A Cybernetic Service Design Approach for Taming Persuasive Service Systems: Reflective Case Studies for Design Practice

PhD thesis

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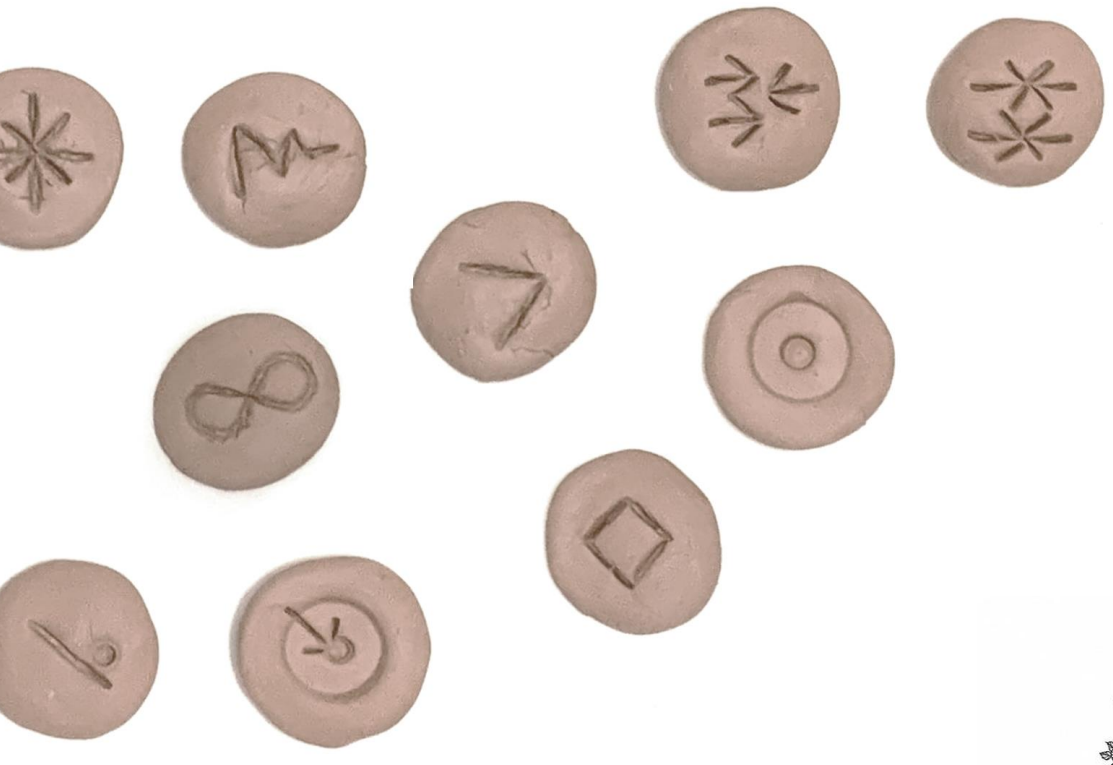

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All Watched Over by Machines of Loving Grace

by Richard Brautigan (1967)

I like to think (and
the sooner the better!)
of a cybernetic meadow
where mammals and computers
live together in mutually
programming harmony
like pure water
touching clear sky.

I like to think
(right now, please!)
of a cybernetic forest
filled with pines and electronics
where deer stroll peacefully
past computers
as if they were flowers
with spinning blossoms.

I like to think
(it has to be!)
of a cybernetic ecology
where we are free of our labors
and joined back to nature,
returned to our mammal
brothers and sisters,
and all watched over
by machines of loving grace.

Abstract

A Cybernetic Service Design Approach for Taming Persuasive Service Systems: Reflective Case Studies for Design Practice

This research concerns the design of a cybernetic service design approach for design of persuasive service systems. Through substantial reflective practice and two case studies, I have taken steps towards a service design approach that can be used by owners, managers, designers and regulators to understand how to better tame services which behave as persuasive systems, i.e., service systems which are designed with the intent to influence people's behaviours or attitudes.

In this thesis, I propose design cybernetics as a language for the design of services as persuasive systems. To develop the approach, I have engaged in substantial reflective practice and participated in two live service design projects, to arrive at insights leading to new theory and practices. I have gained new knowledge of how design cybernetics can be applied in different service design contexts and gained an understanding of how it, in theory, can support more ethical design practice. In the reflective practice, to develop new personal knowledge, I developed a set of cyber-physical boundary objects. In the service design projects, I engaged with Friends, an anti-bullying organisation, and with Planethon, a company focusing on planet-centric business development.

The practice-led design research methodology builds on a pragmatic-constructivist knowledge claim. I use an action research approach combined with reflective design practice to arrive at a design cybernetic praxeology; a way service designers can act cybernetically. The empirical research consists of two streams: conversations with the self (reflective practice) and conversations with others (case studies). The two streams have informed each other and, in the nexus, new communicable knowledge has been created in an emergent process.

The research suggests that there are merits to using design cybernetics in the design of persuasive systems. It is useful to provoke reflections on meta-design of services and it can also be used to describe endogenous design governance. Design cybernetics offers a rich conceptual world that can help service designers to better understand what service design is and does in the context of persuasive systems. I propose that designing cybernetically, with a conversational approach to service design, is a way to reach a more intuitive understanding of challenges pertaining to persuasive systems. By learning to use a design cybernetic approach, designers or those who commission design can become more conscious about second-order design aspects of services. This can be considered a significant contribution, given that cybernetics, since the reflexive turn to second-order cybernetics, has been struggling to find practical uses.

Preface

I usually wake up about seven o'clock in the morning. Before I get out of bed, I check my email, Instagram, Twitter, and Facebook accounts for updates. After breakfast, I use an app to check the weather prognosis for the day, and I use the public transportation app to identify when the next bus is due. On my way to the bus-stop, I browse 5-6 major online news sites. On the bus, I check out the LinkedIn-profiles of people I will meet throughout the day. Perhaps I watch some clips on YouTube or read a few Medium blog posts. At the office, I use Slack, GDocs, Word, Excel, Canva, Zoom, Teams and Google Meet and spend more or less all day in front of a monitor, before it is time to get on the bus again and browse my way home. I round off the day with some Netflix, HBO or consume some other content through my smart TV.

I was privileged to grow up in an era when computers became common in households, and when the Internet and digital services entered the mass market. I was gradually introduced to new and improved mobile phones and computers. I still get nostalgic when I look back at those days and the sense of wonder and limitlessness offered by the new infrastructure. I have spent the past 30 years using digital media and computers, starting my exploration at my father's Macintosh Plus around the age of 6. My two-year-old son is already using digital media and enjoying interactive cartoons and YouTube movie clips (in moderation, I must add).

Whether I want it or not, these pervasive technologies influence my communication and interaction. I extend my agency in the world using digital tools; they help me communicate over distances, formulate my thoughts in words, translate my words from one language to another, and connect with people anywhere on earth. However, these services also profoundly shape my interactions and my personal behaviour.

When I set out to study persuasive systems design in 2018, I did not consider myself a designer. I had a Master's degree in business administration and operations management, and a prior career as a technology entrepreneur. Throughout the years that I was working with developing new service concepts, I never realized that what I did all day was to design. Neither did I know that design was such a powerful source of influence. The community at the Royal College of Art opened up a new world to me, and perhaps more importantly, I learned to decode the languages of art and design. In the world of art and design 'unpack', 'deconstruct' and 'reassemble' were common jargon which I had never encountered before in the business world. Initially, I struggled with the concepts, but eventually, I learned design terminology and eventually even taught design myself. In 2018, I had no idea that 2020 would bring a global pandemic and that I would spend a large share of my PhD journey being confined to my home. As the old saying goes, when some people build shelters, other people build windmills. I used this time to write up the thesis, grow tomatoes and parsley. When writing this preface (December 2020), the practices of digital services are under heavy siege by regulators around

the world. The pandemic has caused the market value of the technology giants Google, Amazon, Apple and Facebook to skyrocket. Questions concerning complexity, ethics and governance of digital services are more relevant than ever, why this enquiry is timely and hopefully, a useful contribution to the debate.

Acknowledgements

This thesis would not have been possible without the help and contribution from the many people who have supported me on this journey. I dedicate my work to Ronald Jones, my dear supervisor and friend, who sadly passed away before the completion of the thesis.

To my patient supervisors,
Dr Ronald Jones (†)
Dr Nick de Leon
Dr Ashley Hall
Dr Juliette Kristensen

To Qian, Rachel, Catherine, Carolyn, Laura, Zowie, Brigitte, Sian, Eleni, Victoria, Dan, Vincent, Welmoet, Cecilia, Claire, Chris, Sarah, Orla, Gyorgyi, Olivia, Kensho, Filippo, Davin, Katie, Jess, Kiran, Kyle, Rosa, Ruotong, Constance and all other creative, lovely RCA students and staff whom I met on the way. To the bold pioneers at Planethon and Friends.

To Anna, Ingvar, Lennart, my sweet, loud family
and my dear friends, near and far.

Finally to,
Dr Tech. Marcus Wallenberg Foundation for Education in International Industrial Entrepreneurship, for investing in design research.

A heartfelt thank you!

Definitions

Services / Digital services

Services are processes that facilitate interpersonal transactions of value (Vargo and Lusch 2004). Digital services are socio-technical systems which support the delivery of a service experience.

Cybernetics and second-order cybernetics

Cybernetics is a system's theory that describes systems based on their goals. Second-order cybernetics is the recursive application of cybernetics to itself. Cybernetics has been described as 'the science of observed systems', while second-order cybernetics is 'the science of observing systems' (von Foerster 2003), where the observer's position is recognised in the system analysis.

