a ‘network’ to be seen independently. One aspect that was added to the cards was synchronisation with player specific abilities (see ahead) making the players want to keep certain IoT items on hand for their benefits.

A threat tracker was introduced to allow players to foresee when the game would end and assess their progress. Later iterations worked on this further to incorporate it more directly with play and enforce a sense of urgency.

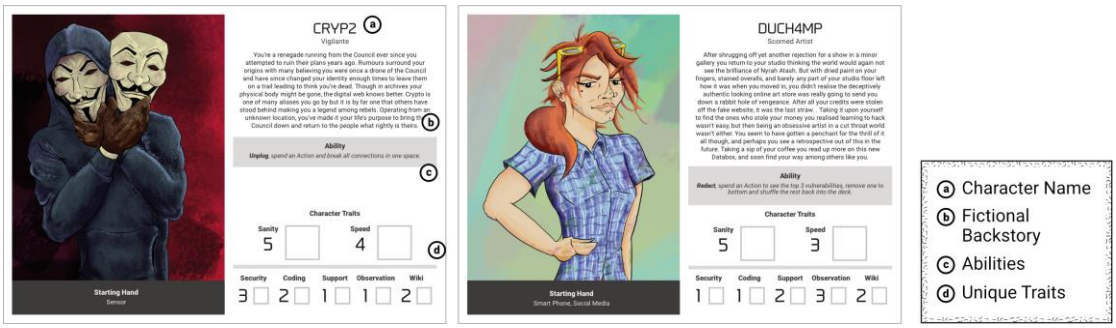

Figure 39: The addition of in-game characters that players could embody drastically changed player perceptions towards the playability of the game. Each character came with their own backstory and unique traits which players modified during play.

New characters were introduced with accompanying backgrounds which fit into the designed fictional backstory of the game (Fig. 39). This was a common approach in other mainstream board games of this kind and certainly seen in the referenced games as well. A new ability system was introduced encouraging players to work together by finding their unique combinations of abilities during play. This new system replaced the assessment and rubrics from the previous iterations and focused on players reading their different items which improved their characters’ abilities and connected them with their actions in the game. Each ability was referenced by a number of dice that players could roll in the game though at this stage what these numbers represented was still unclear and worked out during playtests.

8.3.3.1.1 *Playtests and Feedback*

Prototyping for these iterations was done using simple card and paper, and recycling earlier designed artefacts (Fig. 40). Though, these iterations still involved a game master as a facilitator in the game. Players immediately connected more with these iterations especially with the backstory bringing about a more engaging experience. A total of 2 playtests were conducted with the new sets of rules with alterations being made by player feedback between iterations and tests. As before between 2–3 participants were part of each test in addition to myself as facilitator. Participants were mostly recurring players with a few fresh faces, all still related to design practice and research in some form. The biggest take back was regarding the flow of the game which changed considerably from the earlier attempts due to the adopted phase-based gameplay.

Figure 40: Soft prototyping allowed for the game to remain flexible even during play-tests.

Particular appreciation was given to the aesthetics of the prototypes which though still rudimentary and low fidelity were capable of capturing the spirit of the artefact as game-like. Players enjoyed the new characters with some picking favourites and empathising with them during play. The vulnerabilities mechanic was contested though with many players suggesting it still felt confusing and cluttered.

The tile-based pathfinding approach was highly regarded in these iterations as players highlighted it made IoT visible as constellations. They wished the game was able to represent their association with technologies like IoT better though with one player commenting how it felt very *"Science Fiction-like"*. None-the-less, the general consensus was that these iterations were doing something better than the previous ones but still lacked in certain areas.

8.3.3.2 *Iterations 11 through 14*

These changes brought about new life into the artefact, thus the next iterations (Fig. 41) looked at refinement and a gradual return of the research rhetoric. Iterations 11 through 14 mostly saw aesthetic changes and strategic redaction of mechanics and components. What it attempted to improve upon was representing the philosophy in a subtle manner that it could be infused within the procedural rhetoric. The approach taken for this was through storytelling.

Figure 41: Iterations 11–14 slowly evolved as an overhaul of design to incorporate findings from play-tests and solidify the procedural rhetoric. Besides certain back steps most changes came about as either aesthetic or refinement.

The imagined rich selection of characters was reimagined with improved abilities and management of skills for players. It was necessary for players to relate more with the artefact as not just a source of research related intrigue but also as a playable game. As a step in returning to research roots, these iterations included external research projects as elements within the fictional game world grounding the rhetoric further in reality as opposed to fictional conjecture. Real technologies with plausible trajectories such as the *Databox*[56] (Mortier *et al.*, 2016) were incorporated and imagined as the purpose of play. Players now worked together to create secure spaces within the game world in the form of these Databoxes. Ultimately, it was in the later consequences of interaction choices for addressing IoT vulnerabilities where the artefact became more interesting among players. Databoxes were required to 'win' the game and each had players enact a series of resolution actions to acquire them. Table 5 shows the main changes done in these iterations.

[56] Mortier *et al.* (2016) describe their Databox platform as one that provides a unique ecology for exploiting personal data in privacy-preserving ways. For example, it might enable a media provider to utilise algorithms on data about an individual's viewing habits and those of others in the room. Doing so it may offer up bespoke content of mutual interest without disclosing personal data to the provider. Instead of distributing personal data to remote cloud servers for processing, processing takes place on-the-box, which means no personal data need leave the home or be accessed by anyone else. Databox functionality is not limited to privacy-preserving analytics but also enables actuation of IoT devices.

Table 5: List of changes administered and concerns addressed between iterations 11–14.

Iter.	***Change Administered***	***Addressed Concern***
11	Improved aesthetics	Player connection with artefact
11	Improved character abilities	Player interactions
11	Redesigned item cards	Clarity and purpose
11	Vulnerabilities mechanic	Counteractions that mattered in play
12	Higher level threats	Balance of difficulty
12	(Redacted) Scoring mechanism	Simplification of play
13	Resolution cards	Improved player interaction, purpose, and rhetoric
13	Threat removal	Crisis management
13	Improved dice rolls	Interaction with game and uncertainty
14	Improved aesthetics	Player connection with artefact
14	Conditions	Balance of power between game and players

The biggest change these iterations brought were a better understanding of how the vulnerabilities affected the network and subsequently how players could mitigate them, as well as friendlier usage of terminology that players could relate with. As the game now followed a phase based play approach, players first played out their actions then had to assess if any risks or vulnerabilities had emerged in their turn due to their actions. This was done through a dice roll according to specific player abilities making some players more capable of mitigating risk than others. Failed attempts at navigating the risk phase of play meant players had to draw from a deck of risk cards that facilitated the rhetoric of the game through storytelling. This was also presented in the new resolution cards (later called privacy cards) which players needed to successfully navigate in order to deploy the Databoxes they required to win (Fig. 42).

Figure 42: These iterations saw the cards evolve into more friendlier versions that synched better with the rhetoric of play as well as gave players something to think about during turns. The new resolution cards particularly allowed players to enact a mini-scenario that could go in either their favour or against.

Another important aspect learnt from the reflection phase was the management of collaborative play. While players could only win the game through the single scenario of deploying a set number

of Databoxes, there were multiple ways for the game to be lost. The game itself became an opponent in this manner; a common trait in cooperative/collaborative board games.

8.3.3.2.1 *Playtests and Feedback*

The final 4 playtests were conducted between iterations and towards the end culminating in a total of 10 playtests from the start of the carpentry process between a combined 22 players between all playtests. The general reaction from players for these end iterations was that the paradoxical nature of many mechanics made the artefact play better as a game, such as players having to take risks to achieve their victory states. Furthermore, the biggest gripe from the early versions was the complexity of scoring which was now less tedious as the status of the game board became the scoreboard itself.

Players felt more involved in the game in these iterations. Since the cards referenced elements from the model as well as general understandings of IoT, players better understood the rhetoric of the game and actively engaged in obscure discussion around the present spatial configurations. IoT objects presented in the game could interact with each other and the spaces on the 'board' leading to different combinations of interactions becoming apparent, such as a fridge presenting a vulnerability because of lights in the garden all connected through the same Internet connection. Vulnerabilities thus became something players actively engaged with as they were designed to morph into more difficult threats if certain conditions were met.

The final iteration in this process brought about mainly cosmetic changes. Player boards, cards, and tokens were redesigned to fit a unified aesthetic which players agreed helped in accepting the artefact as a 'game'. The main task during each playtest was to have players think about security and privacy through the different vulnerabilities and resolution opportunities presented in an attempt to argue about the ontologies of these spatial configurations in IoT. How well that was managed is something I will explain in the next section but in the end, one play-testers remark summed up the efforts quite well, *"It plays a lot like a game now!"*.

8.4 Discussion

This entire journey of carpentering a board game from scratch could only be realised through the iterative process afforded by RtD. Before wrapping up this chapter, some insights from this journey can be shared through the playtests. Though iterations 8–10 involved a game master, the artefacts effective use as a research tool was achieved independently considering the views by Donchin (1995, p. 218) of exercising systemic control in games. The following views reflect an overarching discussion of using a board game as a carpentered artefact in this manner for design research, what was learned about carpentering in the process, how well the questions of this research have been addressed, and whether the game worked in general as a carpentered artefact for IoT that manifested an attitude of playfulness.

Gameplay wise, it was a no-brainer. Players found the most recent iteration to fulfil their anticipation of play much better. The narrative approach helped in situating their actions but gave little beyond. Though this could be rectified I feel that this current format of a 'vague' narrative

worked better as the closer the artefact approached being a playable game, the farther away it went from being a formal research artefact. Subsequently, the research had to be reworded and in some places redacted completely to accommodate the 'game-ness'. This is something of contention and could be investigated in future iterations for finding a more homogenous balance.

An aspect that made a large difference during testing of the final prototype was fidelity. Earlier attempts used basic materials such as card and paper whereas the final iteration used common board game materials, such as grey-board with wooden and plastic tokens. This raised production quality affected the experience of play as players said they felt more involved.

Regarding the rhetoric of spatial configurations and philosophically viewing IoT through notions of more-than human-ness there were mixed reactions. Where it successfully translated to some players others were still seeing it as a game and less true to life, even though efforts were made in the design to keep it close to reality. Those that were aware of IoT interactions did praise the accuracy and notion of a fragile Internet. There were moments when the connection became vividly apparent, such as in one case where a player mentioned how by hearing others use phrases like, *"I'm about to connect the **Living Room** to the **Kitchen** with my **Shoes**!"*, it helped in imagining the premise of the game further and situating the idea of more-than humanness.

Regarding the idea of a fragile IoT and the heavy assertion of privacy/security throughout the game, this slightly hindered the artefact in my opinion. The model does not necessarily argue for security and privacy within IoT. The reason for using these concepts in the game was to facilitate a procedural rhetoric of IoT and its possible that for many players that was what the game was about. Granted one of the questions this research asks is around problem areas in the design of IoT, the idea of spatial configurations made it easier to translate through this rhetoric of insecurity as it relates through human users. That said, I believe it makes the artefact (at least through play in these iterations) take an anthropocentric perspective over an object-oriented one begging the question of what are the object-oriented problems in the design of IoT?

This is possibly happening because of how the philosophical arguments and perspectives in the artefact had to be reeled back in favour of playability. Besides a few moments there was little acknowledgement from players regarding the philosophy even after filling the cards with OOO related *Easter Eggs*. Translating the effectiveness of philosophical rhetoric is difficult to measure, with most players taking the philosophy at face value and disregarded it as a humorous anecdote. Those that did engage didn't move beyond a very superficial understanding. In the end, while the game managed to both bring players closer to an understanding of IoT, it could not convey completely the underlying principles that drove the design. Most players tackled it as a strategy game with the specific context of IoT merging into a background process of play.

On the negative associations of IoT one player commented how the game felt like it was *"out to get you"*. In some respects, this holds true as security requirements are constantly evolving. Rather than presenting security as a problem that could be fixed, the game highlighted the requirement for vigilance in managing your networks. Ironically, the speculative element introduced by a backstory

involved a negative storyline which helped the rhetoric considerably. Players began to associate the narrative with their own lives. An earlier iteration of the privacy cards involved a card that described a scenario of data being stolen from a phone through an RFID interaction. This created a stark reaction from players, as they began relating it to events that could happen in their real lives. The game world managed to seep into reality which was a positive take away from the process. In this manner the game certainly advanced from the previous chapters model in addressing SQ1 as a means to highlight potential problematic effects emanating off IoT (albeit from an anthropocentric perspective).

Returning to the idea of whether carpentry worked in this instance and what was learned in the process, one thing for certain is that this approach of designing a game did facilitate levels of learning about IoT for the players involved. Carpentry here might not have been successful in completely transferring the ideas of the philosophical lens for IoT through a game due to the redactions made, that said it did add a layer of philosophical intrigue through facilitating the different manners of interactions in the game. This is quite apparent from player reactions to them. Also, as the players would move between playing on the non-digital spaces in the board to their digital spaces on their item cards, it facilitated the argument of heterotopias coming directly from the model. Though I fear that was not immediately understood by players. What was learned about the process beyond the effectiveness of an iterative RtD process for designing systems like a game, was that carpentry might require more philosophical freedom to function better. Perhaps if removed from the context of a structured game and allowed to exist on its own then the process of carpentry might yield more fruitful results. It is after all a method of exercising philosophical debate and if the game structure required a systemic redaction of philosophical discourse then in retrospect it was probably not the most ideal of mediums for carpentry.

On the subject of SQ2 and how this process manifested an attitude of playfulness, it does so in a direct manner of *(a)* creating an artefact through the act of play, and *(b)* engaging with elements from the model to translate them in a way that may be represented through storytelling. The premise of the game remains a dialogue between players' understandings of IoT and the games representation of IoT. From what the playtests have revealed players engaged with this dialogue in different ways. The RtGD process through its iterations had to facilitate these findings, and for the most part players retained the artefact as a playful representation of the reality of IoT. Playfulness thus arose from how the players engaged with the iterations by expecting a fun and casual interaction when called upon to 'playtest a game'. The design process in turn translated this attitude into the game through its many vignettes and micro-interactions. The process thus became playful because it had to deviate from its strict academic design research roots.

As a closer artefact to IoT this could have been constructed as a programmed live system that took in formal data from participants which could have been humans and IoT objects for a fair object-oriented comparison (the next chapter explores this notion better). The fact that at the start of this process I engaged with a board game rather than any other medium for carpentry, suggests as a

designer my own playful attitude was present within the design process through my own inherent love of board games. This is carried on from how the carpentry of the model was also playful by equating the use of philosophy to building blocks that formed the model itself. Here, in order to design for play I needed to experience play in the process as well. An attitude of playfulness in relation to this artefact therefore occurs from acknowledging where this artefact was situated, as either a playful game or as a formal representation of concepts relating to IoT. From the start of this thesis I have been arguing for the presence of playfulness as an attitude within my own practice of design, and this artefact perhaps embodies that most clearly.

8.5 Wrapping Up

This chapter although about an attempted carpentered artefact was presented to be in line with views of RtD as a "generative" approach (Gaver, 2012, p. 28), focusing more on the process than the outcome. The iterative approach of systemic reflection and exploration in this RtGD process helped in clearly navigating a way through the complexity of representing philosophical theory, turning it into an artefact that together functioned as a means of expressing research and as an enjoyable game. The earlier identified issues with mundanity, confusion, and frustrations were replaced with collaboration, a sense of achievement, and competitiveness.

Redacted of academic and philosophical jargon the infused rhetoric was more approachable in this friendlier language of play. A true expression of findings for an artefact like this cannot be adequately done in a written account as it is by playing the game that one may experience the proposed procedural rhetoric of IoT, and as much of the more-than human concepts as could be infused. As a researcher, I aimed to test the philosophical model created and see if the idea of philosophy for design of IoT could help design research in a real-world context. The game is not intended to act as a design tool for IoT per se. It is better seen as an exploration of what happens *under the hood* when using our IoT devices in an attempt at exploring their more-than human-ness.

It certainly boasts the constellations metaphor for IoT in a visual manner that might provide some merit to design practice, if seen in that light. Many factors affect the usage of IoT that consumers are unaware of, which in part affects the adoption of IoT as well (Perlow, 2019). The game brought to light these largely obfuscated elements, such as the potential consequences of privacy affecting policies even though that might have been an unanticipated by-product. To sum up, this artefact proved successful on several levels. Firstly, to visualise the constellations and ontographs present within the myriad heterotopic spaces of IoT and second, as a way to explore playfulness in the process of design. The coming chapter explores a possible approach of carpentry that may yield more closer approximations of a philosophical lens for IoT through another carpentered artefact.

CHAPTER NINE

PREDICTING FUTURES IN THE IOT

"Let us think the unthinkable, let us do the undoable, let us prepare to grapple with the ineffable itself, and see if we may not eff it after all."

– DOUGLAS ADAMS,
DIRK GENTLY'S HOLISTIC DETECTIVE AGENCY (1987)

9.1 Introduction

Where the Internet of Things Board Game succeeded in effectively conveying the underlying complexity of interdependencies within IoT through a procedural rhetoric in play, it was unable to sufficiently illuminate the influence of object-oriented philosophy within the research. The goal for the artefact was to apply concepts coming from the inter-spatial model devised in Chapter 7, in an attempt to understand them and possibly convey them to others. The ideal would have been for players of the game to view IoT objectively and perhaps if played by designers view the design of IoT in a new way. In the process of designing the game this rhetoric needed to be balanced with playability which resulted in effectively distancing it from philosophical discourse, the inclusion of which could have allowed for more in depth scrutiny of the model. To truly explore a more-than human perspective of IoT, it deemed useful to attempt crossing the human/non-human threshold and welcome in the philosophical discourse further.