Design cybernetics

Design cybernetics is a philosophy which builds on the epistemological similarities between second-order cybernetics and design. Circularity and conversations are central concepts in design cybernetic philosophy.

Persuasive Service System

These are service systems that are mainly delivered through digital media and which uses strategies and tactics from persuasive technologies and system to influence the behaviours, choices or attitudes of its users.

Extended intelligence

The following software has been used for editing the thesis.

MS Word	Spelling and grammar check
Grammarly	Spelling and grammar check
GDocs	Spelling and grammar check
Paperpile	Citation management

Author’s declaration

During the period of registered study in which this thesis was prepared the author has not been registered for any other academic award or qualification.
The material included in this thesis has not been submitted wholly or in part for any academic award or qualification other than that for which it is now submitted.

Gustav Borgefalk
January 7, 2021

Publications

I have previously published outcomes of the research at the following conferences and publications:

Borgefalk G., de Leon N. (2019) The Ethics of Persuasive Technologies in Pervasive Industry Platforms: The Need for a Robust Management and Governance Framework. In: Oinas-Kukkonen H., Win K., Karapanos E., Karppinen P., Kyza E. (eds) Persuasive Technology: Development of Persuasive and Behavior Change Support Systems. PERSUASIVE 2019. Lecture Notes in Computer Science, vol 11433. Springer, Cham

Borgefalk G. (2018), Designing Relationships with Technologies which pass as humans, Touchpoint, vol 10, no 2: (36-39)

1. Introduction

This research explores if and how design cybernetics can be used to design persuasive services systems and if we, by doing so, can better address governance challenges and ethical challenges facing service designers or those commissioning or leading service innovation.

Most common services delivered via digital media are designed to influence people's behaviours, decisions or attitudes. They shape our decisions regarding which goods or services to purchase (e.g., eBay, Amazon), which movies or music to consume (e.g., Spotify, Netflix), what places we travel to (e.g., Tripadvisor, Square), which people we communicate with (e.g., Facebook, Instagram, WhatsApp) and what people we date (e.g., Tinder). However, new forms of computer hardware and software lead to new forms of persuasion, which require new or modified design methods for services, defined as persuasive systems (Timmer et al. 2015). There is a gap between service design *capabilities* and emerging technology *challenges*, indicating the need for a new design approach. This research aims to generate new knowledge about the design of meta-governance systems for persuasive systems using an action research approach, ultimately leading to an improved understanding of how to design services as persuasive systems. The enquiry is positioned in the intersection between *service design research*, *persuasive technology* research, and *design cybernetics*, and this is also the interdisciplinary nexus in which its contribution is situated.

In this dissertation, I argue for the usefulness of cybernetics, particularly the direction referred to as design cybernetics, as an approach to service design. For service design, design cybernetics offers a holistic design philosophy that allows circular analyses of both mechanisms that regulate systems that govern digital platforms, (designing systems) and service systems (service systems that are being designed). There are several benefits to a design cybernetic approach. I make the following high-level arguments, that I will support with evidence in the form of two design case studies and two epistemic service design projects. Together they lead up to new knowledge in the form of new theory and a set of useful frameworks and tools.

1) More advanced computers are a source of accelerating complexity, generating new forms of persuasive technologies and systems. Hence, there is an urgent need for *governance approaches for services using persuasive technologies (*services as persuasive systems) to address design issues related to governance, goals, values and ethics. My research demonstrates that a design cybernetic approach can make governance endogenous in the service design process.

2) I further propose that *design cybernetics* provides a useful vocabulary which service designers can use to articulate better what service design is and does in the context of persuasive systems and to describe the aspects of persuasive systems that are not dealt with sufficiently today. I argue that concepts from second-order cybernetics can be useful to describe *governing metasystems* of persuasive service systems.

3) By integrating ideas from design cybernetics with persuasive technology theories, I propose design cybernetics as a *design approach* for addressing governance challenges in services, and present *tools* to operationalise the theoretical framework. This approach may substantially contribute towards taming wicked problems of persuasive service systems.

Given that cybernetics, since the reflexive turn to second-order cybernetics has been struggling to find practical uses, this should be considered a significant contribution (Richards 2020). My aspiration is that by performing service design research using a design cybernetic approach, more service designers will discover the benefits (and joy) of a design cybernetic approach to design.

Who is this research for?

The growing impact in people's lives by persuasive service systems is a concern shared by many. It influences everyone, in academia, governments and companies, and impacts many different aspects of people's personal lives. I set out to do research that made sense to me and could be used by other concerned citizens and professionals.

My ambition has been to create *communicable knowledge*, which is rigorous but still accessible, playful and easy to access for a non-specialist audience. Ideally, it could be an entry-point to the world of persuasive systems and design cybernetics, where I see my research as a portal to this exciting universe.

However, certain groups may find this research more useful than others. The ambition has been to make the design cybernetic approach valuable for *people who design, use, manage or regulate persuasive service platforms* to understand how they should be understood and governed. The parts which pertain to education may be interesting for design educators or students who wishes to develop or teach, cybernetic design practice. The thesis is also relevant for policymakers, regulators, owners, managers or senior leadership functions in companies or organisations which commission, develop or manage services which use persuasive technologies.

1.1 Introduction and motivation

As stated in the preface, my background is not in design but technology entrepreneurship. I spent almost ten years designing, developing, launching, and managing digital media platforms that engaged millions of people worldwide. Throughout my career, I worked with digital media production, social media marketing, online marketing strategies and open innovation strategies for some of the world's most well-known companies, organisations and academic institutions. I was utterly fascinated by the fact that my team could influence what people *did* on the other side of the planet, from our tiny office in Sweden, using digital media as a force multiplier. Because of digital media and its international platforms, our agency was not just local but global. However, I also began to realise the dominating role digital media played in our lives and how much it influences people's attitudes and decisions (including my own). Reading up on digital influence, I encountered *captology*, a field pioneered by BJ Fogg at Stanford University in the early 2000s (Fogg 2002). Captology stands for 'computers as persuasive technologies', and it describes how technology can be designed to influence people's behaviours and attitudes. The field caught my interest because it touched upon many of the issues I had encountered in my work. This epiphany coincided with several high-profile scandals related to persuasion and media platforms, such as the Facebook/Cambridge Analytica privacy scandal (Isaak 2018), alleged interferences in elections and referendums perhaps most notably the US election in 2016 and the Brexit referendum (Howard and Kollanyi 2016). There were also proposed links between depression and social media use (Lin et al., 2016). The persuasive technology movement was blamed for many of these issues, and the Time Well Spent movement was sparked as a counter-reaction (Newton 2018). It was proposed that its practices and influence mechanisms were actively 'downgrading humanity' suggesting that we are facing the 'social climate change of culture' (Johnson 2019).

I felt a responsibility and a sense of urgency to do something about it, which led me to pursue these PhD studies and perform the research documented herein. Although my foundational knowledge has been advantageous to understand some of the more general mechanisms of digital persuasion, diving into specifics has been both valuable and frightening. I assert that not everything insinuated about persuasive technologies in media is necessarily true. However, in my mind there no longer any doubt that persuasive service systems exert massive influence on our lives and decisions. Understanding how that potential can be used as a force for good has been my primary motivation.

The rising political impact of digital services

Digital services, often delivered in the form of apps or websites, are *never neutral*. They are *designed* to influence our actions and choices, behaviours or attitudes (Lockton 2013, Fogg 2002, Williams 2018). These entities are sometimes referred to as *persuasive technologies or systems* (Fogg 2002, Torning and Oinas-Kukkonen 2009). As a research field, Persuasive systems have its roots in

computer science, more precisely human-computer interaction and information systems research. However, it is sometimes considered a subset of design research, in the nexus of computer studies and design, describing technology designed with explicit intent to influence people's behaviours or attitudes. All design influences people, whether the designer wants it to, or is aware of it, or not. There are several approaches to design touching upon this domain; Design With Intent (Lockton 2013, p. 23), Design for Behaviour Change (Niedderer et al. 2016), Nudging (Thaler 2018) and Gamification (Hamari, Koivisto and Pakkanen 2014a) all have *intentional behaviour or attitude change* at the core of their definitions; however, they apply methodologies and methods from different traditions and epistemologies to study these phenomena.

Throughout my research, and in my profession as a technology entrepreneur, I have come to believe that our current understanding of services as persuasive systems is not sufficient to adequately address the emerging challenges related to the use of persuasive technologies. Modern services systems are often complicated to the degree that people cannot understand precisely *how* these systems do what they do, or *why* they do what they do.

This matters because we are *extending our intelligence* with technology, helping us act in the world (Ito 2016a) and our education, our ability to envision the future, and act to realize it now depends more on the design of the digital platforms and services we use. For better or worse, *'a part of our conscience is deliberately placed in the material environment, and that environment forms not only the background of our existence but educates us too*' (Verbeek 2009). Persuasive service systems are dynamic, adaptive and complex. The evolving service ecosystem calls for new governance models of persuasive systems and new ways of understanding how its control systems work, to ensure that these systems serve humankind and its goals. Although we have lots of data and knowledge about these systems' compositions, they are always subject to a wide range of change, and we do not yet know how to fix their flaws (Spagnoletti, Resca and Lee 2015). They are becoming increasingly *unknowable*, and we need to learn how to *tame* them (Pickering 2004), hence the title of this research.

Service design and service-craft

The research, which has been carried out at the Service Design programme at the Royal College of Art, School of Design, builds on contemporary service design theories that describe the shift from a product-dominant logic to a *service-dominant logic*, where *services*, rather than products become the focus of design (Vargo and Lusch 2004). This has increased the demand for better theories and practices to describe complex services and systems. Dubberly and Pangaro (2007, pp. 1301–1317). denote service design in industrial design 'service-craft', referring to the shifting relation between services and artefacts. *'While service-craft focuses on behavior, it supports behavior with artifacts.*'. They emphasise that new logic calls for new language and argue that although the 'languages' for describing physical artefacts are still relevant, they are often limited to describing physical materiality.

They provide the following useful description of the shift from traditional (hand-craft) to emerging (service craft) models of design.

	Hand-craft	Service-craft
Subject	Thinks	Behaviours
Participant(s)	Individual	Team
Thinking	Intuitive	Reasoned
Language	Idiosyncratic	Shared
Process	Implicit	Explicit
Work	Concrete	Abstracted
Construction	Direct	Mediated

Figure 1: Distinctions between hand-craft and service-craft (adapted from Dubberly et al. 2007)

Service Design is a design discipline that addresses the growing need for design expertise for services. Although all services have material interfaces, it is often concerned with designing *intangible systems:* processes; feelings, atmospheres, behaviours and attitudes (Penin 2018, p.30). According to Nielsen, the total daily media consumption for a US adult (18+ years) was more than 12 hours in Q1 2020 (Nielsen 2020) (including some simultaneous use). As we spend more time interacting with digital services, service designers who develop digital platforms and services become more influential, in the sense that the services they design have a more significant impact in people's lives, on their behaviours, choices and attitudes. Not only because people physically spend more time using them, but also because the inner workings of the systems are largely invisible to the eye, and people have to trust that the service designers behind the services have their best interests in mind, or at the very least, that their intentions are honest and transparent.

A shift towards behaviour-focused design

My research has been influenced by the work of Hugh Dubberly and Paul Pangaro, who proposed that *cybernetics* holds great potential as a language for describing 'behaviour focused design' (Dubberly and Pangaro 2007). In my research, I have built on their theories and extended the vocabulary of service design by using *design cybernetic theory*, to arrive at new design frameworks and tools for endogenous governance and ethics of services as persuasive systems. This research thus addresses

inherent issues pertaining to persuasive systems' design process and aims to support designers of persuasive systems to design differently. Design cybernetics, described in more detail in chapter 3, is a design philosophy and epistemology that builds on cybernetic and second-order cybernetic theories and emphasises the constructive interplay between that which is designed (the service) and the observing/designing system (the designer). Since the 1940s, first-order cybernetics has already been embraced by the scientific community to describe control processes and goal-oriented systems. Certain concepts from second-order cybernetics have been adopted, albeit in limited circles, by architects and designers, but have not yet been recognised in service design to any greater extent.

Service design has a system's approach to design and is well-positioned to use second-order cybernetics to understand what it is to both act and observe in systems simultaneously and use this to address ethical risk factors through improved governance.

In the next section, I will briefly expand on some challenge areas related to services as persuasive systems, introduce the chosen methodology and the theoretical areas in which this research is situated.

1.2 Wicked problems of persuasion, governance and ethics in digital service platforms

In the first section of this chapter, I established that this thesis concerns digital services designed to be *persuasive* – to influence people's behaviours and attitudes intentionally. Next, I will give a brief overview of the problems which caused me to initiate this investigation. These will be further unpacked in chapter 2.

More wicked problems and an increasing need for political design considerations

Victor Papanek (1972, p. 14) stated in *Design for the Real World* that 'There are professions more harmful than industrial design, but only a very few of them'. With the shift from a product-dominant logic to service-dominant logic, this statement is likely equally relevant for designers more broadly. It also means that challenges and problems related to technological complexity become more sophisticated. As the technology analyst Benjamin Evans put it in a tweet, '*Software ate the world. So, all the world's problems get expressed in software.*' (Evans 2020). The increasing complexity of digital technologies means that *designers effectively make or shape more decisions and attitudes for other people*, whether they want to or not and whether they recognize it or not. Although it is essential to recognise the positive effects digital media has brought to the world, it is equally important to acknowledge its flaws. Spending more time using digital technologies, people *have* to rely more on designers' judgments and *will* suffer more from the consequences of their designs if they are not up to par. Increasing complexity also influences how services are composed and delivered, which means

that service designers' responsibility inevitably increases as technology can leverage people's best or worst behaviours alike.

However, there is no such thing as designing technology entirely 'right'. Instead, these problems follow the logic of *wicked* problems, a particular type of complex issues which are notoriously ill-defined. Rittel and Webber (1973) provided a ten-point list describing wicked problems, describing design governance challenges in the context of society and social planning. Their challenge formulation is equally relevant for services as persuasive systems:

"*We do not even have a theory that tells us how to find out what might be considered a societally best state. We have no theory that tells us what distribution of the social product is best-whether those outputs are expressed in the coinage of money income, information income, cultural opportunities, or whatever." (Rittel and Webber 1973)*

Rittel and Webber's paper argues that design is inseparable from *politics*. In the case of persuasive technologies, *politics is played out at the level of design*. A more condensed version of Rittel and Webber's ten points and perhaps better suited for this research context is the definition of wicked problems provided by Conklin (2005) who generalized the concept beyond public policy planning:

1) You don't understand a wicked problem until a solution is formulated.
2) Wicked problems have a 'no stopping' rule, and they are never completely solved.
3) There are no discrete (right or wrong) solutions to wicked problems, only better or worse solutions.
4) Every wicked problem is essentially unique and new.
5) Every solution to a wicked problem is a one-shot operation.
6) Wicked problems have no given alternative solutions.

However, it is important to recognize that *not all problems are wicked problems*: there are many linear and tame problems where linear problem-solving approaches are more appropriate. This table adapted from Pusca and Northwood (2018) and Mcmillan and Overall(2016), accounts very briefly for the main differences between conventional and wicked design problems.

Conventional problems	**Wicked problems**
- Determined and well-structured linear design problems - Defined systems or situations - Either true or false outcomes, successful or unsuccessful solutions	- Open-ended and ill-structured problems - Indeterminacy and no definitive limits for the design problem - Unknown outcomes, better or worse solutions

Table 1: Conventional vs. wicked problems

Design has been described as especially suitable to deal with wicked, ill-defined problems. Buchanan (1992) went as far as to say that *wicked problems are design problems* and stated that design has no particular subject matter of its own; it has universal and indefinite problems and solution spaces. Eggers and Muoio (2015), working for the global consulting firm Deloitte, recast wicked problems as *wicked opportunities*, suggesting that the most significant issues also constitute the most significant opportunities.

Observing our contemporary society, it is clear that people do not have a singular view of how society shall be run. If we do not know what an ideal state is, or what constitutes a preferable future, *politics*, *argumentation* and *rhetoric* become critical design skills to recognize. It is also clear that techno-political problems are not linear, they are open-ended problems that, according to wicked problem logic can be *tamed*, but not solved.

In addition to political/design conversations about what constitutes *preferable* futures for different stakeholders, we can also identify *meta-conversations*, that concern *models and assumptions for conversations*, second-order discussions about *whom* should be allowed to participate in the discussions, *how* power should be represented and distributed and, sometimes, *if and why* certain conversations should exist at all. To an increasing extent, these conversations are mediated by technology or even expressed *in* technology. The influence of media on conversations was obvious to Marshall McLuhan, who emphasised that *understanding new media's properties* is key to understanding how society works (McLuhan 2016). That is undoubtedly true in the context of the design of service as persuasive systems. As subsequent design research has suggested, pervasive industry platforms that are prolific users of tactics and strategies from persuasive technology research are inherently political (Borgefalk and de Leon 2019). As these technological platforms now mediate a large share of human life, the quality of the second-order meta conversations regarding agendas and designs of digital platforms becomes vastly more important.

More complexity, more unknowable systems

The growth of digital, connected devices is undisputed and unprecedented: there is an increasing number of computers (Evans 2020, slide 2), there are more powerful computers available (Koomey et al. 2011), the number of relationships between nodes in computing networks is growing, and the speed of diffusion of computer hardware and software is rapidly accelerating. Hinchcliff (2015) describes the novel computer landscape as ‘a fabric of community, data, devices and intelligence’ that has emerged, calling it *ambient computing* (Table 2). (For a longer discussion, please see chapter 2)

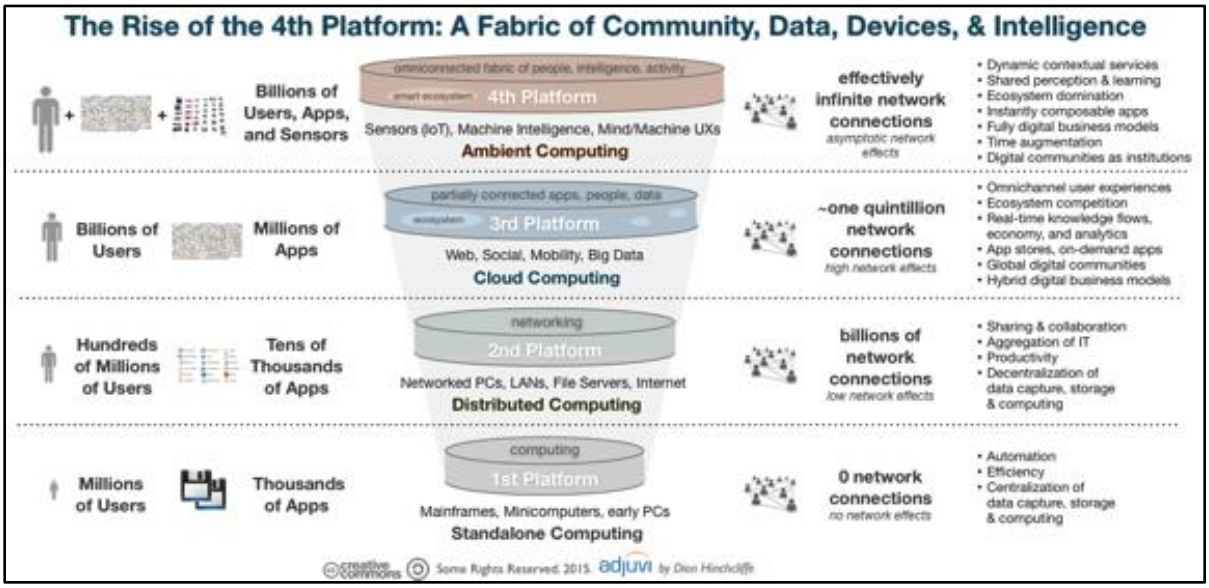


Figure 2: The rise of the 4th platform (Hinchcliff 2015) Creative commons license.