This next and final artefact is an attempt at doing just that. In this chapter, I will be introducing the *Tarot of Things*, a bespoke set of tarot cards designed to provide a glimpse into the inner lives of IoT objects. Similar to the attempt at auto-experience sampling in Chapter 4 to observe a phenomenological perspective of objects and their experiences, this artefact attempts to present an object-oriented perspective of IoT objects by proposing a manner of agency.

In this chapter the artefact is presented in three parts the first being the designed cards, second understanding the means of interacting with the cards, and third an accompanying work of design fiction exploring their use. Collectively they embody an abstract concept of a *supernatural* presence of/for IoT. The cards are designed with the intention to be used by IoT objects and thus the purpose here is to present this abstraction as an aid towards divorcing oneself from one's humanness, an equally abstract and difficult proposition. For this reason this chapter returns to philosophy to explain the design choices and reasoning behind the artefact.

The concept of agency in objects is a tricky prospect and battled with in numerous philosophical texts. As such, this research from the start does not argue for the presence of agency within inanimate objects, rather it proposes the use of philosophy as a lens to view the world as if it

were to have such attributes. The model considered this through alternative spatial configurations touching on a thing geography, and to approach this objective vantage point this artefact touches on post-phenomenology to view human-technology relations through philosophy.

Unlike the board game this artefact embodies carpentry in a purer sense by designing through philosophy in order to retain the prospect of scrutiny and wider discussion. It also enforces the spatial configurations further by locating the perspective as being from within the objects. In the coming text post-phenomenological discourses will be supplemented by object-oriented views of understanding the inner workings of objects, to allow this seeing out from within. In order to facilitate this the earlier understandings of digital/non-digital spaces are revisited, and iterated upon as perceptual illusions.

The referencing of illusions here is done as a realignment of perspectives in order to accommodate object-oriented-ness for humans. Also unlike the board game this is a truer ludic design artefact as described through explorations by Gaver (2002) of designing through engaging curiosity. This might feel confusing to say the board game was a less ludic artefact when it involved play more directly but it is for that reason that I consider it less Gaver's ludic design. The board game required play and thus it was a *ludic* artefact, and due to the nature of its design curiosity and ambiguity could not be fully incorporated to illicit the manner of engagement Gaver speaks of in his design process. Therefore, the Tarot of Things was an attempt to do that more directly. Collectively, this creates the carpentry method assemblage used in this chapter (Fig. 43).

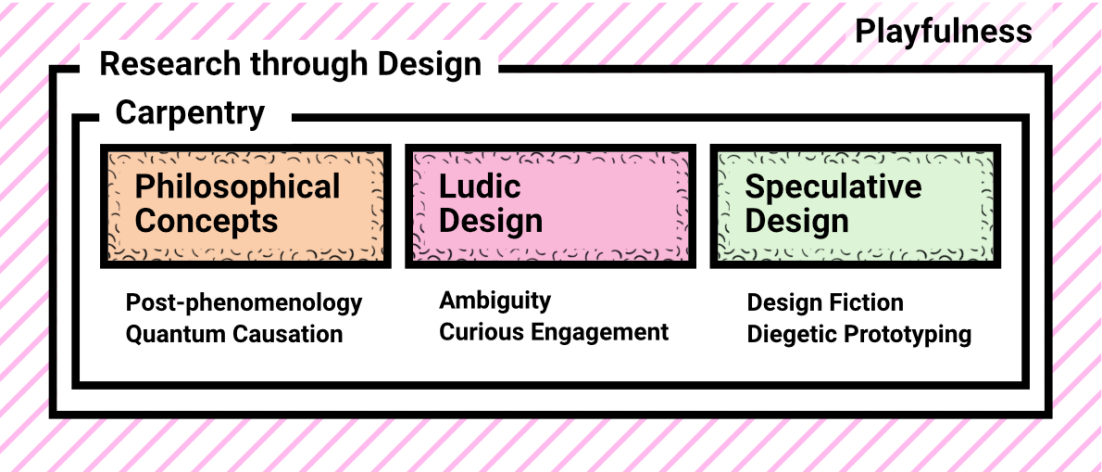

Figure 43: The method assemblage for the carpentry of this artefact combine concepts coming from post-phenomenology to explore a more directly playful approach at speculative diegetic prototyping methods.

Having said that, this artefact incorporates the core rhetoric of an attitude of playfulness in design proposed by this thesis more proudly, as will be discussed further towards the end. Through its discussion on more-than humanness and IoT this chapter also attempts to address SQ3: *How can the philosophical foundations of a proposed non-anthropocentric IoT be manifested in RtD artefacts?* Towards the end the cards are evaluated using a software interfacing approach and through role-played user feedback, to argue for seeing the world through these more-than human

object perspectives which reflects back to the RtD approach used throughout this thesis. To begin I will be revisiting some earlier explained philosophies.

9.2 Philosophical Foundations

In Chapter 4, I spoke of the *Talkie Toaster* from 90's British sitcom *Red Dwarf*, making a parallel between the toaster and its real-world counterparts.[57] Using an object-oriented perspective, *Talkie Toaster* can be approached as a more-than human object asking questions to how and why it functions the way it does. For instance, what does *Talkie Toaster* want from life? What does it do when it's not toasting? These questions may be considered nonsensical from an anthropocentric perspective, as a non-human object cannot be imbued as having such aspirations. However, this research takes playful liberties with such arguments and if considering design as an act of playfulness then what better way than to make sense of the nonsensical.[58]

Ludic design's engagement of curiosity and ambiguity through design may be better utilised for this to allow for facilitating abstract discussions. Thus, to carpenter an artefact that utilises the ambiguity and playfulness of ludic design, certain deeper philosophical arguments around more-than humanness need to be further explored starting with vicarious causation (Harman, 2018a, p. 150). In Chapter 4 I presented OOO's perspective of viewing out from within through the argument posited by Harman (2018a) of rifts existing between ontological polarities an object can take, presenting miniature worlds within/among objects full of relationships and perspectives. We know that within these rifts non-human-objects exist side by side human-objects, to be unpacked as independent and interdependent phenomenon. By this logic, when using a *Fitbit* to track a heartbeat its interaction is not directly related to the human even though that is how it appears. This interaction is with fluctuations in light observed by a sensor with no need of a heartbeat. That said, the *Fitbit's* heart monitor was not designed to interact with light specifically. As design concerns with the human perspective, light is the medium it interfaces with to deduce a 'human' heartbeat, making the *Fitbit* an anthropocentric object. The question to ask here is, how can we see the *Fitbit* as not relating to human engagement? Divorcing of an anthropocentric perspective thus boils down to a change in perception towards post-anthropocentrism.

An examination of perception is a heavy undertaking that has occupied philosophy for centuries with a great deal of literature devoted to the subject (Maund, 2003; Merleau-Ponty, 1996; Pautz, 2007; Price, 1950; Fish, 2010). Some of these notions have been covered in Chapter 4, therefore the discussion here will focus on the perception of technology through notions of post-phenomenology to approach the human/non-human threshold in respect of IoT. Rather than go into a deep exploration of these concepts,[59] the two areas of interest in this discussion come from the

[57] Putting most of the sitcom toaster's depiction aside for comedic value, *Talkie Toaster* remains an expressive embodiment of IoT with its functionality similar to our smart assistants of today.

[58] Worked fine for Dr Seuss!

[59] The referenced sources are more adept at explaining philosophies of perception than myself, furthermore, a dive into the topic would risk moving into further tangents of discourse.

work by Ihde (1990) on human-technology relations and an appropriated perspective of illusions. My intention here is to present a case for vicarious causation as occurring within digital objects through understanding post-phenomenological perspectives and how our present perceptions of technology might be misaligned for the philosophical discourse of this research.

9.2.1 The Perception of Technology and Post-Phenomenology

The influential work by Ihde (1990) around a contemporary philosophy for human-technology relations fall under the heading of "post-phenomenology" (Rosenberger and Verbeek, 2015b, p. 9). This depart is done in an attempt to distance post-phenomenological views from those of traditional phenomenology.[60] Explaining the post-phenomenological perspective, Verbeek and Kockelkoren (1998) posit a combination of philosophies coming from both a Heideggerian functionalist view of readiness-to-hand for objects, to American philosopher Albert Borgmann's concept of engagement with objects. Quoting Ihde's appropriation of Merleau-Ponty's term he calls it the "embodiment of objects"[61] (Verbeek and Kockelkoren, 1998, p. 39) in what is argued as a mediating role played by objects to facilitate the world around them for us, often through their design. "When using a pair of glasses, we do not look at our glasses, but through them to the world" (1998, p. 39).

As an example for how our perception of technology may change due to our relationship with it, Verbeek and Kockelkoren (1998, p. 38) replace Heidegger's oft quoted hammer with an adapter commonly found with digital objects such as mobile phones. As long as the wire on the adapter is unbroken it performs in a readiness-to-hand absorbed into our background lives. It becomes apparent to us only when the wire is broken making the adapter present-at-hand. The relationship changes as the adapter breaks the familiar bond it once had for a "distanced attention" (1998, p. 39) drawing us towards it. They consider these objects transparent as they bind together relationships between people and their worlds. Taking this further they present Borgmann's views of technological objects as capable of "diminishing people's engagement" (1998, p. 40), as they are designed to disburden users from mundane activities functioning best with little human involvement and unnoticed. The adapter is thus designed to fade away into the background reducing engagement with them into a form of consumption.

Verbeek and Kockelkoren (1998, p. 40) argue that the broken adapter effectively withdraws us from the world we inhabit with it because our collective involvement comes from its functional nature. Our relationship with the adapter is not as an object of meaning but resides in functional fulfilment. These technological objects are not asking for engagement as they are not designed to. He compares this to an example of a piano. The piano's existence is predicated around the music it can emit. It has no direct relation to that around it, but rather, it is through the act of playing the piano that it becomes what it is. The piano engages us in order to fulfil its function.

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[60] Classical phenomenologists viewed Technology (with a capital T) as a broad cultural phenomenon transcendentally affecting society by alienating humans from their surroundings (Rosenberger and Verbeek, 2015a; Verbeek and Kockelkoren, 1998). These negative views of Technology were later furthered by Borgmann (1999) as disburdening us from our labours.

[61] The hammer allows its wielder to operate it's designed purpose *through* becoming the hammer.

> *"Rather than thinking in terms of alienation, it [post-phenomenology] thinks in terms of mediation. Science and technology help to shape our relations to the world, rather than merely distancing us from it. This perspective of mediation embodies a reinterpretation of the foundations of phenomenology. It does not see phenomenology as a method to describe the world, but as understanding the relations between human beings and their world." (Rosenberger and Verbeek, 2015a, p. 11)*

The argument Verbeek and Kockelkoren (1998) posit for post-phenomenology through this concept of embodiment and engagement regards out relationships with the technologies that surround us. They stress a need to design objects around their "engaging capacity" (1998, p. 41), revaluating their status from objects to *artefacts* requesting human involvement. Though this might still seem like an anthropocentric approach, it exists in an overlap between Harman's OOO and a view of post-phenomenology. OOO is in many ways a like-post-phenomenological approach, wherein, it refutes prior theories to craft its unique brand of thought presenting a platform for thinking in a post-phenomenological way.[62]

Among the mediations of technology presented by Verbeek (2005, p. 127) is a notion of *Background Relations* or technological relations that exist in our peripherals. He argues for these not as technologies that have become mundane through usage, rather, those that create the backgrounds of our lives as the refrigerator, microwave, *Google Nest*, or light sensors: "They shape our experiences, protecting us from the elements or keeping our food safely chilled, but do so in ways that do not require direct interaction" (Rosenberger and Verbeek, 2015a, p. 19). These technologies facilitate our lives through their presence as they act out their own independent lives. Sensors seek us out as smart heaters keep us warm engaging with us as much as we reciprocate with them.

9.2.2 Human-Technology Relations as Perceptual Illusions

Another perspective that could be taken here is that by viewing the world through this post-phenomenological lens, a perception of objects may be crafted presenting them as embodying illusory interactions. By illusion I am referring to incorrect evaluations of perceptual experiences (Fish, 2010, p. 3); such as seeing a round object as an oval. What I am suggesting is that as *user-objects* ourselves, the interactions (or anticipation of interactions) we have with these objects of the Internet may be misguided forming *perceptual illusions*.

The study of perceptual illusions is often seen in cognitive psychology as it relates to how effects on our biology alter our perception; and as Gregory (1997) differentiates, may be of a physical or cognitive nature. The most common example of such is dipping a stick into water. Due to the refraction of light when entering a liquid such as water (a physical property), the stick appears

[62] As laboriously repeated in Harman's OOO, it does not refute human engagement rather the *precedence* of humans over objects seeing humans as objects as well. When an ontograph is examined, *objects* are interacting with each other, human or otherwise.

broken (a cognitive formulation). A stick entering water thus gives us a level of anticipation associated with the stick coming from its dimensional aspects.[63]

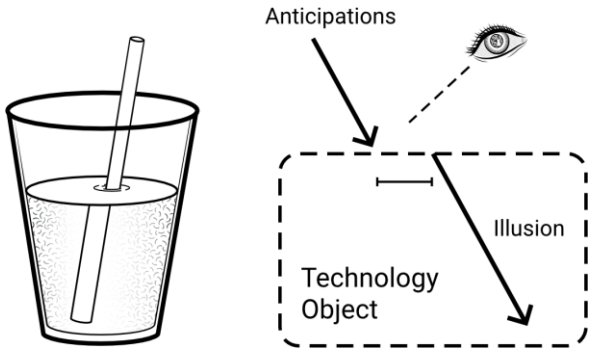

Figure 44: The stick in water does not truly bend, yet upon doing so we acknowledge it as such. This is similar to how our anticipations from technologies foster through our developed illusions of them.

What I am referring to through 'anticipations' in this way is our specific views towards how we engage with technological objects. Combined with the post-phenomenological discussion above, this metaphor presents an example of seeing the background relations of objects as possible perceptual illusions (Fig. 44). Furthermore, using the constellation metaphor by Lindley and Coulton (2017) an ontographical view of how and why these illusions occur could be charted. By being able to see the stick bend our mind acknowledges it as having altered and prepares us for the next time we interact with the water, further informing us of the nature of the stick and water. Similarly, the anticipation of interaction with our devices presents us with the idea of how they must conform. The adapter must function as expected and going in with it we take that anticipation along. Yet one need not be aware of the refrigerator in the background to acknowledge its function just as the smart heater may operate on its own after minimal human input. It is only when certain conditions are met that the illusion is broken such as being aware that the smart heater is also sharing data without consent to third-parties. This is equivalent to removing the stick from water. As these technological objects have existed prior to their 'smart' counterparts our associations with them have been crafted over time. We are aware of the refrigerators functions before it can facilitate us in 'smarter' ways.

This is not to say our smart devices are providing us with false information. The stick does not bend in water it merely conforms to the properties of light and the liquid. In his metaphor the technological object becomes the liquid, and our anticipation of interactions forms the illusion. The *Fitbit* is not reading a heartbeat, it is only reading fluctuations in light. Thus, by acknowledging the presence of our devices as background relations existing in their own right, we remove preconceived anticipations to make way for deeper meaning associations with these IoT objects. For example, how a *Fitbit* does not require human intervention to be a *Fitbit*, it is the nature of the design of IoT

[63] Of course, a stick in water is not really bent, the anticipation spoken of is a perceptual one. In the event of no light or a liquid with an equivalent refractive index the illusion does not happen as it is commonly understood. That said, due to the physical properties of light travelling through different mediums, refraction is still present ergo the image in the liquid will always be a virtual rendering.

to accommodate the human perspective of these devices. They operate independently facilitated by the data provided to them as Lindley *et al.* (2018) put it:

> *"Whilst human object and the device object are, of course, relevant, it is the data object(s) that appear central to the issues here; they are the containers and carriers for the information to which we attach ethical and moral significance." (Lindley et al., 2018, para. 31)*

The human/non-human divide may now be crossed if, *(a)* they are acknowledged as independent entities existing in the backgrounds, and *(b)* their operations are acknowledged beyond anthropocentric functionality and our anticipations of interactions with them. As the data object is what drives IoT, therefore for a carpentered ludic artefact to acknowledge an object-oriented perspective the relationship of data to the object is what needs to be understood, as it should help in informing the world in which the object exists.

9.2.3 Quantum Causation for IoT

The simplest way of making this relation visible through OOO is using *quantum causation*.[64] The four-fold model by Harman (2010c) presented in Chapter 7 explores tensions between the real and the sensual as time, space, essence, and eidos[65] in an attempt to approach this deeper idea of causation using quantum physics (Weir, 2020). The point made is that an objects interactions occur on an atomic level with particles rearranging themselves as needed. Explorations in the quantum realm are still in early stages, but when the matter of space is discussed in quantum physics it is not considered 'empty', instead, accepted as harbouring virtual particles (Weir, 2020, p. 152). Morton (2013) presents an in-depth argument for this on the impossibility of space independent of objects. Quantum causation suggests a platform where non-human real objects can have sensual objects within them, much like how human real objects can. Using Harman's favoured OOO example of cotton and fire, a notion of non-human perception happening through the interactions of quantum particles could suggest why cotton *understands* it must burn when interacting with fire.

[64] This idea comes from the roots of OOO in Islamic medieval philosophy of *occasionalism*; a perspective that defined causation through acts of God (Weir, 2020; Harman, 2005). This occasionalist influence on OOO was refined by Harman over time as not to present an argument for God in OOO, but rather, the presence of asymmetry (Harman, 2010c, 2010a). This is because where physical contact can be considered symmetrical—touching a surface may illicit responses to understand the surface—perception is asymmetrical (Weir, 2020, p. 148). One may be oblivious to what is being experienced through perception alone.

[65] Though important to understand for OOO sake, a deep exploration of these four tensions is not necessary for our argument. Harman's (2010c) own paper or Weir's (2020) apt summary is recommended for a deeper understanding if needed.

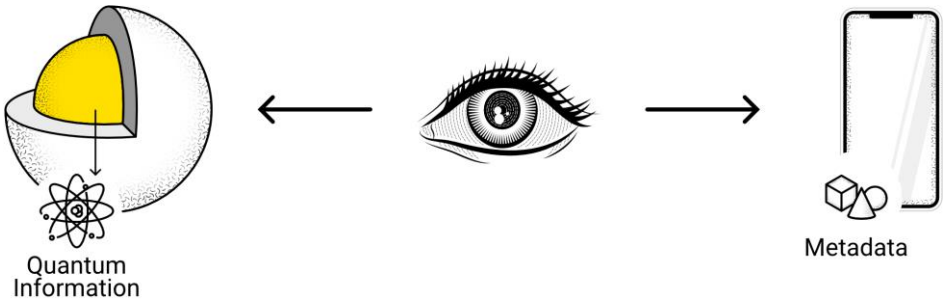

Figure 45: A quantum causation of IoT objects can be imagined through metadata acting as virtual particles just as atoms and molecules create the foundations of causation in the physical world.

Much like the perceptual illusions we have with our objects, this suggests objects have their own anticipations of other objects when they engage. This wrapping of objects within objects mimics the way spaces are defined in the model for IoT as heterotopias, therefore, the quantum realm can be substituted in our case for the digital with data as its particles (Fig. 45). Hui (2016, p. 48) presents an argument for digital objects to be seen as phenomenological objects in this way by charting a relationship between the underlying workings of digital interactions and phenomenological implications around the perception of technology in what is considered a "Genesis of Digital Objects" (2016, p. 49). Code and metadata in this perspective may be seen as constructs intended as ontologies of data and a digital object. Unseen to the user in this quantum-digital space, each bit of information acts as giving a kind-of life to the otherwise non-living.

Through the model presented in Chapter 7 the digital has already been established as an alternative space existing parallel to the non-digital. With the information housed in these digital particles, objects in the digital understand when to fuse with other IoT objects creating their perceptive illusions. The adapter understands electrical current as much as the smart phone does. In a similar light, the smart heater understands fluctuations in temperature coming from its sensors in order to regulate the atmosphere it controls, as objects transcend quantum causation between digital/non-digital realms.

While exploring the constellations in IoT Lindley *et al.* (2018, p. 236) examined how data was communicated between individual entities in an IoT network using *Wireshark* a network protocol analyser. The sheer volume of information going between different points coming from a single computer on the network was found to be staggering and when each packet of information was seen as OOO unit operations similarities were found. A hexadecimal language full of metadata spoken between the different networked objects as they understood each other creating building blocks for their interactions and their individual perceptions of each other. The kettle knew and was aware of the smart lock on the network as did the smart phone. Amidst all these interactions were possibly non-digital causation translated for the digital as well; think temperature, time, pressure, etc.

This myriad of philosophical lenses presents similar building blocks for allowing IoT objects to be seen as capable of relations with other objects, human or non-human. With the philosophical foundation for this artefact in place we can begin carpentering the Tarot of Things to facilitate object-

oriented relations and anticipations. The artefact intends to bridge the human/non-human threshold by allowing a means of 'reading' IoT as being more-than human, and seeing objects in a way that is playful yet insightful.

9.3 Carpentering the Supernatural IoT

For this artefact our carpentry toolbox takes directly from the philosophical foundations described above to attempt creating abstract perceptual realities for IoT objects. To achieve that I use the word 'supernatural' here in reference to the usage of the term "ghosts" residing 'in' IoT objects by Lindley *et al.* (2019, p. 1188), the idea being that where there are ghosts there are (or have been) lives; pasts, presents, futures. As this process is intended to be playful to incorporate the philosophy as broadly as possible, this approach of exploring the vicarious lives of digital objects may be done through acknowledging their aspirations and futures. Since the two main aspects coming from the philosophy include the repurposing of post-phenomenological human-technology relationships (or engaging objects) as illusions of anticipated interactions, and a quantum causation for these digital objects, it is important to establish a baseline on which these concepts may be touched upon sufficiently.

One approach already present in OOO is through *enthymeme* which Harman uses as a way to structure OOO's rhetoric.[66] Enthymeme are seen as logical reasonings with premises left unstated as it is assumed that the participant understands the major premise, for instance *'an offer that can't be refused'* or the giving of a rose being associated with affection. The use of enthymeme suggests the presence of the hidden, thus, it is possible to imagine crafting enthymeme into design practice to explore knowing the unknown; in this case, the supernatural lives of IoT.

In *Enchanted Objects*, Rose explores the concept of human-human connection through a metaphor of "telepathy" (Rose, 2015, p. 85). The argument he presents is not for the validity of telepathy as a practice, rather about what telepathy implies; an indirect communication where one simply 'knows' what the other is thinking. Giving the example of *LumiTouch* by Chang *et al.* (2001), a paired picture frame that glows in sync when held, Rose (2015, p. 85) discusses this possibility of designing to know the unknown. The enchanted interaction of *LumiTouch* seduces with the curious nature of humans poking at emotions. Its glow affirming the enthymemic rhetoric it intends to present forward: miles away, whoever has the other picture frame is holding it up. Design and enthymeme in this way are very much married together and therefore plausible to incorporate into our carpentry process.

The first step for this baseline is to establish the premise on which our enthymemic design rhetoric will operate. It has to be able to explore both the engagement and aspirations of IoT objects as well as acknowledge inner workings through a quantum causation. For this reason and taking

[66] Carried on from the previous chapter, there is a deep chasm of philosophical intrigue into the formulation of enthymeme in dialect which I am purposefully avoiding. For more information one may refer to the works of Walton (2008).

forward the ghost in the machine metaphor from Lindley *et al.* (2019), the lives of our IoT objects may be imagined through divination or fortune telling.

I won't be entering into a discourse around the practice of fortune-telling as for this artefact it is but a medium (no pun intended) for exercising the more-than human perspective.[67] Fate as a concept is prevalent in many cultures representing a philosophical school of thought, whereby events and actions within our lives are deemed subject to a predetermined course or destiny (Zagzebski, 2017). As we are taking playful liberties with IoT to facilitate the more-than human discourse having already presented possible social dynamics among digital objects, this perspective of defining the fates of our IoT objects presents a prospect of the 'aspiring digital object'.

Interests in divination stem from *being* human, and the fact that we can contemplate on our lives. But, with some apt usage of speculative design work it is possible to imagine a moment where the rise in autonomous objects may bring about considerable advances in Machine Learning (ML) to harbour divinatory guidance services for IoT devices; *digital seer's* if you may.

How this artefact attempts divination is with the most basic form of *Tarot*, selected for its simplicity over other methods such as reading tea leaves or astrology. Adding to the ludic rhetoric, tarot also made sense as a 'tool' under the guise of a card game. It takes 2 to 'play' whereby the seer reveals the meaning of chosen cards as if narrating a story. As a reference standard Rider-Waite[68] tarot deck was examined consisting of 78 cards[69] out of which 22 form the *Major Arcana*, followed by 4 suits of 14 cards each as *Cups*, *Pentacles*, *Wands*, and *Swords*. As the theme for tarot is taken from folklore and mythical fantasy, the imagery associated with tarot is of a similar nature. This is most visibly seen in the names and imagery of the major arcana cards: *High Priestess*, *Magician*, *Hanged Man*, etc.

Where tarot's simplicity works for the purposes of this research is through its inherent practice of rhetoric, with the seer tasked to 'make sense' of cards through their meaning associations. Nash (2017) discusses how these associations come from years of evolving classifications of folklore and mythology presented in the visual imagery of the cards. Therefore, the result of a tarot session may be reduced to a list of keywords extracted from card meanings that are independent and interdependent[70] effectively creating ontographs. For the purposes of this research this process has been further simplified and an online reference sheet[71] used for understanding the meanings of each tarot card. As the meaning associations in tarot are vague and ambiguous promoting their own

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[67] That said, as food for thought, academics have shown interest in the research of practices on the boundaries of science and culture—such as psychics and the occult—in the past with even Freud having found interest (Sosteric, 2014).

[68] Other formats of tarot exist with different names for the suits and cards. Rider-Waite is considered among the most commonly used and recognised formats.

[69] Though the traditional Rider-Waite deck has 78 cards, for Tarot of Things an additional major arcana card *(Thing)* was included to facilitate an extended discussion of its relation to the non-human.

[70] These lists of words remind us of Latour's litanies from Chapter 6. They also form an enthymeme by being disconnected information that together form a unit and premise.

[71] For the purposes of this research the Labryinthos Academy was used as a reference for tarot card keywords. For more information, see: https://labyrinthos.co/blogs/tarot-card-meanings-list.

enthymemic natures with seer's extracting information from both the cards and the conversation with involved parties, this opens up a wide area of possibility for keyword associations during any given tarot session and a potential for ludic design's engagement through curiosity and ambiguity.

From the perspective of the above philosophies this divination approach allows for each philosophy to be addressed in the carpentry process. By acknowledging digital objects as having possible fates determined by cosmic (or perhaps network) alignments, they are presumed as engaging with their lives and those involved in it; be they digital or non-digital entities. This in turn also feeds into the rhetoric of possible illusions they might have of their daily interactions. Being programmed and forced to follow algorithms the lives of digital objects may be assumed to be governed by predefined rules. Taking into account potential advances in ML then these rules may also be considered as malleable and capable of evolving, ergo the world perception of digital objects may be equally misaligned as our own as they may accept the presence of other digital/non-digital objects as existing in background relations. The smart toaster may be aware of the presence of human users operating in the backgrounds through their mobile phones, or the smart heater acknowledging the presence of the smart lock through the network. This is all viewable through the constellation metaphor as these objects are connected over the network stressing the point that the lives of digital and non-digital objects are intertwined. Finally, all of these overlapping interactions, acknowledgments, anticipations of interactions, and illusions of background relations are possible through a quantum causation occurring within digital space. The transferring of metadata in the language of IoT asserting their presence among each other, as well as an understanding of certain causation with non-digital objects.

9.3.1 Designing the Deck

With a baseline of tarot now established for this artefact capable of rendering an object-oriented discussion, the next step became understanding what manner of cards could be associated with a more-than human IoT. Furthermore, imagery and symbology associated with the deck need also reflect the 'world view' of IoT rather than human folklore capable of instilling in IoT objects the perceptual illusion of their perceived anticipations.[72] What I mean by this is that the cards need to reflect how digital objects anticipate interactions in their world as they follow different rules to our own. As humans we understand references such as *Death* and *Strength* coming from tarot but what are those equivalents for IoT? Similarly we acknowledge when an object no longer functions as it should, how does that equate for digital objects?

To allow the deck to relate better with IoT each card in the Rider Waite deck was examined separately with its imagery and keyword associations tabulated. The online reference observed for keywords presented multiple associations with cards, some repeating and others differing according to card orientation. The problem occurring here was the fact that many of the keywords were too abstract of concepts to associate with IoT, take for example keywords like pleasure, materialism,

[72] Albeit, a lot of that symbology is coming from an anthropocentric perspective as IoT devices are crafted with the human in mind, sufficient levels of visual abstraction was still used.

and pride. Luckily as each card came with multiple keywords each keyword in a single card would often expand on the previous. For instance, the *Judgement* card when upright may mean 'reflection', 'reckoning', or 'awakening'. As humans we can understand these concepts, and they in many ways are associated with each other depending on contexts. For our purposes this meant systematically picking and choosing which keyword reflected a world view of IoT holistically.[73] In this instance 'reflection' was opted for as a vague yet translatable middle ground, because a 'reckoned' or 'awakened' digital object was more difficult to comprehend.

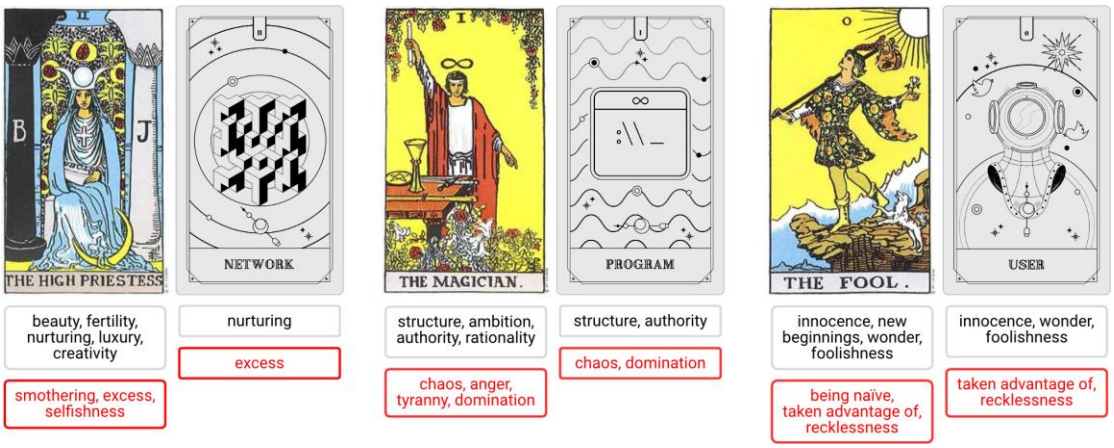


Figure 46: Imagery and meaning associations for Tarot of Things were appropriated from standard Rider-Waite tarot cards. Though a deep dive into understanding digital folklore could have been conducted, the process was simplified and through keyword associations of tarot relevant imagery was designed.

The second aspect to tackle was the representation of the cards. The imagery and context of tarot comes from folklore therefore, what kind of similar folklore may exist for digital objects? Rather than go into a deep analysis of how stories and concepts emerge in human folklore this process was simplified by deducing equivalent concepts emerging from human-technology relationships and ideals. To do this the keywords were again referenced to understand what they related best with. So the *Emperor* card from tarot became '*The Programmer'* for our deck because the keywords associated with it were 'creation' and 'adaption'. Similarly '*The Fool'* became the '*The User'* because its keywords were 'innocence', 'wonder', and 'foolishness'. In this way the imagery associated with the cards were also designed in accordance with the new titles of each card. For the most part the design was kept simplistic again referencing styles from Labryinthos Academy's own Rider Waite deck. An example of some of the cards designed and their referenced Rider Waite cards are given in Fig. 46. A full list of all the cards along with their keyword associations are presented in Appendix C.

Finally, an additional *'Thing'* card was added to the major arcana to represent a means of differentiating this deck as an approximation of tarot. The *'Thing'* card also intends to directly reference the object-oriented-ness of the interactions being forecasted if it were to be drawn. As

[73] The problem associated with this approach might seem vividly apparent at this moment though I will hold discussing it for later.

typically tarot is intended to relate to the individual having their fortune told and in the language of the cards it is often represented by *'The Fool'* card, here that card was substituted for *'The User'* to denote zero precedence between digital/non-digital users.

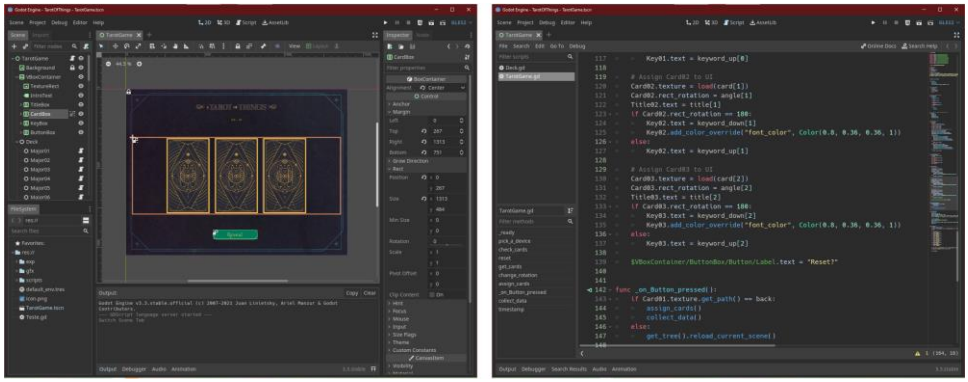
With a visual language and close approximation of keywords, the deck on its own can be used to represent a tarot-like session. But it is also important to understand where these divinatory sessions would occur and who would be conducting them? To carpenter an artefact for IoT divination the initial thought was to make a 'physical' tarot deck. The problem with this is making an IoT object interact with the physical cards. A tarot session involves 3 stages: shuffle, draw, and read. The shuffle stage is done by the one having their fortune read, thus an IoT object would require access and the ability to shuffle a deck of cards. As IoT objects exist in digital space the artefact therefore needed to exist there as well so a physical deck of cards could not work.

9.3.2 Scanning the Stars with Software

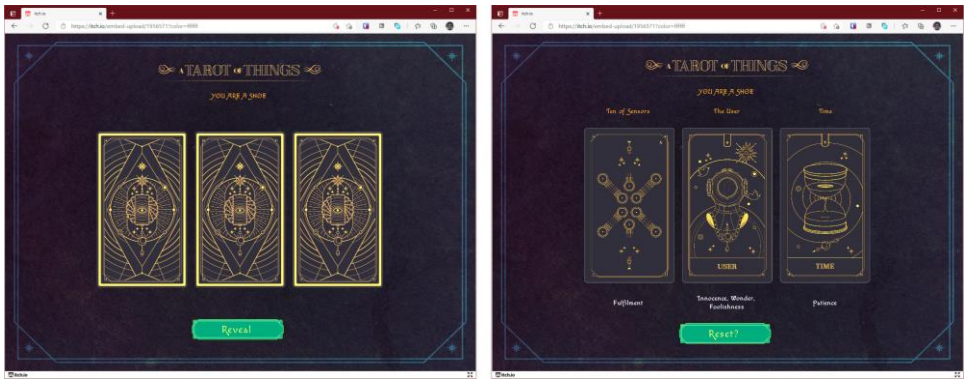
The solution for this was to program the Tarot of Things in a way that it could be accessed by digital objects. Due to tarot's game-like formation programming was done using a *Python*-based game engine to lay a framework for fundamental interactions (Fig. 47a).[74] As a popular programming language, Python is capable of easily integrating with other platforms facilitating interactions with IoT.[75] The intention became for this carpentered software to act as an independent link between IoT object and the act of fortune-telling; the interface being merely a mode for human facilitation (Fig. 47b). Devices would ping the software and be presented with a forecast, either of the interaction it underwent or any future interactions.