The rapid development of computer hardware and software drives *complexity* across many different domains, and a new, artificial, digital landscape is rapidly unfolding. With ubiquitous access to computers, people spend more time online, and their lives are mediated to a greater extent by various digital platforms and services. Digital platforms are also standard tools for organizing resources and human labour. In the modern information economy, 'intelligent' computer programs provide cognitive support to regulators, managers and employees in their work.

The digital revolution has made it possible for anyone with a connected device to access vast amounts of information instantly, but the human brain has limited bandwidth (Bruckmaier et al. 2020). Although it can achieve amazing things, it simply cannot process all available information or impressions. To model and predict events in our environment, the brain uses *heuristics*, cognitive shortcuts, which help us navigate complex environments (Tversky and Kahneman 1974). Designers often work with known heuristics to 'steer' people's behaviours towards desired actions of beliefs, by modelling affordances and signifiers of artefacts, or by creating sequences of experiences. Working with heuristics is standard practice in design fields such as interaction design and service.

Ethics of services as persuasive systems

As stated in the previous section, complexity leads to an increasing need for more effective political discussions about the design of services. A reason *why* this is important is *ethics*. Ethics is a rich and old field of inquiry concerning matters of *value*. Together with *aesthetics*, the study of the beautiful or harmonic, it makes up a branch of philosophy called *axiology (*Hart 1971). In addition to the ethical issues pointed out by the Time Well Spent movement (Newton 2018), there are several other areas where persuasive service systems are in 'murky territory' ethically. Algorithmic bias, autonomous warfare, surveillance, privacy-related issues and other abuses of personal data are but a few areas

where these technologies can cause harm (Dignum et al. 2018, Royakkers et al. 2018). Although ethics of digital platforms are dealt with in different disciplines, I will mainly engage with ethical theories from persuasive technology research. Since the discipline is concerned with these forms of technology's ethical particularities, it is suitable for this context (see chapter 2 for a deeper review). The importance of *design models* is emphasized by Hugh Dubberly. He wrote that "*All models have a purpose and serve constituents. Models have a point of view, and they advocate it. Models are always political.*" (Dubberly 2009d). This research also scrutinises the models and concepts that service designers use to describe persuasive systems.

Governance

The development of more complex services where ethical properties are challenging to discern inevitably leads to governance questions. If we face wicked problems in persuasive service systems, how do we 'steer' and manage the technologies designed to steer us? Steering inevitably too becomes an exercise in design. However, it is not enough to focus on the systems we can see; we also need to engage with metasystems that work behind the scenes to govern and influence the services we see and use, such as a designer's intents and values.

The order of items on a menu determines our range of possible choices in a restaurant, and similarly, our behaviours, attitudes and options are now shaped in and by digital media. That creates new problems, foreseen and unforeseen, which potentially have a massive influence on people's lives. Using computer systems designed to influence people's behaviours and attitudes can be perceived as controversial and value-laden; however, 'control' or 'regulation' of system elements has always been central ideas in cybernetics. In recent years, technical systems have reached a level of sophistication which enables both overt and covert influence and perhaps to some extent - control - of human behaviours and actions to a greater extent than before.

Controlling people's behaviour is, however, in the cybernetic sense, not as value-laden as it may seem. Cybernetics was developed to create a common language for biological, technological and social systems (Glanville 2007). Control in the cybernetic sense can perhaps be more related to Donald Schön's concept of conversations in design *"...doing and thinking are complementary. Doing extends thinking in the tests, moves, and probes of experimental action, and reflection feeds on doing and its results. Each feeds the other, and each sets boundaries for the other."* (Schön 1983, p. 280) The circular constraints and affordances which conversations create, between people and materials, people and people, people or organisations or any other constellation of actors, are the essential components of the 'control' functions. In this way, designers try to 'steer' the outcomes of their work towards their desirable futures, even if they not always end up in the desired place.

Designers and political power

Recognizing design's power to influence what people think or do, perhaps not surprisingly, there seems to be an increased interest from governments and public administrations to use design as instruments to implement policy. In 2010, the UK government jointly with NESTA established the Behavioural Insights Team, also known as the 'Nudge Unit', a government centre specifically tasked to use behaviour design to implement policy and change people's behaviours and attitudes in areas such as sustainability, preventive health and getting people to enrol in pension schemes (UK Behavioural Insights Team n.d.). Applying computer-backed behavioural change techniques on citizens was a somewhat controversial idea at the time, but sparked essential debates about technological paternalism and the ethics of using computers to understand and predict people's behaviour and attempt to change it. In 2014, the unit spun out of government to a company co-owned by the government, NESTA and its employees. Early results from their interventions have shown promising results, and other governments have established 'nudge units' to drive policy implementation. Persuasive systems effectively become policy instruments, but the jury is still out on whether they are effective or not and whether they are used ethically.

While some government branches use persuasive systems as instruments to influence citizens' behaviours, others are trying to regulate platforms that have become more powerful. In 2020, the UK issued a Select Committee on Democracy and Digital Technologies to scrutinize the impact of digital technology and pervasive industry platforms on the democratic society. Their report states that '*Transparency of online platforms is essential if democracy is to flourish. Platforms like Facebook and Google seek to hide behind 'black box' algorithms which choose what content users are shown. They take the position that their decisions are not responsible for harms that may result from online activity. This is plain wrong. The decisions platforms make in designing and training these algorithmic systems shape the conversations that happen online.*' (UK Parliament 2019) This quote illustrates how many regulators feel about digital services influencing their citizens to do, say or vote in particular ways. For non-democratic, authoritarian governments, however, the possibilities offered by persuasive technologies are vast, since they operate on different ethical codes than democracies. Some see opportunities for using persuasive systems to consolidate the government's power. Others see opportunities to create an artificial layer of trust in a society where interpersonal trust is low. Persuasive technologies can clearly be used both for good and for bad purposes but what is considered 'good' or 'bad' always depends on the *observer*. Deciding how to govern or 'steer' pervasive industry platforms become a matter of politics and service designers suddenly find themselves in uncomfortable political power positions, with growing influence over other people's lives.

Entering the 21st-century design cybernetic era

Twenty years since the inception of the field of persuasive technologies, new, complex challenges related to persuasive platforms are beginning to surface. There is a growing interest in software applications such as predictive computing and artificial intelligence, enabling *more subtle and powerful digital persuasion* (Timmer, Kool and van Est 2015). New forms of persuasion include, for example, *personalized persuasion, ambient persuasion, persuasive transmedia storytelling, subliminal persuasion* and *persuasive games* (read more in chapter 2).

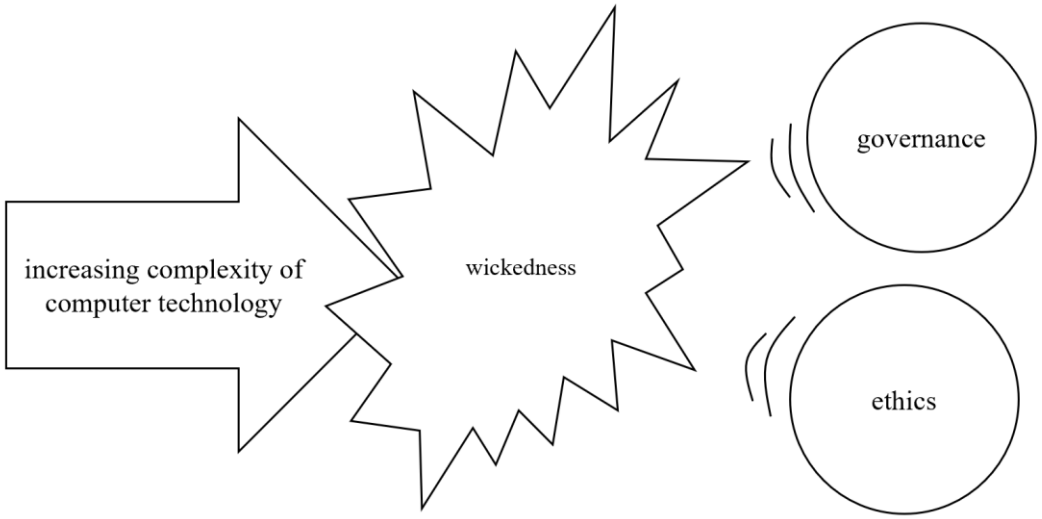


Figure 3: Challenge areas for services as persuasive systems.

The main driver of the 'wickedness' of problems is increasing *complexity*, rapid changes in computing products (hardware and software), the substrate of persuasive technologies, that create new economic, political, philosophical, cultural and social opportunities and risks. That leads to more 'wickedness' in problems related to governance and ethics.

Renewed relevance for cybernetics for the design of persuasive service systems

When exploring different system's approaches, I encountered *cybernetics* as an approach to describing purposeful systems, and was captivated by its elegance and usefulness. Discovering *second-order cybernetics* and *design cybernetics* sealed my fate, I soon realised that there was significant untapped potential in using that approach in service design. Historically, cybernetics has been applied to some extent in service design, however, mainly in the pre-Internet era. Stafford Beer was a British professor who gained a reputation for his application of cybernetics to the management of organizations and operations research (OR). He described cybernetics as the *science of the unknowable*, alluding to that some problems can never be solved or dominated by knowledge, we can

just learn how to cope with them (Pickering 2010a). He described a type of 'exceedingly complex problems', which he argued could never be understood completely by man (Pickering 2010a). Governance problems of persuasive service systems indeed belong to that category.

Computer hardware and software are now sufficiently advanced to implement some of the earlier cybernetic visions, making design cybernetics a functional language to describe digital persuasive products and services' properties. In the past twenty years, technologies such as artificial intelligence, blockchain, miniaturization, robotics and biotechnologies have enabled new means for communication and control. Despite the promises, it is also essential to recognize that earlier cybernetic ideas may or may not be realized in their original form and that it is imperative to critically evaluate their usefulness - they will with no doubt, in many instances, need to be updated and adapted to current circumstances.

1.3 Research approach: Mixing theory and practice

The research builds on a pragmatic-constructivist view of knowledge, assuming that people do not only discover an existing world but that human knowledge and society is the result of a social, constructive process of meaning-making. Bruce Archer wrote that design research '*...is systematic inquiry whose goal is knowledge of, or in, the embodiment of configuration, composition, structure, purpose, value and meaning in man-made things and systems.'* (Archer 1981). Since the 90's, different approaches to human-centred design have emerged, promoted by actors such as Stanford D. School, IDEO and the Helen Hamlyn Centre for Design. The human-centred design paradigm shifts the focus of design away from designing systems and things. Instead, it explores how designers can put things and systems to use and better support people's needs, considering the human perspective in all aspects of the design process and involving users actively in the process of design.

Design research is distinctively different from scientific research because it focuses on the process of devising *new* solutions - 'changing existing situations into preferred ones', imagining and building concepts which do not yet exist (Simon 1988, p. 67). There is also a focus on design on solving *applied* problems, which suggests a pragmatic research approach. The thesis consists of *qualitative* design research, and it uses a non-linear (circular) design cybernetic approach to generate new knowledge. Design cybernetics offers a philosophy and epistemology that merges the domains of design with first- and second-order cybernetics, creating a holistic and influential theory of knowledge grounded in both theory and practice. A more extended discussion about my epistemological stance is found in chapter 4.

Methodological approach

For the investigation, I have developed a cybernetic service design methodology to support the main research activity that I refer to as an epistemic service design - service design project to seek new knowledge, not primarily for satisfying a customer's brief. The reflective process embedded in the research can be described as 'reflection-on-action' and 'reflection-in-action' as two different modes of reflective practice, where new knowledge is created through the act of design (Schön 1983). This research applies both these perspectives. Whereas I have documented my reflections as I design, I share those reflections in this research and evaluate the design decisions taken throughout, in an iterative process.

The research questions are explored through a series of conversations: *conversations with the self* and, through a series of projects, *conversations with others*. The conversations with the self can be described as *reflective practice*. It has been both a necessary and enjoyable part of my design process, where I have created *new personal knowledge*. The 'conversations with others' on the other hand, was an opportunity to share my research and *co-create new communicable knowledge* by interacting with other people. Two design projects with Friends (chapter 6.2) and Planethon (chapter 6.3) were part of my reflective practice. I developed new theory and tools in situ, exposed underlying challenges, and evaluated the proposed theoretical framework's value-in-use and practical tools. The *action research* involved my active participation in change projects, where I addressed problems in collaboration with need owners in a joint search for solutions. The outcome of the research is *communicable knowledge* which is informed by the conversations. The thesis concludes with an analysis of the work and its relation to existing scholarship (chapter 7) and a final chapter that summarises and concludes the thesis (chapter 8). That makes this research *for* design (for designers to use) and also *through* design (generating new knowledge by designing), as per Christopher Frayling's classic definition (Frayling 1993). *'I say of cybernetics that, before it is a method, or an applied science, it is a field of knowledge that shapes our philosophy, influences our behaviour and extends our though.'* Wrote Roy Ascott (2003, p.127). This research has been executed in that spirit.

1.4 Aim of Research and Research questions

This thesis aims to make a theoretical contribution in the interdisciplinary nexus between design cybernetics, persuasive systems, and service design, which leads to a new approach to understanding how to 'tame' challenges relating to ethics and governance of persuasive service systems. The *purpose* is to understand how concepts from design cybernetics can be applied to the process of designing services as persuasive systems, and how tools for the design of pervasive platforms based on these principles could be designed to arrive at more ethical and understandable services.

The research questions are:

R1: How can a design cybernetic approach contribute to the understanding of services as persuasive systems?

R2: How can different concepts from design cybernetics be applied in a persuasive service system design project, to create more understandable and valuable service propositions?

1.5 Thesis Structure

Chapter 1 provides an overview and summary of the research, and it establishes the context in which it is situated. It describes some contemporary challenges with services as persuasive systems and introduces the research questions.

Chapter 2 reviews existing scholarship of persuasive systems, in order to arrive at a definition of persuasive service systems which is useful in the context of this research. I draw on interdisciplinary research about persuasive technologies and from design-led approaches to behaviour change. I provide a review of existing models for systems designed to influence people's behaviours and attitudes. The purpose of this review is not to repeat what others have already done but to provide a new review from a service design-centred perspective.

Chapter 3 continues the literature review with a brief history of design cybernetics and a review of concepts, focusing on their usefulness to describe services as persuasive systems. The purpose of this review is to demonstrate the theoretical usefulness of design cybernetics as an approach to describe services as persuasive systems, and to give the reader an understanding of how design cybernetic ideas emerged.

Chapter 4 outlines the design research methodology used. The methodology draws on a pragmatic-constructivist knowledge claim, as embodied in a design cybernetic conversational methodology described as epistemic service design, a service design process where the goal is to create new knowledge. The reflective practice is expressed as a series of 'conversations with the self', while the action research component of the research is expressed in 'conversations with others'.

Chapter 5 accounts for the iterative stages of my reflective practice that have contributed significantly to upgrading my personal knowledge and supported the design projects that I did as part of the action research process. I describe tools which were developed to apply design cybernetic in service design practice, methods for using the tools and its contribution to theory.

Chapter 6 is an account of two case studies in which I engaged in 'conversations with others' through initiating and participating in live design projects. These projects contributed significantly to situated knowledge about the usefulness of the design cybernetic approach and contributed to new knowledge which I used to refine my tools, methods and theory.

Chapter 7 stitches together insights from the two conversational streams, discussing how the reflective practice and design projects have generated new knowledge and informed my thesis. The chapter

provides analysis and synthesis of the theoretical and empirical work and concludes the thesis by summarizing the findings and contribution to new knowledge.

Chapter 8 concludes the thesis with a summary of conclusions and recommendations for future research directions.

2. Design Challenges for Persuasive Service Systems

In this chapter, I intend to demonstrate how the design challenges of governance and ethics in digital services, can better be understood by framing the services as persuasive systems. In this context, governance is not particularly referring to nation-states or regions' political governance, but rather systemic control aspects in design of socio-technical systems in the form of affordances and constraint. The purpose of the review is to give the reader an understanding of what *persuasive service systems* are and the theoretical landscape in which the research is situated. I position the research with respect to existing scholarship and extract insights that can be used in the design process.

First, I introduce a definition of services and persuasive service systems. I account for persuasive systems research related to service design. Next, I discuss current models used in the community for designing services as persuasive systems. Last, I summarize the review's learnings and point to the gaps in knowledge that this research fills.

2.1 Defining Persuasive Service Systems

This section aims to provide sufficient information to the reader about the positioning of this research in relation to existing literature and point to opportunities for design cybernetics to add value and be useful when developing new design methods. In the case and projects section, I will refer back to these concepts and evaluate how new design approaches can contribute to new knowledge in relation to the existing literature. The purpose of this section is thus to answer the sub-question:

How can design cybernetics contribute to the design of persuasive service systems?

I begin with an introduction to service design, to the field of persuasive technologies and systems and their positions in relation to other research areas.