[74] The engine used was an open source game engine called *Godot*. For more information, see: https://godotengine.org/.

[75] For a list of benefits for using Python, see: https://www.pythonforbeginners.com/learn-python/benefits-of-learning-python.



(a)



(b)

Figure 47: Carpentering the Tarot of Things as a ludic artefact; (a) programming for the artefact was done in Python on the Godot game engine; (b) the end result was outputted in two forms as software, one that could be read by humans while the other by IoT objects.

Programming for a deck of tarot is rudimentary with the deck being assigned to a data set referenced in Python and then iterated on through a series of functions. The interface itself was kept simple since it was only required for research purposes. In the end the program would be self-administrating but for the purposes of testing the interface would prove vital.

9.3.3 A Tarot of Things

The name *Tarot of Things* is given to not just the deck of cards but also its supporting application. In its human-oriented form[76] the application simulates the inclusion of objects by shuffling through a list of non-human objects and presenting the statement *"You are a…"* followed by the random object. This asserts the agency of the object to be viewed through the cards later drawn. In the final version this would represent the object having its fortune told. Finally, pressing a button reveals the 'forecast' which would otherwise be done programmatically in private sessions between software and device.

[76] Can be experienced online here: https://www.fictionware.org/tarot-of-things/.

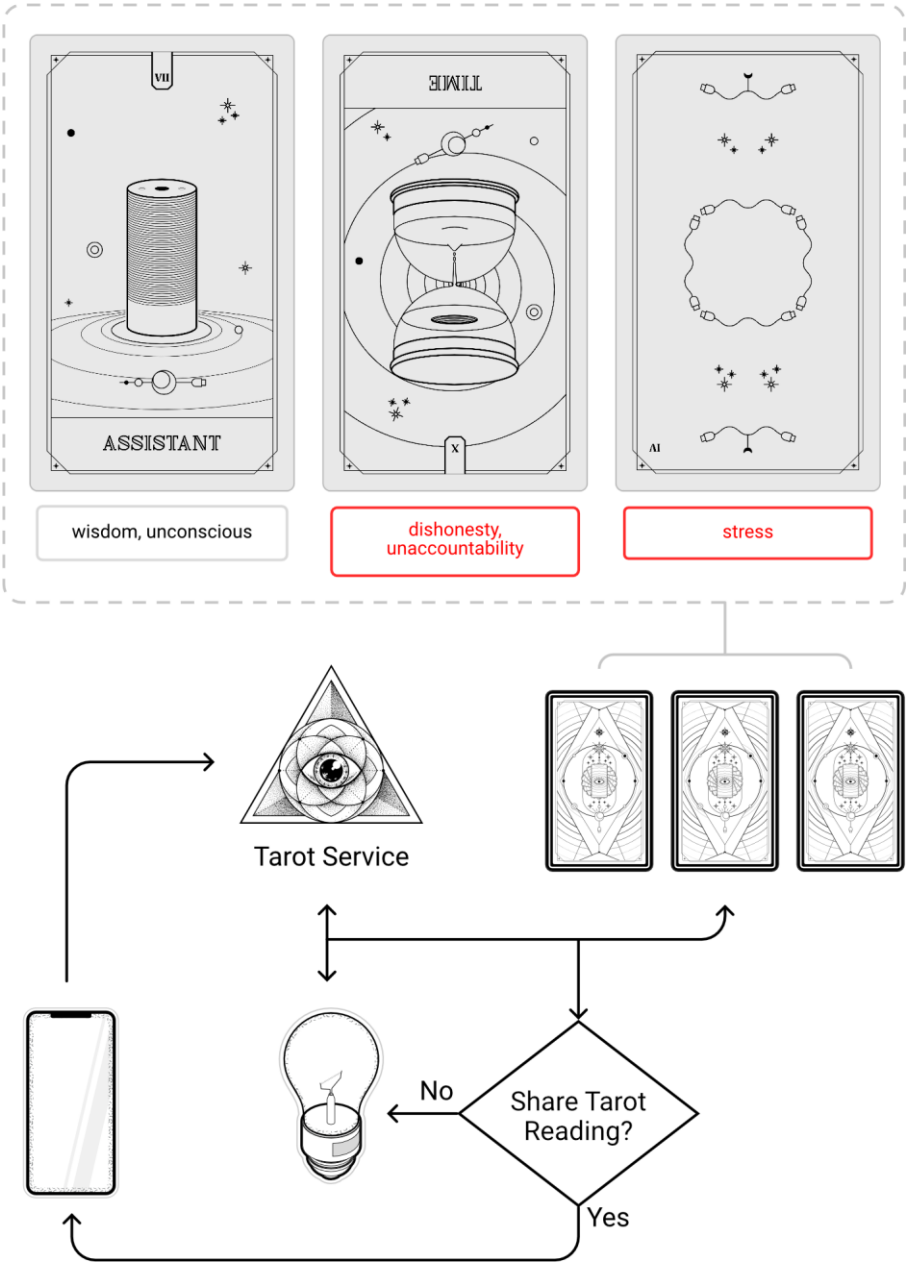


Figure 48: Tarot of Things acts as a fortune telling service offered to IoT objects. Through word associations of tarot the digital seer enters into a conversation with the object; ideally occurring independently of any human involvement. In this illustration this is facilitated by the human through a smart phone.

For the purposes of this research these sessions are conducted using the carpentered interface. Through this 'forecasting' as keyword reductions ontographical relationships returned may now be assessed through the enthymemic rhetoric of fortune-telling, allowing practitioners to raise questions which would otherwise seem implausible. Consider the example of a lightbulb remotely switched on by a smart phone (Fig. 48). The tarot program exists on a network in the cloud accessible by the bulb. Upon switching on the bulb, it pings a server triggering the generation of a forecast. Table 6 shows a random configuration of the cards presented. This process also highlights a quantum causation occurring within digital spaces through object engagement. The vicarious lives of our digital objects existing in the backgrounds becoming prominent through the cards with their

perceptual illusions manifested. An assessment of keywords raises questions such as, what is wisdom for a bulb? How can one be unconscious? Could a bulb be dishonest or unaccountable? And, what stresses a bulb? Furthermore, the enthymemic rhetoric afforded by fortune-telling between the cards and their meaning associations (*Assistant* in relation to *Time* for instance) presents a heightened layer of information regarding the aspiring digital object.

Table 6: Random configuration of cards with subsequent keywords generated by Tarot of Things

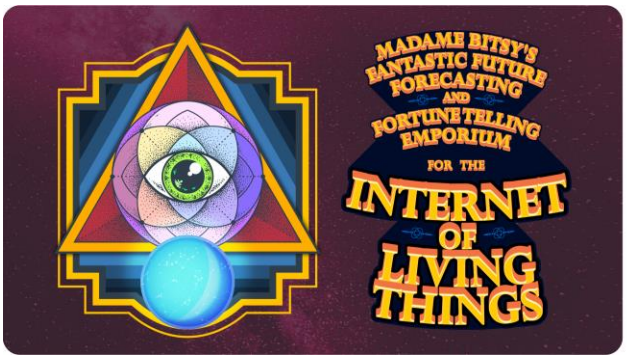
Card	***Orientation***	***Keyword(s)***
Assistant	Upright	Wisdom, Unconscious
Time	Inverted	Dishonesty, Unaccountability
Four of Cables	Inverted	Stress

Where some of these questions might seem more straightforward to answer—for example, *Dishonesty* does it send its operating data to a third party without informing the owner?—others present unique challenges. Of course, all of this is subject to the understanding of the designer/practitioner and how much interpretation is allowed. But it does provide a useful starting point for the discussions which otherwise would likely not be considered under pretences of orthodox HCD methods. Some of these questions might very well lead to novel design solutions from an object-oriented perspective.

9.3.4 Madame Bitsy's Emporium

As earlier expressed, this chapter includes a design fiction to explore Tarot of Things as a means of presenting the object-oriented aspect further. In its current format, it facilitates the human practice of seeing through a more-than human lens. Design fiction pushes the boundaries of Tarot of Things into a near-future where IoT objects are provided independent divination services imagined as a fortune-telling mobile app. The fictional app provides both divination services to IoT objects, and upon receiving permission from the objects presents that information to human cohabitors.

As a basis for this service, the fiction takes advantage of the many 'fortune-telling' and 'psychic' apps available on smart phones intended for humans (Fig. 49b). Among those apps, the work of fictional start-up *Gaaps* is presented with the purposefully flamboyant title of *Madame Bitsy's Fantastic Future Forecasting and Fortune Telling Emporium for the Internet of Living Things* (Fig. 49a). Unlike other applications claiming psychic prowess that target humans, *Madame Bitsy's* clientele are IoT objects and services. The intention here is to provide human-readable forecasting of futures for human cohabiters of digitally empowered IoT objects.



(a)

(b)

Figure 49: Design fiction for exploring Tarot of Things; (a) branding for Madame Bitsy's Fantastic Future Forecasting and Fortune Telling Emporium for the Internet of Living Things; (b) fictional news clipping designed for world-building purposes of speculative fiction.

The character, name, and aesthetic intentionally fuels the world-building aspect associated with design fictions (Coulton *et al.*, 2017) presenting IoT objects as 'living objects' by *Madame Bitsy*. The application itself resides on a human cohabiters' mobile device, requiring access to nearby IoT devices. Initiation of a divination session remains independent of the human thereafter in order to keep the personal privacy of IoT objects in mind.[77] As such, interaction during the session is done software to software within digital space. Traditionally this link is done in-person between seer and client and begins with a shuffling of the tarot deck by the client; in this case, shuffling is done by the device through a series of pings between itself and *Madame Bitsy*. Once the digital deck is shuffled the cards are revealed to the device through a series of questions akin to two chatbots speaking amongst each other. Upon receiving a 'response', a final permissions check is done between seer and client before articulating the session for human presentation. The translation uses an appropriated Tarot of Things interface and the deck of cards. With the information purposefully

[77] Like any good seer or psychoanalyst, *Madame Bitsy* is bound by client/seer privilege so as to not divulge sensitive information without consent.

skewed to aid in the believability of fiction, the translation is presented in as legible a manner as possible to be read as what the device's future holds.

Figure 50: Madame Bitsy engaging in a private divination session with her client HAPI-Fork. On receiving consent from the fork, Madam Bitsy presents the human cohabitors with the conversation for them to understand their relationship better.

As an example, the fiction undergoes a session between *Madame Bitsy* and a smart fork *(HAPI-Fork)* to explore this supernatural perspective (Fig. 50). The interaction although imperfect presents an interesting dialogue between two non-human entities. One might be compelled to nudge it further and wonder what the fork meant by not being *'emotionally balanced'* or how it was *'indecisive'* in its role. The fiction explores the possibility of the forecast going on to include a response from *Madame Bitsy* to the user, painting the picture of an indecisive fork with intentions of evolving further (whatever that might mean).

Whether the fork intends to act upon the forecast presented by the application is an unknown, what is known is that through ML devices can rewire themselves to repurpose their logic. So, the indecisive fork might become a decisive one and stop doing what a smart fork is intended to do. The fiction of *Madame Bitsy* allows for this philosophical point of view to be further probed in a way that can be seen as food for thought to both philosophy and the design of IoT.

This fiction also highlights the different philosophical perspectives the carpentry process here has overseen. The fact that the device has complete authority to deny access of the forecast to the human-user expresses the level of quantum causation occurring between *Madame Bitsy* and the fork. Likewise the different cards and the conversation between seer and client paints a picture of the fork existing within its world governed by its own anticipations of interaction. *Madame Bitsy* allows the fork to be seen as an engaging object capable of seeing outwards towards other 'things' around it. In the fiction the fork suggested itself to be emotionally unbalanced, this statement though an abstraction when attempting to contemplate for a non-living entity presents an argument for the vicarious lives of this object and quantum causation within it. Why does it feel that way? Is it because of other objects around it? Or the lack of objects? Is it lonely? What sort of information/data is this

object dealing with? The fiction dives into further ambiguity on purpose to continue the thread of questioning.

9.4 Feedback

As a final step, Tarot of Things was subjected to a series of tests with participants for feedback into this more-than human perspective. Though the artefact did not require this in the same way that the Internet of Things Board Game did, it helped in judging the ease of using this as a way to view its object-oriented-ness.

The approach was evaluated through semi-structured interviews with 8 participants where they were asked a series of questions around their knowledge of IoT and their experience of the cards. There is evidence to show the benefits of using simulation and role-play in research as exploratory mediums (Druckman and Ebner, 2008), in that light, participants were given random IoT objects and asked to roleplay as them when questioned. The questions were around their impression of the cards, and whether the keywords related to them as IoT objects.

Each participant underwent a series of card/keyword/object configurations, to see how much of the concept could be passed across. The immediate issue faced by participants was the lack of a starting point for role-playing. Questions like, *"How can I think like a backpack?"*, were common. Though after the initial few hurdles of configurations and aligning their thoughts to those of non-human objects they all began embodying the objects more freely.

That said, their embodiment was heavily influenced by their *humanness*; as in, the objects no longer took on the guise of bulbs and forks but instead became *bulb-person* and *fork-person*. The reason for this could be attributed to the curated keywords. Though there was enough variance to bring about odd interactions, they were also the only entry points for participants to take on the more-than human perspective. Being curated they were still subjected to prior anthropocentric assumptions. In one instance, a thermometer was presented to a participant along with the keyword *Discipline*. They managed to make a story out of how thermometers would make your mind more rigid according to the reading; ergo, you need to rest because you are sick, 'says the thermometer'. This is a specific view of the keyword association of 'discipline' and 'thermometer' and does not take into account the potential for 'discipline' to mean something else for it.

The prevailing argument presented by participants was, *"Why does this matter?"*. When asked about how they see the nature of IoT objects as being capable of more than their designed intentions, some participants argued that they would see the object as being more useful than its otherwise non-enhanced variant; for instance, how a telephone is a minor function in a smart phone. This aside, doing the role-play made them aware of how these objects might be doing things they had not envisaged. One participant suggested how the keywords and cards made her wonder if she should be more careful with her devices. If an object can be identified as *Manipulative*, then what else could it be?

9.5 Discussion and Conclusion

Having presented the Tarot of Things in its entirety we can now embark on how well this artefact was able to address the question(s) of this research, as well as how well it captured the attitude of playfulness. Firstly, this particular process of attempting a purer form of carpentry and making an artefact capable of rendering philosophical rhetoric has brought about mixed results. The philosophical discourse embedded within the artefact through understanding objects as having their own lives governed by rules beyond our own though present from the cards, the question raised is to what extent does that truly translate? The dense philosophical constructs referenced in this chapter were done to present a foundation for why this perspective of quantum causation could make sense for digital objects in hopes of arguing for object-oriented agency. There is no contention for its existence in the physical world, but to approach a construct of causation among digital objects these philosophies had to be married together. In the process these cards are still coming from an anthropocentric understanding of living and existence. Perhaps inanimate objects 'live' out their lives differently. The only reference point we as humans can put forward is our own.

That said, in light of SQ3 where Tarot of Things cannot be deemed a complete object-oriented success due to the current impossibility of fully divorcing from the anthropocentric perspective, I can say that this approach was able to explore the philosophy of OOO as a lens for design of IoT much better than the board game. True, the board game was more heavily involved in the RtD process, this does not rule out the design process of this artefact. That is because as a whole this artefact comes from the understanding of concepts and trials and errors presented in the previous chapters. This makes the Tarot of Things the result of an RtD process starting from the model in Chapter 7. The use of tarot here is similar to the endorsement of tarot by Semetsky (2006, p. 188) within psychoanalysis, as being capable of enabling an awareness of "unconscious material into consciousness". Here the *unconscious-consciousness* is hinting towards the inanimate IoT object to act as a bridge for practitioners. Ergo, through this RtD discussion originating from the model the philosophical foundations for a proposed non-anthropocentric IoT is manifested in this artefact.

This appropriation of tarot is meant to see through and dive within unconscious materials for insight through what Semetsky (2006, p. 188) calls "projective hypothesis". The seer of a tarot session is no different to a psychoanalyst in this regard, keying the possibility for a *philosopher-designer-psychologist* or *philosopher-designer-mystic* through the view of carpentry.

This artefact is unique as it can exist as separate entities. It is a deck of tarot cards that though skinned differently still references similar concepts and may very well be applicable to non-digital objects existing among digital objects (such as humans). Combined with the programmed logic and reference of the fiction it becomes a different artefact relating more to digital objects as if advocating for their existence. Either way it presents a perspective of being among and engaging with digital spaces. It exposes our established illusions and misconceptions of how our interactions occur with the objects we surround ourselves with. Perhaps presenting a means of understanding what these interactions are and where they can be improved upon.