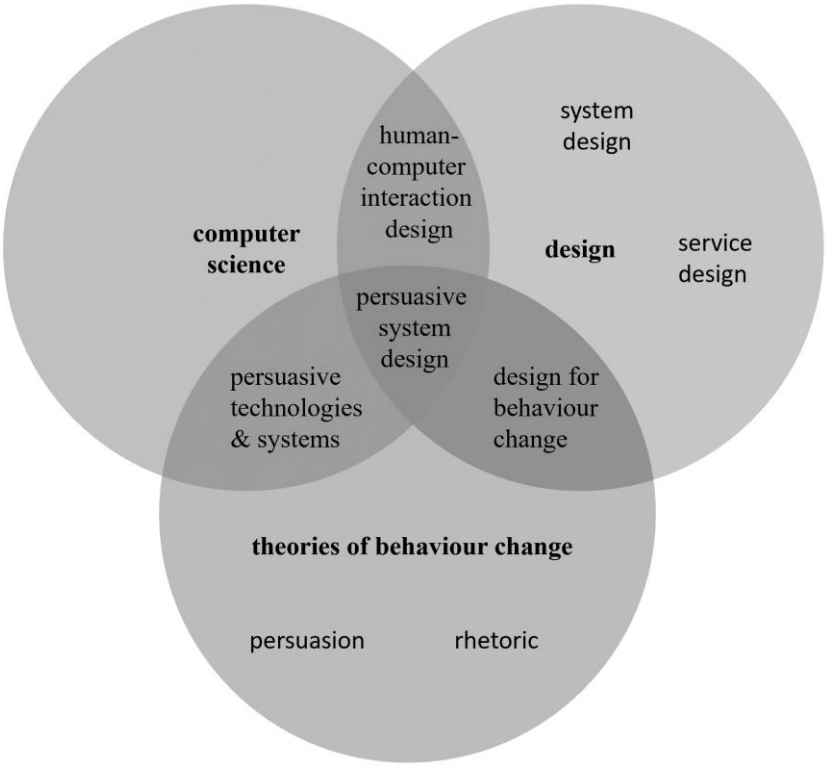


Figure 4: Overview of the theoretical landscape

Persuasive service systems (*services as persuasive systems),* describe services, delivered wholly or in part digitally, as purposeful, goal-oriented systems designed to intentionally influence people's behaviours, choices, emotions or attitudes. It builds on the service-dominant logic paradigm and subsequent theories that service-craft focuses on the design of people's behaviours and attitudes (Vargo and Lusch 2004, Dubberly and Pangaro 2009b).

To stake out this research's boundaries, I have reviewed literature that covers service systems designed to influence people's behaviours or attitudes. The research sits in the nexus between three major fields: computer science, with the sub-field human-computer interaction (HCI), design, and Behavioural Science. In design, I have drawn on theories from design overall, and specifically its sub-fields design for behaviour change and service design. In HCI, I have narrowed my literature studies to the field of persuasive technologies and systems, which emerged specifically for the study of how digital systems could persuade. Both the design and HCI theories are informed by theories of persuasion, which has its roots in rhetoric, and in behavioural sciences (including psychology) which describe the origins and properties of human behaviour and actions. Persuasive service systems is thus an *interdisciplinary* area of study, and notwithstanding the above fields, it is also informed by other theoretical areas of study. I focus on the *system* level of analysis, where the boundaries of the service are defined by the resources and stakeholders who are 'enrolled in the project of design' (paraphrasing Krippendorf 2019).

2.1.1 Design and design methods

There are numerous definitions of the word 'design', originating from the term *designare*, meaning to make, to mark out something (Cambridge Dictionary). Through most human existence, design has been connected with crafting, making and building physical objects, and merging functional and aesthetic requirements when envisioning and producing artefacts, buildings, clothing, and tools. As people's tools and technologies, have become more advanced, the practice of design has also evolved - as have the language and theoretical knowledge about the practice of designing (Frayling 1993). Despite attempts to 'scientise' design research, it has shifted away from trying to squeeze design into science, to proposing design as an independent field of enquiry, exploring and creating knowledge in different ways than traditional, linear scientific methodologies (Cross 2001).

From products to systems

In *Four Orders of Design*, Buchanan argued that design has evolved from visual communication and product/industrial design to concern actions and interactions, and complex systems and environments (Buchanan 2001). With the emergence of more advanced computer systems and the increased focus on using design methods to solve wicked problems, *systems thinking* has become a cornerstone of design theory and practice. Further fuelling the need for more comprehensive and communicable system languages, is the trend that the primary unit of exchange in the global economy is shifting from goods to services, why new design approaches and methods are needed (Vargo and Lusch 2004). Dubberly et al. (2015) write that '*Design practice has become enmeshed in systems and ecologies. [...] ...the major issues the world faces - the issues that really matter - are all systems issues. They are wicked problems, which means that they are essentially political in nature and cannot be solved by 'experts'.'* Mapping intangible systems make it easier to intervene in them to 'tame' them, and to better understand complex issues.

In the 1960s, Ludwig von Bertalanffy devised the need for a General Systems Theory that would facilitate conversation about systems that crossed disciplinary borders. (Von Bertalanffy 1956) That coincided with the emergence of cybernetics, and the two domains are closely related. However, Von Bertalanffy describes General Systems Theory as the more general case and cybernetics as a subset of systems theory. Today, however, systems theory is but one of many systems sciences that have emerged in different disciplines, including *System dynamics, Operations research, Total quality management and Organizational learning* (Fischer 2014, Dent and Umpleby 1998). Each discipline has its own set of diagrams, maps and tools, although they share some basic element of system's thinking.

Donella Meadows describe systems as '*a set of things- people, cells, molecules, or whatever - interconnected in such a way that they produce their own pattern of behaviour over time.'* (Meadows 2008, p. 2). Albeit systems approaches have been adapted in many disciplines, it has been argued that

few systems practices have emerged from within design. Sevaldsson (2011) argues that there are few to none systems practices developed from within design, which is informed by design thinking and design practice. I do not entirely agree with Sevaldson's analysis, in service design, for example, a whole range of methods have been developed to address systemic challenges: stakeholder maps (Giordano 2018), service blueprints (Shostack 2007), et cetera. However, these do not form coherent, universal systems theories though, but are instead collections of concepts and tools which can be useful in specific cases, to 'zoom in' on particular mechanisms in service systems.

System design and service craft

Donella Meadows write that systems generally concern *stocks* and *flows*, stocks defined as '*the elements of the system that you can see, feel, count or measure at any given time*.' and flows as '*filling and draining, births and deaths, purchases and sales, growth and decay, deposits and withdrawals, successes and failures.*'. These are essentially the 'rules' of systems, observations of recurring patterns (Meadows 2008, pp. 25-34). The central components of systems are *feedback loops* which demonstrate causal connections between stocks and flows in systems. Although their origins may be traced even further back, feedback loops were described by Maxwell (1868) in his work on steam train governors and was further developed by Ashby (1960, pp. 37-38) to describe processes in living organisms. Among designers, systems are often described in language and captured in models, abstract simplifications that help us form stable representations, shared understanding, and systems.

In *Cybernetics and Service-Craft: Language for Behavior-Focused Design*, Dubberly and Pangaro (2007) argue that design has shifted away from hand-craft, to service-craft 'and that this shift calls for new languages to describe service design activity. They write that *'service-craft exemplifies a growing focus on systems within design practice*' and emphasise that this is a reason why systemic thinking becomes more important as part of design theory and activity. That corresponds to the shift away from goods-centred logic, towards service-dominant logic, which has already made a large imprint on design research, leading to the establishment of service design research (see for example Vargo and Lusch. 2004). However, they argue that hand-craft is still essential, but that service perspective is added as a layer on top of the physical layer. The authors provide three reasons to why new methods are needed:

1. Service-craft takes place in teams, and teams need coherent languages to communicate between its members. Without a common language, it is not possible to work effectively on designing-for-systems.
2. Services are mostly immaterial, and designers do not have useful languages for discussing dynamic relationships, behaviours and nuances thereof.

3. Systems only reveal themselves to designers and users gradually, and it is seldom possible to have a complete view of a system. Simplifying complexity and providing interfaces for different actors to study, understand and connect with systems becomes paramount.

Further, the duo argues that cybernetics can be a source for new language in design. They allude to Herbert Simon's description of designers, that they 'changing existing situations into preferred ones' meaning that design is to some extent a goal-oriented activity (Simon 1988). Today, design primarily concerns how human behaviours, practices and emotions can be deliberately influenced (Verbeek 2006).

Cybernetic systems are *goal-seeking*, meaning that they seek stability or balance. Whenever there is a disturbance from the environment, the system tries to restore the system to a target state. It also means that cybernetics systems *have* defined goals. Meadows provides the example of a coffee machine that is set to boil coffee. It switches on the heater to bring up the coffee's temperature to the desired temperature and then, through circular feedback, senses the temperature and stabilises it at that level. *Generators* increase flows in systems, while *discriminators* decrease flows. These terms should be familiar to most system thinkers. I assume that this thesis's readers are familiar with the basic concepts in systems theory and will, therefore, not go too deep into these basics in this thesis.

2.1.2 What are services and what is service design?

This research concerns *service design*, i.e., the way services and service systems are envisioned, created, constructed and maintained. Service design research emerged out of interaction design, to address the perceived shift in the economy, away from crafted goods and products, towards solutions and services. The change to service logic called for new methods of design inquiry, which led to the establishment of service design (Sangiorgi 2009). Services have been described as economic activities that produce time, place, form, or psychological utilities, (Haksever and Render 2013) or as something that occurs when there is a value exchange between parts.). Focal points for service design are thus, *human interactions* where *transactions* and *value exchanges* take place. Lara Penin writes that 'interactions are at the core of services' and describes value exchanges taking place in *touchpoints*, which are interfaces between the customer/user and the service (Penin 2018, p.24). These touchpoints are the 'material face' of the service and make up the artefacts and structure which supports the services interaction.

Service design considers services as the object of design activities, rather than products, as is the case in product design (Sun 2020). However, Kimbell (2011) proposed an even more distinct framing, 'designing for service' and services as the fundamental basis of exchanges of value. Kimbell and Blomberg (2017) further suggest three objects of service design: *the service encounter*, defined as users or customers' experiences in service systems, and other people involved in the service delivery.

The *value co-creating system*, that focuses on the outcomes of service systems for the participating actors in service ecosystems. Finally, *Socio-cultural configurations* denote the socio-material structure of networks and how agency emerges in actors' interactions.