This artefact becomes holistically more playful in this manner of incorporating philosophy, mysticism, and technology by engaging with obscurity. In reference to SQ2 of how a playful attitude is manifested, this artefact does that from the start by facilitating that the human/non-human threshold must be bridged through accepting the agency of objects as abstract as it may seem. The point of suggesting that where there are ghosts in the machine there must have been lives lived by the machine resonates with this attitude of playfulness that everything has play within it as Bogost (2016) argues for. Furthermore, through the philosophical discourse of enthymeme and merging this concept with ludic design, this artefact speaks of approaching the unknown through design practice and curious engagement. The role-playing conducted in the process itself promotes the artefact and making of it as a playful act towards understanding IoT, or more specifically understanding the more-than human IoT.

Both executions, Tarot of Things and *Madame Bitsy*, become individual acts of carpentry with the sole intention of exploring the design of IoT through a philosophical lens in a manner that is both playful and insightful. Irrespective of how the Tarot of Things are viewed it is a testament to carpentry's associated playfulness when combined with design. It raises odd questions on designed objects, such as what comes next in the evolution of a fork. Implications of this knowledge within fields of design and technology could open doors for further research or the design of products considering product-perspectives over user-perspectives.

MOVING FORWARDS

CHAPTER TEN

DISCUSSIONS AND CONCLUSIONS

"Why, sometimes I've believed as many as six impossible things before breakfast."

— LEWIS CARROLL, ALICE'S ADVENTURES IN WONDERLAND

In its course this research has explored a number of areas around the central premise of designing for IoT. Along the way the most prevalent concept reverberating throughout has been the crafting of transdisciplinary method assemblages for executing philosophical carpentry as design research practice. Among the different assemblages imagined, two core aspects resurfaced: an iterative RtD approach, and an attitude of playfulness within the act of design. As this thesis is even titled *'Design by Play'*, one may easily think that was always the focus. Though playfulness has a strong presence in each artefact in this work through an ever present attitude, this research remains concerned with design of IoT and specifically an object-oriented more-than human perspective from a RtD approach. The rhetoric of playfulness was used to facilitate the application of the supporting philosophy applied through carpentry as a methodology, which as I highlighted in Chapter 6 that for me design is inherently playful. Therefore, while I will be addressing the topic of play more directly later on in this chapter, the main focus will be collating findings from previous sections to offer a closing discussion around more-than human perspectives and the use of playful methods for design of IoT.

The core research question asked in Chapter 2 was, how a RtD process manifests itself within performing philosophical carpentry intended for a diverse audience. This was expanded with three sub-questions around *(1)* whether it was possible to highlight potential problematic effects of IoT through a philosophical lens, *(2)* How does an attitude of playfulness occur in this research through design activity, and *(3)* whether philosophical concepts of a proposed non-anthropocentric IoT could be manifested through RtD artefacts.

After presenting the three artefacts of this research that attempted to address the notion of more-than human design practices for IoT, the artefact chapters addressed their positions in light of the sub-questions. Though I will return to them later to expand further upon, the core question can now be addressed directly. Since this thesis has dealt with philosophy throughout, some of the answers and supplemented questions I present below may feel more philosophical than others. Therefore, to facilitate questions around the implications of this research as a broad RtD project for design application, this chapter revolves around three core aspects presented as an interwoven discussion: carpentry and the more-than human, things of the Internet, and an attitude of playfulness.

10.1 The Living Internet of Things

To begin, the argument of non-anthropocentric perspectives for IoT will be addressed starting with agency within IoT. From the very start, this thesis has been nudging at the notion of animating the inanimate. From the automatons of yesteryears to AI-powered assistants on our desks, the bringing of life into an object is an act that has occupied design and is fuelled by the limits of our imagination (Marenko, 2017, p. 30). While laying the foundations for this research I defined IoT as a network of non-digital objects facilitating a language for digital ones, as if existing on multiple planes (Madakam *et al.*, 2015, p. 166). These planes I later defined as one being our own which we occupy as non-digital human-objects, and the other a digital ether of binary code and algorithms. In the start of Chapter 4 I mentioned an episode of *IT Crowd* that described the Internet as a tangible object. Though the sitcoms intentions were satirical, concepts established in previous chapters argue for philosophical weightage of a tangible Internet.

We use the phrase *'surfing the Web'* describing the Internet similar to a wave on the sea. We talk of *'going online'* as if it were a physical location like upstairs or outside. But unlike the internet you can touch the water, acknowledge the sea, and calculate the dimensions of spaces through real-world physics. In Chapter 9 I presented the idea of using post-phenomenological and object-oriented perspectives to imagine a physics for IoT, down to a digital quantum level. Furthermore, using the model described in Chapter 7 IoT was characterized as heterotopic spatial configurations, presenting a perspective of how IoT interactions may be charted through philosophy and understood as independent yet interdependent unit operations.

Moreover, these chapters have been presented as steppingstones towards the artefact in Chapter 9 that proudly embodies concepts coming from before in one place. The Tarot of Things is in that regard is the result of the RtD project that has been my PhD. Artefacts designed in the process were each exercises in philosophical carpentry and each intended for different audiences. The model represented a deep dive into dissecting the non-anthropocentric IoT. The board game focused on expressing the details of the model to a wider audience. And the final artefact presented a merger of dense philosophy with the approachability of fiction. The human/non-human threshold was thus approached through this process of RtD and carpentry.

These approaches allowed for the acknowledgment of an alternative perspective of IoT. One that posits viewing the workings of digital worlds as a parallel to our own non-digital world of atoms, molecules, and particles. OOO was presented in this thesis as the means for exploring this hidden digital-particle realm. The convoluted ontographical relationships of these physical incarnations of digital spaces forward the question of whether the Internet can be seen as a living thing? Because if so, then design is required to accommodate it in addition to the human.

As suggested by Ropolyi (2018, p. 44), acknowledging the Internet as an artificial living organism when seen through these philosophical arguments places precedence for redefining our relationship with technology. "Philosophy of the internet discloses that human existence is being transformed" (2018, p. 47). A More-than Human perspective urges us to ponder over the Internet as

no longer a presenter of information or the super-highway as it once was, but an entity capable of generating, calculating, and fostering information.

10.1.1 Is this discussion about privacy and security in IoT?

The Internet is also not inert and is capable of harbouring threats as the Internet of Things Board Game capably demonstrated in Chapter 8. The topic of privacy and security on the Internet has been the elephant in the room looming in the backgrounds of each chapter. One of my sub-questions has been whether this process may highlight problematic effects of IoT through philosophy. This research was not necessarily about that, yet it is difficult to remove this argument from any discussion of the Internet. Rosen (2000, para. 7) calls the many smart devices we collect around us "gossiping appliances" as they are constantly in conversation with each other about none other than *'us'*, their human cohabitors. The threat to privacy from pervasive technologies is one of constant debate (Austin, 2003; Vamosi, 2011; Acquisti and Gross, 2006; Berman and Bruening, 2001; Booch, 2015). There are valid points made in the argument for if the future of HCI is in advanced pervasive technologies such as IoT and ubiquitous computing, then at some stage privacy and security become assets of interest to multiple parties and therefore easily violated (Stajano, 2010, p. 287).

Vamosi (2011, p. 25) presents the case of Adam Laurie aka *Major Malfunction* (a white hat hacker), who while staying at a hotel attempted to interact with his mini-fridge through the infrared channel found in the room's television[78]. Moving from there he managed to access other guest names and room numbers. This insecure backchannel not only provided him with sensitive information but also gave access to the objects in those rooms. The hotel clearly required to reassess its network security, but given that the channel Laurie used to access these spaces was so unusual it becomes a design concern above all. Why was such a loophole in the design of the television possible?

Discussions into HCD from Chapter 3 place it as complicit in this obfuscation of information; ease of access enabling underlying complications to go unnoticed. Booch (2015) argues for how newly established technologies face problems yet eventually become acceptable. Giving the example of how boilers were once uncommon yet soon became a necessity in every home, he argues that this same logic now holds true for contemporary technologies like IoT. Boilers had their problems as well and so does IoT, so should we just ride out the storm?

The problem is that the nature of how IoT is connected to the home is very different to technologies of before. The interactions we have with these new technologies are intimate and therefore as designers/developers we are required to be more vigilant in their making (Booch, 2015, p. 13). Even though the primary concern for The Internet of Things Board Game was not highlighting privacy/security concerns in IoT, it ended up being the core rhetoric of play only because that was the most legible means of conveying our relationship with IoT. It also happens to be what is considered problematic with contemporary imaginings of IoT. Though I might have

[78] For more information, see: https://www.wired.com/2005/07/a-hacker-games-the-hotel/

explored IoT as a more-than human construct, our relationship with it remains one of utility even though its relationship with us is not necessarily the same. The Tarot of Things and the constellation metaphor (Lindley and Coulton, 2017) reminded us that we shouldn't take these objects of the Internet lightly as they are probably operating in ways we as users haven't considered. Viewing through this alternative object-oriented perspective is an argument in promoting vigilance as much as redefining relationships with technology through design.

That said, I did not set out to answer the question of whether IoT can be made more secure or private. The concern of SQ1 was to see if taking a non-anthropocentric approach towards design could help navigate the recurring problems of anthropocentric methods. Privacy and security on the Internet happens to be an easily relatable construct, but that shouldn't divert attention from the more-than human discourse here. The extent at which the Internet has permeated our lives has brought with it a world meticulously crafted with imitations of life through IoT objects. I've refrained from calling my artefacts 'tools' even though I utilise the metaphor of a toolbox to build them because they can't be equated to exact design tools. Rather, they are engines for generating discourse around the idea of a *Living Internet of Things*. They present alternative perspectives within our relationships with IoT. Therefore on that front, taking a philosophical carpentry approach at design for IoT was indeed successful, even if all its done is highlight further the inherent concerns of privacy and security. In other words, rather than waiting out the storm of ill-fated design decisions in IoT, measures for designing meaningful interactions in IoT could be taken from using philosophical discourse in design through such artefacts as the model in Chapter 7. Certainly, if anything through this journey of RtD the artefacts carpentered have embodied the philosophical foundations for non-anthropocentricity within a reference of IoT.

The Tarot of Things posited this idea by allowing an embodiment of the non-human through the technological life-giving elixir of IoT coming from the RtD process. This was a main premise of this research after all, manifesting the non-anthropocentric through a practice-based approach of carpentry. Conclusions from the participants of that study in Chapter 9 add to an ever-growing underlying fallacy of the object-oriented approach—how does one truly divorce the human?

10.1.2 Going beyond Human-Centred Design

All three artefacts (four including *Madame Bitsy*) put forth the notion of the more-than human, in that IoT exists as an entity that supersedes the presence of humans that use it. The human-user relationship with the non-human objects of IoT is one of facilitation, with anticipations mapped out accordingly via monopolies of orthodox design methods such as HCI and HCD. If anything, these artefacts beg the question of why design can't step away from the human?

Though a human-centred ideal in design is readily and widely accepted, arguably the most prominent and quoted scholar on the matter Norman (2005) had later warned of the potential perils of HCD speaking in favour of *Activity-Centred Design* instead. His argument revolved around the fact that technology does not adapt to people, rather it's vice versa predicating the notion that saturation of HCD might prove harmful.

The basic tenet of HCD where technology adapts to the human is not possible with IoT where every day newer tools and devices are designed to 'enhance' human interaction. This relationship of facilitation requires the human to alter itself, thereby, no longer being human-focused but activity-focused. In this guise of HCI, IoT objects break because users can't see the woods for the trees being too focused on the detail that it must serve 'them'.

This is the anticipations of interactions discussed in Chapter 9, how our established understandings of technology have fostered a particular world view of them. They must operate in a certain way, ergo they must be designed in a certain way. Yet, in truth that is what is holding these devices back, the tether to the human. In *The Mushroom at the End of the World* Tsing (2015, p. 247) talks of more-than human perspectives through entanglement with nature arguing that we are dependent on "natural processes" such as time and entropy and unable to counter them. Ropolyi (2018, p. 47) posits that as humans we are now part of three domains, one relating to the natural world, the second the social world, and third the digital world. As such, we are now equally dependent on the 'natural processes' of the digital world, ironically a design of our own. This is akin to the context collapse argument of Boyd (2008) discussed in Chapter 7. The Internet has altered our social mediations effectively redefining our humanness to accommodate these technologies as part of us. A few years ago a mobile phone was a luxury item, today a necessity for functioning in modern society. When our understanding of being human around technology has changed, so should the approaches towards solving the wicked problems associated with them.

This is not an argument against HCD throughout, it is an argument for acknowledging alternative approaches for certain uses, such as IoT. Cruickshank and Trivedi (2017, p. S4161) discusses how the merger of alternative discourses in design practice present innovative positions towards redefining relationships between designers and users. This research presents its artefacts in a similar light: The Internet of Things Board Game as a means for overviewing IoT interactions as dynamically produced assemblages; the model for establishing a philosophical baseline and grounding practice within theory through application; and, the Tarot of Things for pushing the envelope further into post-anthropocentric more-than human perspectives proudly.

Carpentry as an approach facilitated the possibility of thinking around these philosophical lines with design practice. It was able to ask alternative questions because the method assemblages were capable of fostering such discourse. Stam and Eggink (2014) argue in favour of philosophy and design converging to shape the worlds around us, saying that through socio-technological mediation and open ended imaginary perspectives presented by philosophy, new design approaches may be envisioned. Each artefact in that regard played with the idea of what taking a More-than Human-Centred Design approach could be like.

10.1.3 Is this a transhumanist argument?

Viewing IoT as a living organism with objects having their agendas is not a rejection of the human in design. The irony of this approach is that at the end of the day, all design must converge back towards the human. Whilst some argue that these objects of the Internet may well be moving

in the direction of a singularity therefore future-human design would be different, however, currently their purpose remains servitude[79]. Design's anthropocentric agenda of retaining control to the human through HCI presents further hurdles than clear paths in imagining viable futures. Particularly taking into account contentions between the futures promised by concepts such as IoT and ubiquitous computing, compared to the way technology has evolved (Kinsley, 2012).

In the early twenty-tens, companies like Ericsson and Cisco[80] (Evans, 2011) predicted the expansion of IoT to 50 billion connected devices by 2020. As of end 2019, roughly 20% of that prediction has come true with the lack of actualisation being assigned to the complexity associated with IoT[81]. Designed IoT objects fall prey to their own folly with an estimated 30% of IoT projects never leaving proof of concept[82], with many that do ending in consumer's arguing over the benefit and meaningfulness of such devices[83].

The continual forward trajectory into the marriage of human and technology through attempts such as IoT is a nudge towards transhumanist futures. Though this thesis does not attest to the worldview of transhumanism where human minds and bodies are obsolete and in need of an overhaul (O'Connell, 2017), there is no denying that taking on the more-than human perspective is also taking on an alternate transhumanist perspective. Rather than surgically embedding diodes in humans to become walking RFID tags, the more-than human approach is embedding a perspective of life in IoT.

Moving past carpentry Bogost (2012, p. 131) discusses the fate of OOO through the alien presence of our objects in everyday lives. Arguing against the anti-object-oriented rhetoric that it demeans the human entity by calling us objects, he instead is of the opinion that it is cowardice to think that placing interest in non-humans is an embezzlement of resources towards understanding the human better (2012, p. 132). "Speculative realism provides the best means for creative work to be done, and it provides genuine excitement to think that there are new argumentative realms to explore" (Srnicek cited in Bogost, 2012, p. 132).

'Futures', be they technological or otherwise, are often imagined through embodiment, telling, or symbolising (Adam and Groves, 2007). Presenting at times their paradoxical natures (Anderson, 2010). The case of *iRobot* (manufacturer of popular automated vacuum cleaner *Roomba*) can be taken as an example when in 2017 they raised alarm in consumers by openly acknowledging their devices tracked dimensional data along with considerations of sharing among third parties[84]. The fallacy of IoT thus hinges on design choices and interventions.

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[79] That is till future AI churn out their killer robots and digital overlords.

[80] For more information, see: https://www.ericsson.com/en/press-releases/2010/4/ceo-to-shareholders-50-billion-connections-2020.

[81] For more information, see: https://www.iot-now.com/2019/12/20/100460-missing-41-billion-iot-devices-2/.

[82] For more information, see: https://venturebeat.com/2019/07/30/microsoft-30-of-iot-projects-fail-in-the-proof-of-concept-stage/.

[83] For more information, see: https://www.cnet.com/news/juicero-is-still-the-greatest-example-of-silicon-valley-stupidity/.

[84] For more information, see: https://www.nytimes.com/2017/07/25/technology/roomba-irobot-data-privacy.html.

A potential for tyrannical future *Roomba's* aside, the common factor here is a connection between human and the beyond (as in machine, organisation, institution, policy, more-than human, and so on). The artefacts created through this manner of carpentry discuss the beyond in terms of OOO using methods like speculative design and ludic design to invoke a playful curious engagement with the world. Future-oriented or alternative present provocations—such as those presented in the transhumanist worldview—could be imagined by simply asking 'what if' and allowing the playful centre of design practice to radiate.

What if toasters did not want to toast? What if chairs knew who sat on them and held grudges? What if a refrigerator denied access to encourage weight loss? What if automated doors required us to tip them? What if cars understood our moods to give more scenic routes? These are questions that are at once fascinating, terrifying, and ridiculous. Though they might seem as being about a post-anthropocentric approach, the process of approaching them could present valuable information for the greater *Anthropocene*[85]. These bizarre transhumanist agendas imagined through blurred visions of IoT are difficult to approach without the playful appropriation of philosophy and speculative design combined, which carpentry and RtD aptly facilitated.

Morton (2011, p. 165) while discussing OOO argues in favour of Heideggerian philosophies of humans to be present among nonhumans, explaining how speculative realism affords imagining alternate realities difficult to contest. His description of the *Hyperobject* as an object so massive it's distributed across time in a way that their true extent cannot be imagined (Morton, 2013), it is a testament to the fact that humans are not the centre of concern as orthodox design practices have lead us to believe. Think global warming, quantum theories, the Internet, these entities exist as much greater objects than the human-object that OOO speaks of. Morton (2013, p. 41) further goes on to express how through its execution OOO acknowledges the world aspect that Hyperobjects exist in and may provide vital knowledge for unearthing these realities further. It's no longer a question of why think of more-than human futures, but why not?

10.2 The Mantra of Playfulness

This is now a good time to bring about the attitude of playfulness I chant throughout this manuscript. I've attempted to retain this attitude in each chapter. The parallels between design and play presented in Chapter 6 point towards a homologous entity of designing through the act of play. Playfulness is a core conduit to my practice of design and life in general as I described in Chapter 1. As a maker my approach towards design is present within RtD in light of Faste and Faste's (2012, para. 17) presenting of RtD as a "hands-on" approach at designing. My own view of play resides in an overlap of Sicart's (2014) and Bogost's (2016) perspectives of play, as something that is in both people (former) and things (latter). Furthermore, DeKoven's (2014, p. 21) expression of play as a

[85] Generally taken to mean in terms of geological impact by humans such as on climate and environment, my usage of the Anthropocene is more in line with what Morton (2017) considers solidarity with humans and non-humans. "The Anthropocene is the moment at which humans come to recognize humankind…the moment at which species as such becomes thinkable in a non-metaphysical way, such that humankind cannot rigidly exclude nonhumans" (Morton, 2017, Chapter 3, Humankind is a Subscendent Whole, para. 10).

path we opt to take as an adult reminding us to be playful at times, is also something I cannot ignore as that expressive path is present in how I conduct my daily existence. I remind myself to be playful when confronted with interactions. Some of that playfulness manifests in my actions where others might not, but that expression remains in my personality and is carried on in my design practice.

Asking questions such as whether my Roomba has tyrannical tendencies or if a chair can be designed to reject its sitter is akin to Bogost's (2016a) playful musing that words within buns are pleasant.[86] They ask the odd question coming from a history of observation. Bogost presents his *Put Words Between Buns* as a "magic crayon" (2016a, para. 19) for making, in this case a commentary on meme-culture.[87] The seemingly obscure questions asked throughout this thesis present RtD and carpentry as a process for viewing the world through that glint of playfulness to approach alternative musings for IoT.

My application and justification of design in this manner raises a question of whether 'design is play'? As a designer, it is important to be explorative and what these artefacts present is that when ludic engagement is included in the mixture of the design process, the exploratory drive may be pushed further. Perhaps this might not work for all forms of design but in the case of design for HCI, there is compelling literature arguing for ludic pursuits (Rose, 2015; Gaver *et al.*, 2004; Gradinar, 2018).

On the subject of HCI and design, one needs to be open to different engaging formats of interpretations, particularly those that facilitate multiple meanings in design and its evolution (Sengers and Gaver, 2006, p. 100). Essentially, users of artefacts and designers of artefacts approach *'the artefact'* differently. "If we take supporting multiple interpretations as a central goal, design shifts from deciding on and communicating an interpretation to supporting and intervening in the processes of designer, system, user, and community meaning-making" (2006, p. 102).

The argument made is to design systems as blank canvases which can be modified, interpreted, reinterpreted, and evaluated at will. A ludic forward approach could present novel opportunities for taking on objective views such as these. On ludic artefacts like the Drift Table, Sengers and Gaver (2006, p. 103) claim that if there is a goal it is not to communicate a "single correct interpretation but to avoid communicating an incorrect one". This can be taken to an extreme even to allow a design to communicate no single interpretation at all and be entirely ambiguous, something that is very commonly seen in Art (Gaver *et al.*, 2003).

A large part of the play rhetoric used throughout this work comes from Bogost (2016) for a reason. Not only does his views of 'play everywhere' partly align with this interpretation of design practice, but as the leading voice in carpentry as a methodology (Bogost, 2012) this was a perfect merger of ideals. Carpentry at its core may not be a playful activity as Sicart, Gaver, or DeKoven see it, but it certainly is as Bogost sees it as existing within things. The purposes of incorporating these alternative perspectives into the folds of carpentry was to encourage that core sense of

[86] For more information, see: http://bogost.com/projects/buns-life/.

[87] For more information, see: https://nuvomagazine.com/magazine/spring-2020/the-philosophy-of-meme-culture.

playfulness that I as a designer retain in my practice. *I am a playful individual and so are the objects around me hence my interest in playing with them.*

Carpentry is not strictly defined by Bogost as about curiosity, but I argue that through its process of laying bare systems as ontographs it invokes a sense of curiosity. Like when the light-gun from my Famicom was opened up during my childhood I saw it as individual components that created this thing, yet it simultaneously presented me with a sense of further intrigue. Within the design processes of both the Tarot of Things and the Internet of Things Board Game, ambiguity was the driving force for generating knowledge by presenting as little information as possible. Players made connections themselves using mechanics provided to them. Role-playing within IoT presented the opportunity however limited, of entering existential experiences with objects. Though it could be said that these artefacts were both heavily curated, the counterargument is that design *must* be curated. Bereft of a bespoke IoT tarot deck, discourse could have been achieved through a standard Rider-Waite deck as well. But, the meaning associations between the fantasy imagery of tarot juxtaposed with IoT would have sent things in completely different directions.

Granted carpentry itself is not about ambiguity either instead it is about making things clearer. But to that I say that every unit operation envisioned through carpentry ambiguates itself from the world around it existing as a piece on its own. A pair of sand covered gears lying on a beach in Karachi might have once been part of a printing press in Germany, that ontographical nature of the gears is retained if the knowledge of their relation to the press is present otherwise they could equally be components for a number of things. As a unit operation the gear's function becomes as ambiguous as its history.

Taking a playful attitude towards things changes the structures that frame any given activity making them transformative experiences (Back *et al.*, 2017). Due to the nature of design as an activity that involves attributes of playfulness, this function can easily be translated into a design artefact. Playfulness, curiosity, ambiguity, and emotion all thus become attributes that design practice can have. More importantly, they become assets a designer can use in their design.

I can't go as far as saying all design is play, but it is something I would like to think and perhaps strive for. The artefacts of this research certainly worked with a ludic agenda present. Choosing a board game as a medium was not driven simply by the idea that a game would make the complex philosophy of OOO more palatable. Rather, that games offer unique experiences in which complex rhetoric can be explored in a meaningful way. Both, as an experience for academic and personal value.

10.2.1 Being a playful philosopher-designer

My experience of attempting to be a philosopher-designer as posited by Lindley *et al.* (2018, p. 232) through this exercise of carpentry reminds me of the many enchanted objects presented by Rose (2015). His use of metaphor to describe human connection with the non-human through an air of enchantment resonates with this idea of *Carpentry for design of IoT*:

> *"Think of the network as the new electricity. Connected products as the new electrification. Electricity is plentiful, invisible, and powers hundreds of products we take for granted. We rarely consider all those electrons running through every wall of our homes, schools, and businesses. Yet invisible as they may be, those electrons do flow, and we feel paralyzed during a power outage when the flow comes to a halt. Only then do we remember that candles and hand-cranked mixers and drills and phonographs were once the norm." (Rose, 2015, p. 265)*

The quantum level interactions of OOO and those of metadata within IoT are no different from this perspective presented by Rose. It is when the perfect model of a smart future breaks that we return to simpler times. The philosopher-designer approach is to see past the frames of human anticipations and illusions to view objectively. If the smart future is to break, then look from the other side to see what happened. As a contribution to design research, this work attests to the potential presented by the exercise of carpentry in becoming philosopher-designers, especially where practice-based design is concerned.

In the conclusion to Chapter 7 I present a view where the philosophical concepts discussed through the model are used as play-things. This idea is close to how Sicart (2021) understands his concept of the "plaything" though not in a one to one manner. For Sicart (2021, p. 2) his argument resides on the premise that play is a manner of "material entanglement" through his understanding of play as a "mode of being". To him playthings are a way to "describe the ontology of the things that come to being in the material practice of play" (2021, p. 12). Going into a philosophical discussion around play and the objects play is facilitated through, his definition of playthings defines the ontology of said playable objects being separated from their epistemology. As an example he presents Twitter bots as playthings that playfully engage with Twitter. Though this approaches Bogost's 'play is in things' concept slightly, it retains Sicart's stance of play as a mode of being human. For this reason I hyphenate my understanding of playthings to retain my separate hybrid stance towards play in the process of design, what fits with my understanding from this is of how a *play-thing* can facilitate understanding across this material entanglement.

Sicart (2021, p. 9) presents his argument by connecting this concept to Karen Barad's Agential Realism suggesting that play becomes a "discursive material practice" which he argues (using Barad's terms) "matters" the things being interacted with to facilitate playfulness.[88] I like this notion because it suggests play exists in both the person playing and the objects being played with in a manner that playfulness is being reciprocated. He goes on to suggest with an example of playing with a stick that, "the stick is not a toy, or a game: it is a thing I am playing with, and that plays with me" (2021, p. 9).

[88] Agential Realism and the concept of 'mattering' is certainly relevant in a way for expanding upon the discussion in this thesis, as it relates to notions of post-phenomenology and OOO on a level (Frauenberger, 2019). I graze this concept rather than going into it further as I believe in the context of this research it stands as a second step into further research on the matter of play, technology, and more-than humanness.

Metaphors such as constellations, thought experiments such as Tarot of Things, philosophical models, or experiential ludic experiences such as the Internet of Things Board Game allow for an objective stance for design of IoT to be presented. In this manner of equating concepts, models, artefacts, people, and more to play-things I am encouraging a manifestation of playfulness within the design process facilitated through a practice-based RtD approach. The contention associated with OOO will remain until further philosophies emerge that 'play better' together. Exercising carpentry in this manner might just help fuel greater philosophical debates around OOO and other philosophies answering those deeper set questions (Lindley *et al.*, 2020). However, what is clear is that the process of using design and philosophy in this manner helped to elicit ideas of security, ethics, agency, power, intention, and others that were otherwise undisclosed.

Future directions for this approach lie in the potential for merging philosophy with design. This body of research explored the tip of the iceberg when it comes to philosophical constructs. OOO made sense here because the artefacts related to IoT in this manner of understanding a post-anthropological stance for technology. Other philosophical movements and concepts could bring their oceans of knowledge with them; consider the existential IoT, the moral IoT, the perceptive IoT, or the Nietzschean IoT. Furthermore, stripping this research down to its philosophical discourse concerning design presents the potential in using philosophy and design in this playful manner to further knowledge in other areas, such as between Hyperobjects and Sustainable Design. On that note, I would like to add to the note by Lindley *et al.* (2018, p. 232) that we should strive to be '*playful'* philosopher-designers practicing carpentry and other such methodologies that discuss broader perspectives in design, technology, and society.

This weaving of transdisciplinary method assemblages to craft unique knowledge benefiting multiple sources could not have been possible without the playful attitude in design I've held on to. These combinations bring with them reverberations down to the cores of their disciplines. Be it philosophy, design practice, anthropology, or computer science, vibrations are sent back towards building future implications. These are playgrounds where design is played out and through this playfulness orthodoxies such as HCD can be challenged and improved. To paraphrase Bogost (2016, p. 25), in order to enjoy the playgrounds of design and philosophy we need to be less nervous about where we stand in between them, and instead allow these playgrounds to reveal their inner most realities to us through their medium, play.

10.3 In closing

Taking from my unorthodox introduction, a childhood among characters like Sonic the Hedgehog, Mario, and Link is a certain kind of growing up. You see life differently, filled and fuelled with aspirations of playfulness. I can't say that was not an influence on this work. As a printmaker, I learned to feel pulled prints to understand what happened to the paper. A surreal manner of learning a language from impressions like braille. The games I encountered over my years ranged from complex to simple, but they were capable of pulling me in and holding my attention. The long walks through streets of Lahore finding hidden gems like the USB Ghost Tracker was its

own manner of engaging with the playgrounds around me, luring me in to practice their magic. A quote from Douglas Adams' *The Long Dark Team-Time of the Soul* fits eloquently with my approach at design: "… my methods of navigation have their advantage. I may not have gone where I intended to go, but I think I have ended up where I needed to be" (Adams, 2014, p. 123).

With a continued debate around the security of IoT the initial response from many not related to this field is often the same. When talking of my research, the jokes I hear are that I probably work for MI5 since IoT is surveillance, in fact my cousin thinks I'm working on *Skynet* from the *Terminator* franchise![89] She's now settled on referring to my work as *'tingling toasters'* a play on *Talkie Toaster*. I prefer this understanding as it aligns a lot more with what this work actually is. The toaster from *Red Dwarf* was more intelligent than the onboard computer featured in the show with one episode having it question its purpose in life when it couldn't make toast. The playfulness associated with this description summarises the intent of this work. Design for me is enacting playfulness and so I approached the matter of design of IoT as such.

In light of the opening quote of this chapter, playfulness and belief in the impossible are what pushes one down the rabbit hole of discovery. *YouTube* morning show sensations Rhett and Link follow a mantra of *Mythicality* which they define as "a quality of being that embodies a synergistic coalescence of curiosity, creativity and tomfoolery" (McLaughlin *et al.*, 2017, p. 8). In many ways, this research followed a similar vein.

This thesis is an argument for a transdisciplinary perspective to understand futures that are no longer simple. An argument for staring down orthodox design practices and welcoming terra incognita. Above all this is an argument for the place of play within the halls of design. In the end, the futures of IoT are all about tingling toasters and devious drones after all.

[89] No one's returned from the future to stop me so far, but finger's crossed.

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APPENDIX A

A.1 Game Design Definitions and Terminologies

A list of game design definitions and terminologies used in Chapter 8, and in parts of this thesis, are presented here.

- **Mechanics or Mechanisms**[90]**:** Constructs of rules or methods used within gameplay to facilitate interaction; e.g. use of dice to move.
- **Element:** Concepts used within the confines of the game world to express certain ideologies with intentions of engagement; e.g. incorporation of chance through the use of dice.
- **Piece:** Tangible items used to facilitate mechanisms and elements within the game interface; e.g. dice.
- **Interaction:** A means by which mechanisms may be engaged; e.g. capturing a piece on the game board, where capturing is a mechanism.
- **Objective/Goal:** The aim of play, often a goal of sorts to differentiate between success and loss; e.g. collecting victory points, or capturing the King in *Chess*.
- **Deck Building:** Mechanism where players collect cards from shared or independent decks to 'build' their own playable deck for the duration of play; an example of games that use this mechanic are *Dominion* and *Star Realms*.
- **Worker Placement:** Mechanism where players assign a limited number of tokens to spaces on a game board to benefit from specific actions; an example of games that use this are *Agricola* and *Stone Age*.
- **Defector:** A conscious abandonment of allegiances during play in effect allowing a player to become a 'traitor'.
- **Eurogame:** The term, as Costikyan (2018, p. 181) explains, takes its name from origins in Germany, Europe. Though many such board games do come from Europe, a game does not need to be developed there to be called a Eurogame. Rather, the name is given to a specific style of play that cherishes strategic excellence over theme. Often abstract depictions of the themes they present with a level of complexity unique to each executed through employing acute combinations of mechanisms. Examples of such games are *Carcassone*, *Catan*, or *Istanbul*.
- **Ameritrash:** Described as a "backformation" of the term Eurogame, it has little to do with being 'American' (Costikyan, 2018, p. 183). Unlike Eurogames, these rely on a "tight formation of theme and mechanic" (2018, p. 183), often allowing the mechanics to emerge from the thematic experience. Where Eurogame's are often less visually appealing relying on strategy over presentation, Ameritrash games are designed to thematically stand out. Modern examples are games like *Arkham Horror* or *Twilight Imperium*.

[90] An extensive list of game mechanics can be viewed here: https://en.wikiversity.org/wiki/Game_mechanics.

APPENDIX B

B.1 The Internet of Things Board Game Explored

The Internet of Things Board Game was a lengthy endeavour into understanding the creation of unique procedural rhetoric in play around philosophy, design, and IoT. All aspects of the game would be too difficult to communicate as it went through 14 iterations with some being entire overhauls in design and rhetoric. So as to not derail the focus of this thesis, this information is kept as supplementary content as the true rhetoric of the game can only be understood by play. This special section is therefore devoted to illuminating as much of the game as possible in its latest iteration (14 at the time of writing).

For ease, this section is presented as a game manual with additional footnotes explaining the reasoning behind certain decisions. The detailed background process of reaching this iteration is explored in the journey of Chapter 8.

In addition to the game manual presented here, the game may also be experienced online as a video playthrough. As of writing this manuscript the playthrough is intended to give a brief idea of how the game operates. This online content may be updated in the future with further information regarding the operations of the game. The playthrough may be experienced here:

- https://youtu.be/V-u2XsMj5mI.
- https://haiderali.co/Internet-of-Things-Board-Game.

B.2 Backstory[91]

Imagine a world in a parallel realm not very different to your own, in a time not too far into the future with people not unlike you. Imagine a place shining with technological brilliance driving a society offering peace, tranquillity, efficiency, and ultimately futures full of happiness and hope: Welcome to *Sol* on the distant world of *Atlas Prime*. A place where technology and human are two sides of the same coin, where the physical meets the digital and paves the roads you walk on.

Just around the turn of the century, the forerunners of *The Algorithm* praised it as a way to move forward. One system to control all and ensure daily safety bringing about a *technirvana*. Soon heard of in magazines, e-zines, and newspapers everyone spoke of it and expected others to join. However, what was meant to be a means of watching over and securing loved ones evolved into an obsession of control as *The Council* was born!