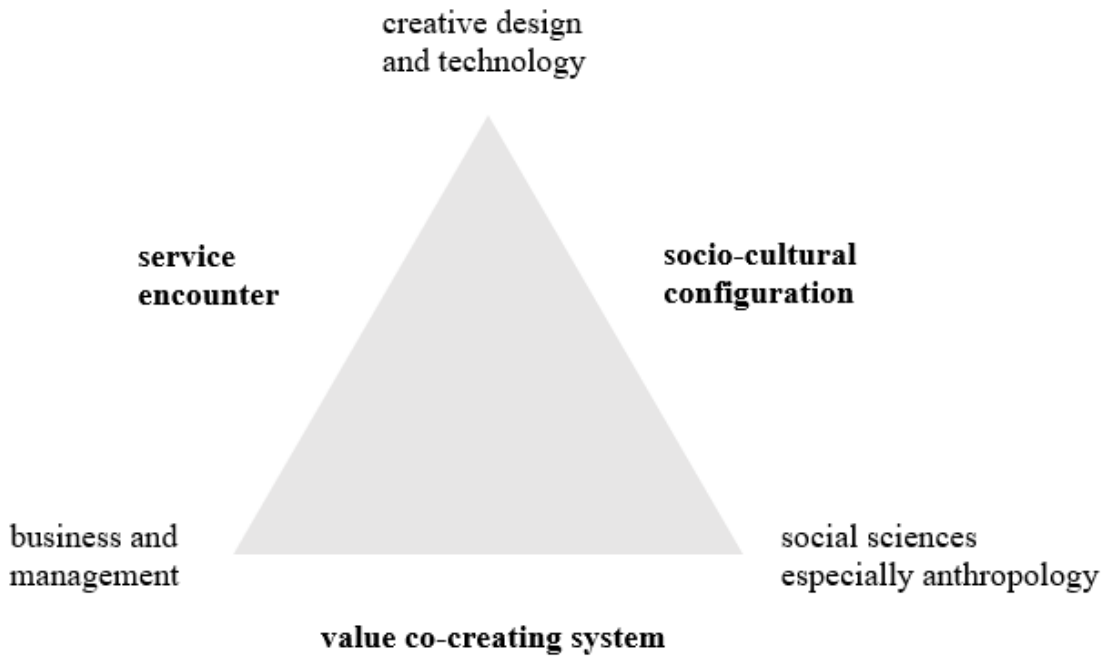


Figure 5: The object of service design. Adapted from Kimbell and Blomberg (2017)

IHIP - intangibility, heterogeneity, inseparability and perishability

Services are considered different from products in four dimensions: *intangibility*, *heterogeneity*, *inseparability* and *perishability*, highlighting the ephemeral nature of services. (Regan 1963, Lovelock and Gummesson 2004) Furthermore, Vargo and Lusch (2004) formulated eleven foundational premises of service design, of which five are considered axioms. These are:

1) Service is the fundamental basis of exchange.
2) Value is co-created by multiple actors, always including the beneficiary.
3) All social and economic actors are resource integrators.
4) Value is always uniquely and phenomenologically determined by the beneficiary.
5) Value-co-creation is coordinated through actor-generated institutions and institutional arrangements.

The relationship between services and products was further illustrated by Pine and Gilmore (2011). They demonstrated that services and experiences partially evolved in part as a way for businesses to differentiate products which had become commodified. Consider, for example, coffee.

Coffee beans are by now a standard commodity. When enough actors have entered the market for roasted coffee, roasted coffee (product) also becomes a commodity. Services (cafés, coffee shops) emerged to differentiate between places that serve coffee and eventually, the experiences in these coffee shops become the means to differentiate and compete between coffee shops. Since the materials of service design differ substantially from those of traditional product design, new methods were needed for designers to address the co-creative and ephemeral nature of services, as outlined above by Vargo and Lusch (2004). Service design and experience design also developed to create a competitive edge for businesses which in substance were very similar. Service experience is the key reason why you choose to go to a particular café over another. Both places serve coffee, but the experience that comes with the coffee makes the difference for the customer's choice.

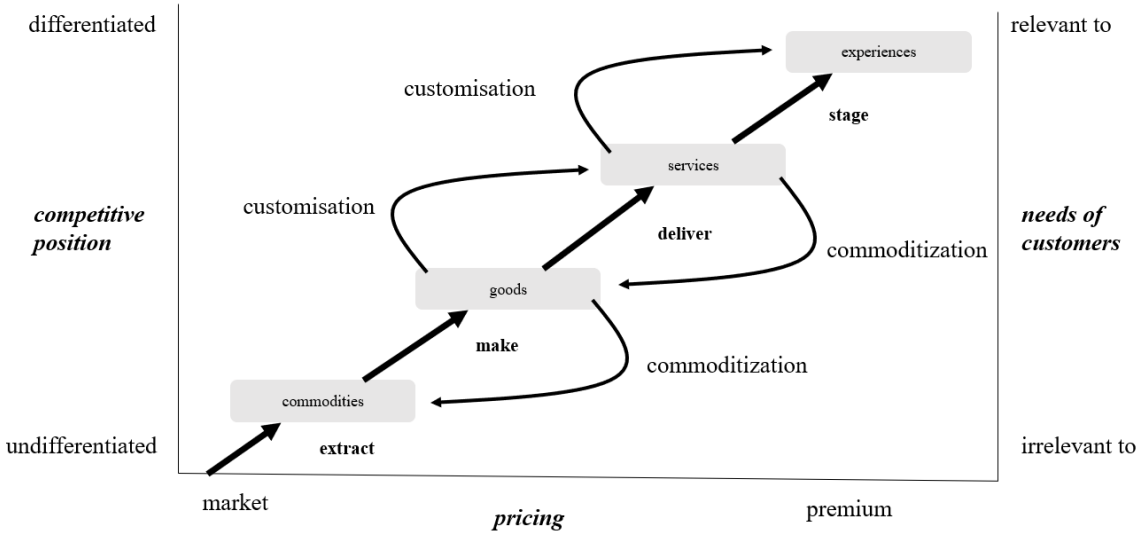


Figure 6: The progression of economic value. Adapted from Pine and Gilmore (2013)

Digital service system

Service systems have been described as 'configurations of people technology and other resources interacting via value propositions to create mutual value' (Spohrer et al. 2008, Fonseca and Pinto 2014). A service system has a broader definition than a service, capturing the mechanisms of the service and the systemic environment, be it cultural, social, technological or institutional, in which the service exists. It is also broader than the focus of interaction design, UX/UI-design or graphical design, which concern the design of individual touchpoints and interactions, rather than focus on system-level challenges. One often refers to services as either digital or physical. However, *there are no wholly digital services*, all services have physical touchpoints and interfaces, where the user or designer accesses the digital, meaning that services are always *hybrid* systems, which mediate exchanges of value between people. With this in mind, however, I will use the term *digital services* to describe service systems that are at least partially delivered via digital media to the user.

The evolving computer landscape directly impacts the properties and agency of persuasive service systems. New technologies can enable entirely new services or significantly alter existing services, intentionally or unintentionally, affecting people's behaviours and attitudes. A growing share of human life and communication is mediated by services delivered through *pervasive digital industry platforms*. The largest and most well-known digital industry platforms are sometimes referred to as FAANG (Facebook, Apple, Amazon, Netflix and Alphabet's Google), or if we include the Chinese mega-platforms, the Big Nine (adding IBM, Microsoft, Tencent, Baidu and Alibaba, but excluding Netflix) (Webb 2019). In information system scholarship, these platforms would be described as *dominant industry platforms* or *platform leaders*, because they set the standards for all other actors in their respective ecosystems (Cusumano and Gawer 2002). Most of our digital experience is delivered directly or indirectly through the FAANG-platforms, a system of systems that mediate human life and influence the lives of billions of people (Borgefalk et al. 2019). In this research, I refer to these digital industry platforms which use persuasive technologies as 'pervasive platforms', or 'platforms'. These could be consumer-facing, but they could also be business-to-business platforms (B2B), peer-to-peer platforms, or embedded systems such as those found in our refrigerators and cars, which are invisible to the eyes. As platforms have become more pervasive, they have been studied in many different fields, ranging from computer science, engineering, art, management to economics and design.

In the next section, I will provide a more in-depth description of persuasive systems and give examples of services that can be considered persuasive systems.

2.1.3 What is persuasion?

Persuasion is sometimes defined as "The action or process of persuading someone or of being persuaded to do or believe something." (Oxford Dictionary). This definition captures two fundamental dimensions of persuasion, changing people's behaviour (actions) and attitudes (beliefs). Perloff (2014, p. 17) offers a more detailed definition, 'a symbolic process in which communicators try to convince other people to change their attitudes or behaviours regarding an issue through the transmission of a message in an atmosphere of free choice' emphasising the symbolic and communicative nature of persuasion.

Depending on the persuader's intent, persuasion can be distinguished from *coercion*, *deception*, *propaganda* and *manipulation*, which are generally considered unethical (Fogg 2002 p. 15, Perloff 2014, pp.25-27). Albeit the word persuasion sometimes has negative connotations, it is a central part of people's lives - everyone persuades all the time, at home and at work.
Examples of persuasion include:

- Persuading a five-year old to get dressed and to go to preschool.
- Promoting your ideas at work to your colleagues or manager.
- Negotiating with labour unions.

- Convincing someone to buy something from you.

There are many situations in which we persuade or are persuaded. As a central part of interpersonal communication, persuasion is also at the heart of businesses. Marketing is perhaps the most closely connected to persuasion, and the global marketing industry is worth nearly USD 1.3 trillion (Redburn 2019), suggesting that persuasion as a service is valued highly. Perloff (2014, pp. 7-13) further writes that although some aspects of persuasion have remained the same, contemporary persuasion differs from past in several ways:

1) The number of persuasive communications has grown exponentially
2) Persuasive messages travel further than ever
3) Persuasion has become institutionalized
4) Persuasive communications have become more subtle and devious
5) Persuasive communication has become more complex and mediated
6) Persuasion has gone digital

The underlying driving force for several of these factors is digitalisation and globalisation driven by Information and Communication Technologies (ICT), allowing for new forms of communication.