Initially proposed as a way to streamline matters of government, *The Council* proposed using *The Algorithm* to gain access to all affairs of life. From family trees to bank details, to how many bags of tea were left in people's pantries. Suddenly data was the new currency, and one digital signature was all it took to fetch, analyse, and upload information to a hive-mind network.

Now, people are born into a world where they are digital cookie distribution machines dropping bits and bytes of information about everything they do. The once free cities of *Atlas Prime* have all

[91] The addition of a backstory proved to be the most effective aspect of initiating play. Players felt more connected to rhetoric after situating it better.

been following the image of *Sol*. Over time *The Algorithm* evolved to include other versions, secret incremental updates that gradually tightened its grip on everyone and everything. The past, a distant blur of memory that *The Council's* data-hungry algorithms have almost entirely wiped out exists in the form of rogue code woven into the digital fabric of the free cities inhabitants. Lost advertisements, Memes, Gifs and messages commented into program code have been circulating in the shadows of *Tor* networks; those that still are out of reach of *The Council's* deep search engines. They whisper a prophecy of the counter system called, the *DataBox*.

The *DataBox* is said to give people back power, essentially blocking out *Council* attempts at foraging data. By giving people control over what data can and cannot be in the reach of others, *DataBox* is the nemesis *The Council* have been fearing. As such, they've created their countermeasures. Although a series of algorithms meant to hunt out rogue code, its ferocity of action with a seek and devour reputation towards data cookies has given it infamy as the *Cookie Monster*!

Now with the enemy having unleashed its hounds upon whosoever attempts to stand against them, a ragtag group of vigilantes have taken up the mantle to fight back. ***Welcome to the Resistance!*** The last bastion against an invisible enemy! You and your party members will traverse between the tangible and the intangible Internet to take back what is yours. But be warned, *The Council* is ever watching. Botnet's and Spyware are but the tip of the iceberg as they intend to stop you, or worse, have you assimilate!

Afraid of potentially losing all their influence and control, *The Council* have begun work on another upgrade to their *Cookie Monster* algorithms. An update proposed to eliminate all links to code related to *DataBox* on any connected network. Deceptively named *The Crumble* this increment should successfully end any chance for resisting the reach of the *Cookie Monster*. As part of the *Resistance,* you can't allow that and must fend off any daemons thrown at you establishing a secure encrypted network.

Tread lightly, there are Privacy bombs and traps everywhere! Be prepared lest you get spotted in virtual floodlights. The digital landscape is no longer a peaceful one so keep an eye on that *Threat Tracker*. Will you build your secure networks in time for *The Crumble*?

B.3 Game Objective

The Internet of Things Board Game is a 2–4 player cooperative[92] board game where players work together against amassing digital threats to build a secure network amongst themselves. Create digital links as you traverse physical spaces on the board and secure them by deploying *Databoxes* equal to **twice** the number of players. Build all the *Databoxes* and win the game!

[92] After play-testing the cooperative model of play worked the best as it was able to communicate the rhetoric most effectively compared to other approaches.

B.4 Play Setup

The board is prepared according to the number of players[93]. First, place the *Server* tile in the middle. Next, separate *Insecure Tiles* (see B.6) and *Regular Tiles* into separate piles upside down and according to the number of players from Table 7, take the top tiles from each pile to make a tile deck. Return the remaining tiles to the box, and shuffle the tile deck placing them in a pile upside down. Now pick tiles from the top of the deck and place them following the numbers in Fig. 51. Each tile of the board is now a different ***space*** that players can navigate. **Once placed tiles cannot be moved**.

Table 7: Number of players and tile formations

Players	***Regular Tiles + Insecure Tiles***	***Infected Tiles (Tokens)***
2	9 + 3, or, 8 + 4	2 (2), 2 (1)
3	7 + 5 or 6 + 6	2 (2), 4 (1)
4	19 + 7	4 (2), 4 (1)

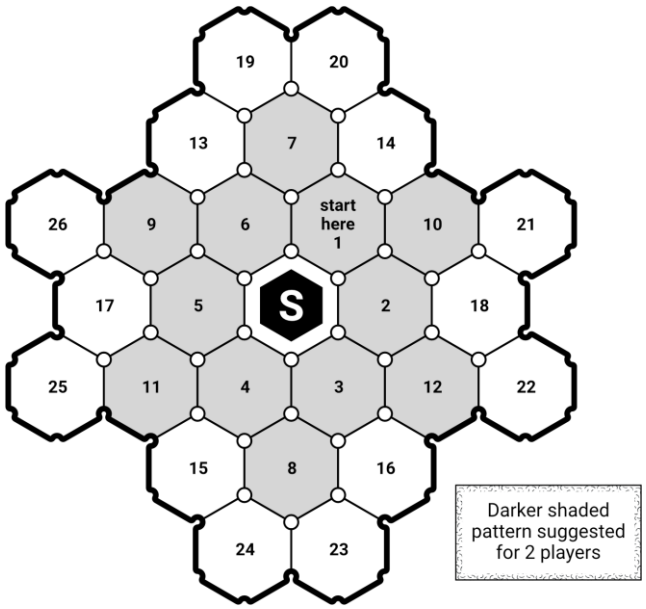

Figure 51: Board formation for play, darker shaded formation suggested for 2 player game. Follow numbers to place tiles.

Next, ignoring the *Server* randomly pick tiles (see B.8.2) and follow Table 7 to add *Vulnerability* tokens (see B.12) to them infecting those spaces. Add double tokens from the table first, then single. Players now select an *Avatar* (see B.7) to play with, taking that avatars board and placing the corresponding standee on the *Server* tile. Any items associated with selected avatars are collected by players, as well as one *Primary* item each (see B.9.1.1). Players set their avatar to their starting settings and finally, place the *Threat Tracker* (see B.15) to the side of the play area agreeing upon a difficulty level for play. Starting with whoever last used an Antivirus on their devices, play may now proceed clockwise.

[93] This modular approach meant play time could be controlled better and allowed flexibility in levels of difficulty.

B.5 Phases of Play[94]

Each player's turn comprises of two phases, an *Actions Phase*, and *Risk Phase*.[95] During the **Actions Phase** a player gets to do up to 2 actions per turn (unless they are *Delayed*, see B.7) allowed out of the following actions:

- **Move:** Players can move in any direction up to their *Speed* level (see B.7).
- **Find:** Roll for *Observation* (see B.8) over spaces with an **EYE** icon to draw one item from the *Items Deck* (see B.9).
- **Trade:** If sharing a space with a player trade any number of items with them.
- **Rest:** Recover 1 *Sanity* **OR** attempt to resolve any *Daemon* cards in hand (see sec. B.13.2).
- **Connect:** Return items in hand or use items in spaces to make a *Connection* (see B.10).
- **Discard:** Remove 1 item in hand from play.
- **Ability:** Use player or card *Abilities* (see B.7).
- **Resolve:** Attempt to clear a space of *Issues* (see B.13).
- **Deploy:** Spend 2 actions to attempt a *Privacy* card (see B.9.2), if succeeded deploy a *Databox* (see B.14).
- **Skip:** Skip an action.

After spending actions the player must enter the **Risk Phase** by rolling for *Security* (see B.8). In the game, this is often called *Rolling for Risk* or conducting a *Risk Check*. If they succeed play continues to the next player. If they fail the following is done in order:

- Place a *Vulnerability* token (see B.12) in the space occupied and any further connected spaces.
- Draw a card from the *Risk Deck* and follow the card in order top to bottom (see B.9)
- Do risk checks on all items in hand using the new dice-count from the drawn card (see B.9).
- If the drawn card requires other players to act as well, do so accordingly.
- The player ends their turn, next player begins with their *Action Phase*.

B.6 Understanding the Tiles

There are 2 kinds of tiles in the game, *Regular Tiles* and *Insecure Tiles* (Fig. 52). They both function similarly, except for one thing: *Insecure Tiles* force players to *Roll for Security* twice during the *Risk Phase*, meaning they could cause it twice. This only occurs if a player decides to stop their *Move* action on an *Insecure Tile*. *Insecure Tiles* are recognised with their darker borders. Tiles are all named after physical locations such as a living room, kitchen, etc. and act as physical spaces. Spaces also signify connectivity using the notches in the corners (see B.10). See Fig. 52 to

[94] A phase-based play approach was appropriated from both *Dead of Winter* and *Eldritch Horror* as it incorporated a more dynamic means for communicating rhetoric.

[95] In the latest iteration, terminologies were changed for ease as players felt 'vulnerabilities' was a mouthful during play. The term 'risk' was then adopted to denote a general understanding of urgency and peril throughout, whereas 'vulnerabilities' became a specific kind of token in-game.

understand the different parts of each tile. Each space, subsequently, has a connection requirement which needs to be fulfilled before it can be secured by turning into a *Databox*.

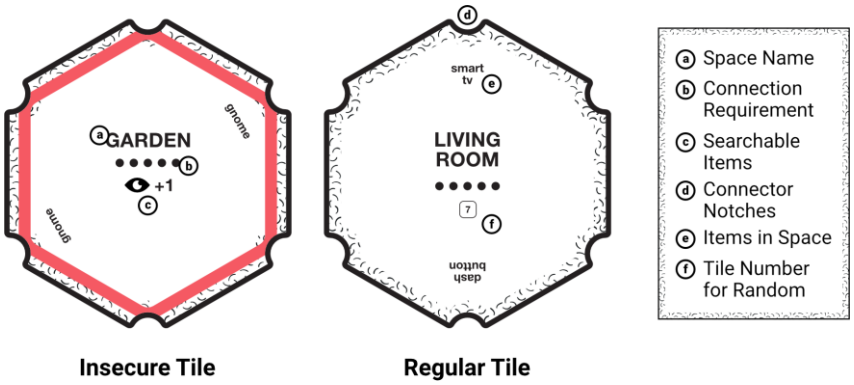

Figure 52: Regular and Insecure Tiles are similar except the latter forces players to do extra actions.

Some tiles have items players can connect to within them (see B.10). Generally, when a player connects a space they place a *Connection Token* in the open space next to the present item. **Be careful when making these connections!** If you end up connecting with an *Insecure Tile* you have to *Roll for Risk*.

Tiles also show as dots how many connected spaces are needed before deploying a *Databox* (see B.14). Players may use their *Find* action to draw cards from the *Items Deck* (see B.9.1) on tiles that have an **EYE** icon (some tiles allow for more than 1 item to be drawn indicated by a number next to the icon).

B.7 Avatars[96]

Players may play as different characters or avatars in the game. Each avatar comes with their own standee and board for keeping track of skills. Avatars each have unique abilities which players can use during play as actions. Certain avatars have *Passive* abilities which are always active, for instance, *Spook* can always clear all *Vulnerability* tokens in a space in one action.

[96] Avatar inclusion brought about an entire new dynamic in play. Players explained they embodied the game and understood the rhetoric much better through experiencing the many in-game vignettes as their avatars.

Figure 53: Players may choose between 6 in-game Avatars each with their own variable skills and abilities tracked using blue and black tokens.

Avatars have skill levels defined by their *Speed*, *Sanity*, *Security*, *Observation*, and *Coding* skills on their boards, with their starting skill levels highlighted (Fig. 53). *Speed* is denoted in the top right corner of the avatar board and refers to how many spaces a player may navigate up to in their turn. As the game progresses these skills rise and fall, and players may keep track using provided blue and black tokens. To keep track of reduced speed, add black tokens next to the *Speed* skill. For all other skills (except *Sanity*) when a player must permanently reduce their skills such as after the *Effect* of a *Risk* card (see B.9.1.4), black tokens can be placed as reminders. Each number on the tracks (except for *Sanity* and *Speed*) represent the number of dice a player can roll for that skill. For instance, in Fig. 53 *Spook* has a *Coding* skill of 4 meaning the player controlling *Spook* can roll 4 dice when asked to roll for *Coding*. However, as *Spook* also has 2 black tokens on his *Coding* track the player only gets 2 dice to roll.

B.8 Rolling Dice

There is a lot of dice rolling in this game![97] The general rule while doing most dice rolls is:

$$d6(SkillLevel) \pm Modifiers$$

Modifiers are any cards or events that alter the number of allowed dice during play (see B.9). Skill level is the level of the skill asked to roll for. For instance, *Spook* has a *Coding* skill of 3, when asked to roll for *Coding* the player controlling *Spook* gets 3 **d6** to roll with, however, if they also have a *Health Monitor* item they get an additional **d6** (see B.9.1.2).

Having multiple dice in a roll is important as it increases your chances of *passing*. A pass is if the player gets a **5** or **6** during the roll on **any 1 die**. Alternatively, players may lower the difficulty of play by including **4** as a pass. Anything besides will be considered a fail and depending on the situation (which often will involve a card or token) the corresponding *Effect* will come into play (see B.9).

[97] Players mentioned this to be tedious yet enjoyable. As a takeaway, future iterations would look into approaching this interaction differently.

B.8.1 Doing an Attack Roll

Sometimes players will have to get aggressive and attack the board. When doing an *Attack Roll*, players roll for *Coding* against a **d20** going to the opponent (sometimes cards make players attack each other). Dice are rolled together subtracting the total value of player dice from the opponent. The opponent always wins a draw. To win players must get a value higher than the opponents unless the following rolls occur:

- A **1** on the **d20**; this is an *instant kill*; the player wins immediately irrespective of what they rolled.
- A **19** or **20**; this is an *instant hit* from the opponent making the player face consequences if present. If no consequences (such as an *Effect*, see B.9), the player must back away 1 space losing either 1 *Sanity* or lowering a skill by 1. This rule is irrespective of getting a higher value from the dice, but if the roll was higher the player may roll again after taking damage.

B.8.2 Randomisation

During play, players will often be asked to randomise an action. This is done by rolling a **d20** and referencing the tile with the corresponding number. Each *Regular Tile* has a number printed from 1–20. Random actions may never reference an *Insecure Tile*.

B.9 Understanding and Reading Cards

There are 4 decks of cards in the game: *Items*, *Risks*, *Privacy*, and *Daemons*. Cards in the deck usually have a *Function* and an *Effect*, with the latter represented in a darker shade. Each card is read top to bottom and often have numbers or icons in the corners which trigger other *Effects*.

B.9.1 Items Deck

This deck is comprised of three kinds of items *Primary*, *Secondary*, and *Tertiary* each with their functionality (Fig. 54). Players may carry cards in hand up to a hand-limit of **5 cards**. Certain events and cards may change this number during play.

B.9.1.1 Primary Items

These are smart phones and tablets, and their *Function* is to make connections in the game. They each have a connect limit (see B.10), and upon completion players get a bonus action for every completed *Primary* item in hand. For instance, if there are 5 blue *Connection* tokens on a players smart phone item, for all future turns including the current one they get 3 actions instead of 2. Although, if at any point they lose that *Primary Card* or have to reduce tokens on it, the bonus is lost.

As an *Effect* activated upon failing the *Risk Phase*, players must do a *Risk Check* on all tokens present on the card. For each failed roll, players move that token to the *Effect* portion of the card. When no more spaces are left there the card is discarded and the *Threat Tracker* (see B.15) advanced by 1.

Figure 54: Primary, Secondary, and Tertiary items and associated icons.

B.9.1.2 *Secondary items*

These are different everyday IoT objects that players discard to make connections on the board using their *Primary* items. The *Function* of each *Secondary* item is between activating icons used by other cards (often *Risks*) and increasing skill levels as modifiers according to the colour of the card; orange for *Coding*, blue for *Observation*, and green for *Security*. Each time a player fails a *Risk Check* during their *Risk Phase* (see B.11), the *Effect* of that card is played out.

B.9.1.3 *Tertiary items*

These are either *Accounts* or *Buffs* both acting as benefits if players keep on hand, but come with associated higher risks if they become insecure (by failing a *Risk Check*). *Tertiary* items often act as modifiers when calculating dice counts for rolling. Furthermore, these cards usually may also be spent for an immediate bonus function. Players may spend these cards and take advantage of bonuses at any moment in the game. Once spent, the card must be discarded unless specified.

B.9.2 Risks Deck

This deck is full of all that can go wrong in the game![98] Each time a player fails the initial roll for *Security* during the *Risk Phase*, the top card is drawn from this deck and its *Function* played out. First, the number in the corner denotes how many steps forward the *Threat Tracker* moves (see B.15). Second, players collect dice equal to the totals of each skill represented on the card following the subtractions. The new dice roll is then used for each subsequent *Risk Check* (see B.11) in that phase. Finally, the player(s) takes any associated damage followed by the cards *Effect* immediately. Besides the regular *Risk* cards, there are also *Data Leaks*. These cards affect **ALL** players immediately triggering all *Privacy* tokens (see B.13) and advancing the *Threat Tracker* (see B.15).

[98] Intended as a means of countermeasures and facilitating the game as a stand-alone player acting against the group.

Figure 55: Cards from the Risks Deck all have negative affects on players.

Figure 56: The Privacy Deck presents conditional loops as vignettes for players to deploy Databoxes.

B.9.3 Privacy Deck

Cards from here are invoked when players attempt a *Deploy* action for a *Databox* (see B.14).[99] Players must successfully navigate the different conditions presented stepwise otherwise face consequences. These cards require players to first roll according to the icon in the corners to see if they may proceed. If at any moment players fail a dice roll, they must execute the cards negative *Effect* at the very bottom and discard it. However, if they pass the initial roll, they enter the second step often requiring a more difficult skill check. Upon passing that as well, players may execute the positive *Effect* of the card along with deploying a *Databox*. For instance, the *Chasing Daemons* card (Fig. 56) has players roll for *Coding* to be able to move forward to its next step, which further requires an *Observation* minus 1 check. Upon passing, this card gives the player not only a *Databox* but also +1 *Sanity*. If at any moment in this card the dice rolls fail, the negative *Effect* is played, and the player loses 1 *Security* skill discarding the card from the game.

B.9.4 Daemons Deck

These cards act like software daemons[100] where it gets its name from. They are not drawn by choice and instead issued by other cards as constant *Effects* upon players; often reducing their skills and abilities (Fig. 57). Many cards have an *Effect Amount* in the corner linked with the card. For

[99] These cards take inspiration from the way cards are played in both *Eldritch Horror* and *Dead of Winter*. They act out a scenario entering players in a dialog with the game executed through dice rolls and vignettes.

[100] Programs that run in the background affecting systems in various ways.

instance, if a player receives a *Virus Daemon,* they must add 1 *Vulnerability* token on every space they move to. *Daemons* are stackable and may only be removed by doing a *Rest* action (see B.13.2) and attempting the cards *Resolve* portion.

Figure 57: Daemon cards function as continuous negative Affects on players.

B.10 Making Connections

Items collected throughout the game may be traded for *Connector* tokens (Fig. 58). This is an important part of play. To win players need to deploy *Databoxes* which can only be done in spaces that have reached their connection requirements. There are a few prerequisites To make a connection. First, a player must have a ***Primary Item*** on hand (see B.9.1.1). Second, players need to navigate to a space with an empty notch. Finally, connections can only be made by either discarding a ***Secondary Item*** (see B.9.1.2) from their hand or using an item in the space.

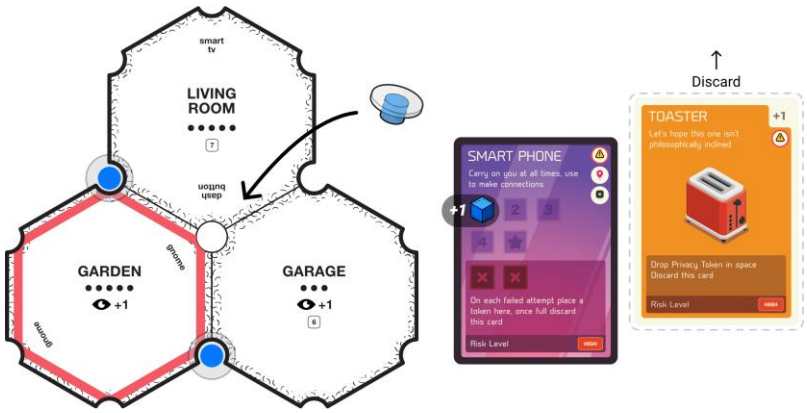

Figure 58: Physical spaces are connected using Connector tokens by discardind in-hand Secondary items or using the items in space.

Items in spaces are shown on the tiles and can only be connected to the notch they occupy. When players discard an item from hand to make a connection, they add a blue *Connection* token to their *Primary* item[101]. Each new *Connector* makes a new *Connection* token on their card. These cannot be removed once added thus players must acquire new *Primary* items to make further connections if they reach their connection limit. As a bonus, using in-hand items to cover notches meant for items in spaces in the same action, gives the player two blue *Connection* tokens together

[101] This mechanism intended to solidify concepts coming from the philosophical model into gameplay, essentially acting as physical representations of occurring digital interactions.

to place on their *Primary* item. Finally, all notches on a tile may be used for connecting, even those on the outer rim of play.

Figure 59: An example of performing a Risk Check on a players cards.

B.11 Conducting Risk Checks

During play (particularly the *Risk Phase*) players will have to undergo *Risk Checks*. These are done by rolling *Security* on **each** item in hand. Failing any of the checks means executing that cards *Effect* portion (which could further trigger a secondary *Risk Check*). During the *Risk Phase*, these checks are more elaborate with the dice count being decided by the drawn card (Fig. 59).[102] For instance, the *Virus Attack* card (Fig. 55) tells the player to do the following in order:

- Move the *Threat Tracker* ahead 2 spaces.
- Collect the total dice count of the player's *Security*, *Observation*, and *Coding* skills.
- Subtract that dice count by 6 to a minimum of 1 dice.
- After using that new dice count to roll on all items in hand, reduce player *Security* skill by 1 as damage.
- Then finally play any *Further Effects* on the card. In this case, the player takes an *Infected Daemon* (see B.9.3) and rolls for *Privacy* (see B.13).

[102] This particular mechanism aided in making players realise that their own assumptions of control in IoT interactions might not be as they believe, with the varying dice counts affected by associated IoT risks hinting at the fallacy of IoT interactions.

B.13 Tokens

Table 8: There are a number of tokens in the game representing different functions and affects.

Token	***Function (F) / Effect (E)***
Round Connector Tokens	**(F)** Shows connections between physical spaces
Blue Connection Tokens	**(F)** Denotes connections made during play on cards
Orange Vulnerability Tokens	**(F)** Denotes low-level insecurity issues within a space or item; **(E)** Converts into a *Threat* token if more than 2 in one space
Black Threat Tokens	**(F)** Denotes high-level insecurity issues within a space; **(E)** Each *Threat* moves *Threat Tracker* ahead by 1 (see B.15)
Privacy Tokens	**(F)** Ticking time bomb that churns out *Vulnerability* tokens after certain events; **(E)** If the number of *Privacy* tokens exceeds the number of players the game is lost
Block Tokens	**(F)** Denotes a disconnected space; **(E)** If *Block* tokens exceed the number of players the game is lost
Databox Tokens	**(F)** Marks the space as a *Databox*; **(E)** Step closer to victory (see B.14)

B.14 Resolves and Other Actions

When players are on a space or card that has an issue needing to be resolved (*Vulnerability*, *Threat* or *Privacy* tokens), they may encounter them as a *Resolve* action often by rolling for a skill. The interactions of the different tokens are shown in Fig. 60.

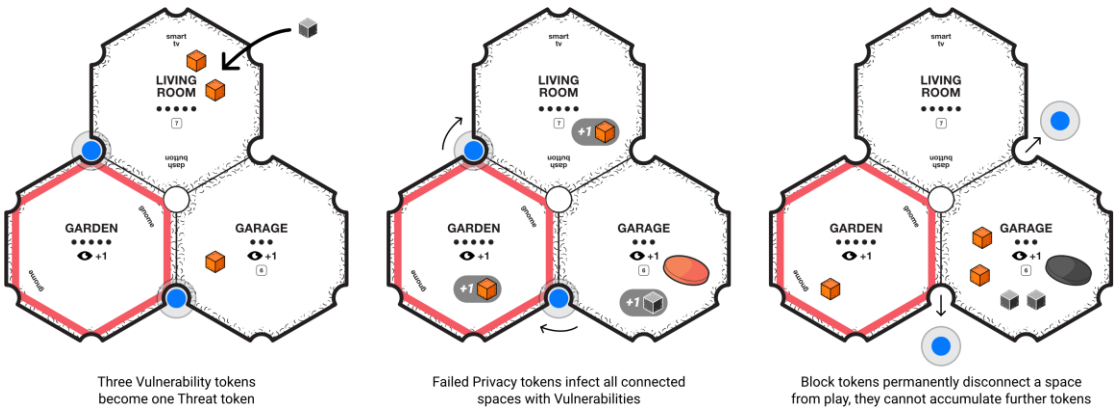

Figure 60: Different tokens have different interactions.

Vulnerability: These tokens are easier to remove and simply take an action to clear 1 from the space occupied, unless a players avatar or other cards allow them to resolve multiple.

Threats: If a space has 2 *Vulnerability* tokens, a third token would replace the 2 with a black *Threat* token. They are persistent, advance the *Threat Tracker* (see B.15), and require an *Attack Roll* to resolve (see B.8.1).

Privacy Tokens: When instructed to roll for *Privacy* the player rolls **1d6** for each *Privacy* token in play; 1–4 is a fail, 5–6 is a pass (follow the difficulty level of the game, see B.4). If the player fails on any of the tokens the following happen in sequence: a *Threat* token is placed in the space occupied by the player; all adjacent spaces of the failed *Privacy* token receive *Vulnerability* tokens; all connected spaces from the *Privacy* token receive *Vulnerability* tokens. If during this action (or any other) the *Server* receives a *Vulnerability* or *Threat*, all spaces **connected** to the *Server* with *Connector* tokens will also receive *Vulnerability* tokens. *Privacy* tokens are removed through an *Attack Roll* (see B.8.1). If a *Privacy* token falls on the *Server*, **players must resolve it within 1 round otherwise the game is lost** (see B.16).

Block Tokens: Some cards, and in dire circumstances certain players, may *Block* a space. Place the Block token on the tile and remove any *Connector* tokens from it as well. These cannot be resolved; they are permanently disconnected spaces from the board. They do not accumulate any further tokens and any tokens present within if removed do not affect the *Threat Tracker*.

B.15 Being Delayed[103]

At times players may become *Delayed* during play. This is not something they would do at will but be forced by cards. *Delayed* players skip the next *Action Phase*, but must endure the coming *Risk Phase* of that turn. To indicate a *Delayed* player, place their standee on its side in the space they occupy. After completing the *Risk Phase*, they may continue as before.

B.16 Resting

As an action, players may *Rest* and regain 1 or more *Sanity*. During this players are also allowed to resolve any number of *Daemon* cards **ONCE** in that action. To do that, they must follow the *Resolve Function* on a *Daemon* card (see B.9.3). Certain events and cards may allow players to do this function multiple times.

B.17 Databoxes

To win, players must secure spaces with *Databoxes* equal to twice the number of players. These are special tokens that may only be placed in space after the connection requirements are fulfilled **AND** a player has a successful *Deploy* action (Fig. 61). When a player is ready to deploy a *Databox*, they spend 2 actions to draw the top card from the *Privacy Deck* following its conditions (see B.9.2). Upon successfully navigating the card, a golden *Databox* token is placed in the space marking it as secure. **No further tokens of any kind may come into a Databox.** As a bonus, each Databox deployed will recede the *Threat Tracker* (see B.15) by 1 and if players manage to deploy a *Databox* in an *Insecure Tile*, they may recede the *Tracker* by 2!

[103] Being *Delayed* and *Resting* were among the many mechanisms added from *Eldritch Horror*, that said, these are still fairly common mechanisms used in modern board games. Though the names could have been changed, it was decided not to as this did little to affect the rhetoric and merely worked as a method to facilitate further play dynamics.

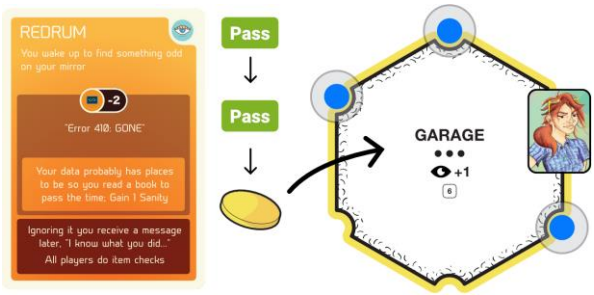

Figure 61: Databoxes are deployed by successfully completing Privacy cards.

B.18 Threat Tracker

The *Threat Tracker*[104] (Fig. 62) keeps track of when *The Crumble* occurs signifying a victory for the game. To stop that happening, players must attempt to finish before it reaches the end. The *Tracker* moves forward in two ways:

1. When a *Risk* card or other card moves it forward.
2. When a new *Threat* token appears in play.

Certain card events may recede the *Tracker* during play. Players may only do so themselves by deploying a *Databox* (see B.14).

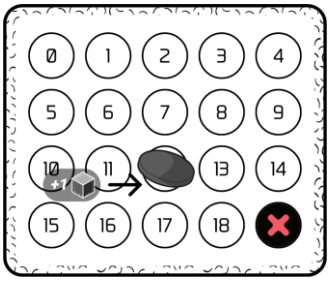

Figure 62: The Threat Tracker counts down the end of the game and win for The Council.

B.19 End of the Game

The game ends with either the players winning or losing to *The Council* (the board). **Players may only win if they deploy *Databoxes* equal to twice the number of players.** *The Council* wins if **ANY** of the following comes true:

- All players are *Delayed* together (see B.13.1).
- The *Threat Tracker* reaches the end (see B.15).
- There are *Privacy* or *Block* tokens equal to more than the number of players (see B.13).
- There is a *Privacy* token on the *Server* and it's not resolved within 1 round of play.

[104] This mechanism was appropriated from the *Doom Track* in *Eldritch Horror* which signified the end of or near end of game.

APPENDIX C

C.1 The Tarot of Things Deck

Cards for the Tarot of Things were created by simplifying descriptions of standard tarot cards as keywords and equating/curating them to a close approximation of IoT. Meaning Associations were assigned in accordance to traditional tarot methods for both upright and inverted configurations of cards. Keyword associations utilised throughout were extracted from Labyrinthos Academy's online reference sheet[105]. The total list of cards in the Tarot of Things deck are presented below as 23 Major Arcana cards and 14 cards each in suites of *Cables*, *Chips*, *Clouds*, and *Sensors*, making 79 cards in total.

The Tarot of Things can be experienced online along with a complete list of cards for download from:

- https://www.fictionware.org/tarot-of-things/.
- https://haiderali.co/Tarot-of-Things.

[105] For more information, see: https://labyrinthos.co/blogs/tarot-card-meanings-list.

Table 9: List of cards and keyword associations in Major Arcana for Tarot of Things.

Card Name	***Keywords(s) Upright***	***Keyword(s) Inverted***
The User	Innocence, Wonder, Foolishness	Taken Advantage, Recklessness
The Program	Structure, Authority	Chaos, Domination
The Network	Nurturing	Excess
The Operating System	Legacy	Servitude
The Programmer	Creation, Adaption	Cunning, Deception
Data	Playfulness, Addiction	Restoring Control
The Connection	Conviction	Doubt
Assistant	Wisdom, Unconscious	Repression, Secrets, Hidden Agendas
Logic	Choices	Indecision
Idle	Insight	Isolation
Time	Patience	Excess
Cables	Discipline	Loss of Direction
Disconnection	Release	Stalling
Termination	Change, Metamorphosis	Stagnation, Decay
Gateway	Courage	Reckoning
The Hacker	Disaster	Disaster Avoided
The Server	Pleasure	Negativity
Deep Learning	Intuition, Wisdom	Secrets
Node	Rejuvenation	Insecurity
Logs	Illusions, Unclarity	Misinterpretation
Loop	Fate, Karma	Lack of Control
Thing	Reflection	Doubt
The Constellation	Harmony	Incompletion

Table 10: List of cards and keyword associations in Suite of Chips for Tarot of Things.

Card Name	***Keywords(s) Upright***	***Keyword(s) Inverted***
Ace of Chips	Inspiration	Boredom
Two of Chips	Making Decision	Bad Planning
Three of Chips	Expansion	Delays
Four of Chips	Community	Transience
Five of Chips	Conflict	Avoiding Conflict
Six of Chips	Success	Lack of Recognition
Seven of Chips	Perseverance	Overwhelmed
Eight of Chips	Movement	Panic
Nine of Chips	Resilience	Fatigue
Ten of Chips	Responsibility	Stressed
Assistant of Chips	Exploration	Procrastination
User of Chips	Adventure	Recklessness
Network of Chips	Determination	Jealousy
Programmer of Chips	Big Picture	Impulsive

Table 11: List of cards and keyword associations in Suite of Clouds for Tarot of Things.

Card Name	***Keywords(s) Upright***	***Keyword(s) Inverted***
Ace of Clouds	Discipline	Manipulative
Two of Clouds	Adaption	Disorganized, Overwhelmed
Three of Clouds	Teamwork, Collaboration	Disorganized, Group Conflict
Four of Clouds	Conversation, Frugality	Greediness, Possessiveness
Five of Clouds	Need, Insecurity	Insecurity
Six of Clouds	Sharing	Power, Domination
Seven of Clouds	Perseverance	Distractions
Eight of Clouds	High Standards	Uninspired
Nine of Clouds	Rewards	Obsession
Ten of Clouds	Culmination	Lack of Resources
Assistant of Clouds	Diligence	Laziness
User of Clouds	Efficiency	Obsessiveness
Network of Clouds	Practicality, Security	Self-Centeredness
Programmer of Clouds	Abundance	Excess

Table 12: List of cards and keyword associations in Suite of Sensors for Tarot of Things.

Card Name	***Keywords(s) Upright***	***Keyword(s) Inverted***
Ace of Sensors	Intuition	Emptiness
Two of Sensors	Connection	Broken Communication
Three of Sensors	Community	Overindulgence
Four of Sensors	Apathy	Awareness
Five of Sensors	Disappointment	Acceptance
Six of Sensors	Memories	Independence
Seven of Sensors	Daydreaming	Lack of Purpose
Eight of Sensors	Disillusionment	Avoidance
Nine of Sensors	Satisfaction	Dissatisfaction
Ten of Sensors	Fulfilment	Broken
Assistant of Sensors	Sensitivity	Insecurity
User of Sensors	Idealistic	Fantasy
Network of Sensors	Calm	Dependence
Programmer of Sensors	Balance	Coldness

Table 13: List of cards and keyword associations inSuite of Cables for Tarot of Things.

Card Name	***Keywords(s) Upright***	***Keyword(s) Inverted***
Ace of Cables	Clarity	Chaos
Two of Cables	Stalemate	Indecision
Three of Cables	Suffering	Recovery
Four of Cables	Restoration	Stress
Five of Cables	Sneakiness	Lingering Resentment
Six of Cables	Transition	Unresolved Issues
Seven of Cables	Trickery	Rethinking
Eight of Cables	Imprisonment	Freedom
Nine of Cables	Anxiety	Reaching Out
Ten of Cables	Failure	Upwards
Assistant of Cables	Curiosity	Deception
User of Cables	Impulsiveness	Unpredictability
Network of Cables	Complexity, Perceptive	Cruel
Programmer of Cables	Discipline	Manipulative