Persuasion's Roots in Behavioural Science and Theories of Behaviour Change

While persuasion focuses on the social context of persuasion, fields such as *neuroscience*, *behavioural science* and *psychology* have provided a starting point for exploration of design and behaviour change. Sociological studies of persuasion have emerged to describe human behavioural traits in different social contexts and what events lead to behaviour or attitude change. The dominating theory is that *values attitudes* and *beliefs* guide people's actions and behaviours. *Values* are guiding principles in people's lives, macro constructs that underlie attitudes. *Attitudes* are learned evaluations of an object, person or pace, which influences a person's thoughts or actions (Perloff 2014, pp. 75-88). Having an attitude means that you have a more or less strong opinion about something, in contrast to the things we are neutral to or unaware of. Beliefs are more specific than values. They guide us cognitively in more specific context. For example, if 'freedom' is something you value, you can believe that 'this particular website is taking away my freedom', operationalising the value in context. Fishbein and Ajzen's theory of reasoned action is regularly used to connect attitudes and beliefs to behaviours, via intentions (Fishbein and Ajzen 2011). The model (Figure 8) describes the influence of background factors which impacts a person's values and beliefs. The 'actual control' part of the diagram describes constraints from the environment, affordances and signifiers which designers can work with to 'steer' behaviours, by physically or cognitively enabling or discouraging actions.

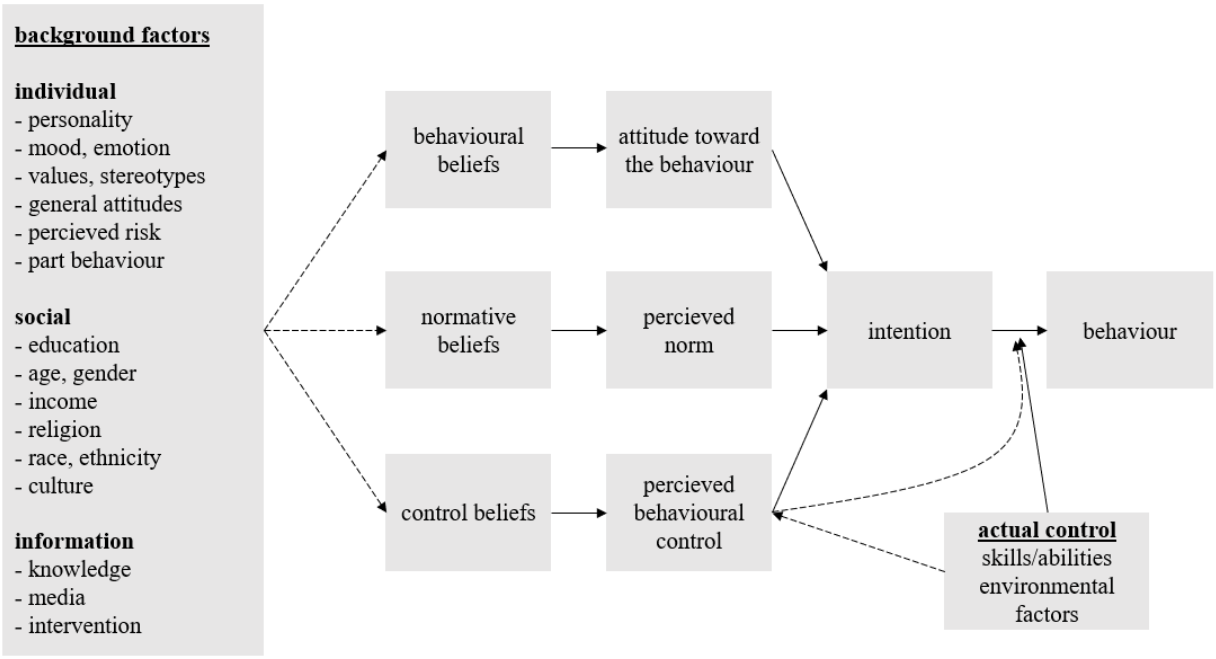


Figure 7: The theory of reasoned action. Adapted from Fishbein and Ajzen (2011, p. 22).

Influencing attitudes

Apart from manipulating a person's environment, designers can also design for attitude change, targeting the 'backend' of the model. This is commonly done via persuasive *communication*. Two dominant models for persuasive communications are the Heuristic-Systematic Model (HSM) by Chaiken (1987) and the Elaboration Likelihood Model (ELM) by Petty and Cacioppo (1986), which together forms a unified framework for describing the process of persuasion. Both theories offer a dual-processing model for how the brain changes attitudes or behaviours. A central route (systematic processing), which is characterised by elaborated reflection and consideration over behaviour and a peripheral route (heuristic processing), which relies on mental 'shortcuts' to trigger certain behaviours or attitudes (Perloff 2014, pp. 188-215). The models have a few limitations: they do not specify which messages in particular that 'work' to influence someone. Neither do they specify in detail individual variations in cognitive processing. Other research has focused on persuasive messaging, however. Cialdini defines *six fundamental strategies* for interpersonal influence: reciprocity, consistency, social proof, authority, liking and scarcity (Cialdini 2001). Cialdini's persuasion strategies are commonly used in offline or online persuasive technologies and systems, as foundations which to build services or features on. Other key content factors include *narrative*, coherent stories that transport people from one attitude to another via an imaginary domain and changes their attitudes in the process (Allen et al. 2000). *Evidence*, presenting facts, statistics or verifiable data that supports a statement, has also been documented as an effective persuasive messaging strategy (Reinard 1998).

Next, I will briefly account for a few interpersonal influence strategies and tactics, to illustrate some of the mechanisms, before we go deeper into interactive, computerised persuasion.

Persuasion's roots in Rhetoric

The different persuasive messaging paths described in the last section are further scrutinized in the field of rhetoric. In particular, the role of language has traditionally been the focus of study. Among the earliest and most well-known rhetorical frameworks can be found in Aristotle's works, where he describes *ethos*, *pathos* and *logos*, as three persuasive characteristics a man can possess. Ethos concerns the persuader's character, traits and personality, which should build trust with the audience. Pathos refers to the emotional connection one makes with the audience and how well the message resonates in their hearts. Logos is the appeal to the mind, where the persuader uses logic and knowledge as a means to persuade (Rapp 2010). These three modes of persuasion are still highly relevant today, and Aristotle's work is central reading in any rhetoric course. Interpersonal influence begins with a persuader's persuasive intent, (also known in rhetoric as *a rhetor)*.

While the classic view on rhetoric has been focused on language, it has been suggested that persuasion is not exclusively an interpersonal matter, but that designed objects and processes can be persuasive too. It is proposed that there exists not only rhetoric of words, but *rhetoric of things*, unspoken communication between objects and their users or observers. '*The designer, instead of simply making an object or thing, is actually creating a persuasive argument that comes to life when a user considers or uses a product as a means to some end*.', writes Buchanan (Buchanan 1985). Buchanan argues that *technological reasoning* is the logos of design, denoting the utility that different artefacts communicate to the user. The *character* of an artefact is the ethos meaning that it reflects its maker in some way and finally, *emotion*, as the pathos of design, the persuasive appeal of artefacts, or differently put, their argument to you as a user or viewer, that they are important and worth caring about.

With the rise of digitalisation, *rhetoric of systems* has emerged as a third essential dimension of rhetoric. It is no longer enough to describe language and shapes, but also how things and language are *networked*. Richard Lanham (1993) presented early ideas of *digital rhetoric*, which Losh further developed who discussed digital rhetoric as a field of inquiry in her book *Virtualpolitik* (2009). Terranova (2004, pp. 98-130) describes how computer systems can exert a form of 'soft control' via its composition and the control which increased networks impose on people. A new connection in a network means another relation to managing, making us less 'free' and more dependant. Attempts to capture the dimensions of system rhetoric has also been made by Carter (2019). He uses Latour's Actor-Network Theory (ANT) to describe a networked, apolitical approach to rhetorical networks, focusing on their functions, rather than perceived intent.

How are these three forms of rhetoric expressed in persuasive service systems? Comparing the choice architecture of the online 'room' with a room in the real world, the major difference is that the choice architecture is *interactive*, rather than passive. If you walk into a store, you usually don't expect the walls to change colour or shape or the doors and windows to move around. When you are online, however, the virtual 'room' may look different depending on who visits the website. An example from Amazon.com (figure 8) illustrates how these three modes of persuasion works in practice.

In the example of Amazon.com, the website's persuasive tactics are not only textual; there is also a rhetoric of things going on there. The polished photos speak of a high-tech camera. The colour choices are designed to attract people's attention to different sections of the website. Actions are restricted and controlled; you can only click (well, generate a response from clicking) where the designer wants you to. In this case, the 'thing' is not just a thing; it is a designed process, a *service*. The rhetoric of networks is working behind the scenes, connecting the user to other people (for example through access to references) and other things in the website's network (through recommendations).

	Rhetoric of Words	**Rhetoric of Things**	**Rhetoric of Network**
What	Persuasion through texts	Persuasion through images, colour choices and site layout	Persuasion through interactive connections and relationships
Example	A thorough description of the advantages of the camera Description of 'secure transactions' Reduced price, discounts	Persuasive, crisp images Enhanced colours on purchase buttons Logos of brands	Recommendations, connecting you to similar items Reviews by other people allowing you to tap into a wider network.

Table 2: Rhetoric of words, things and networks

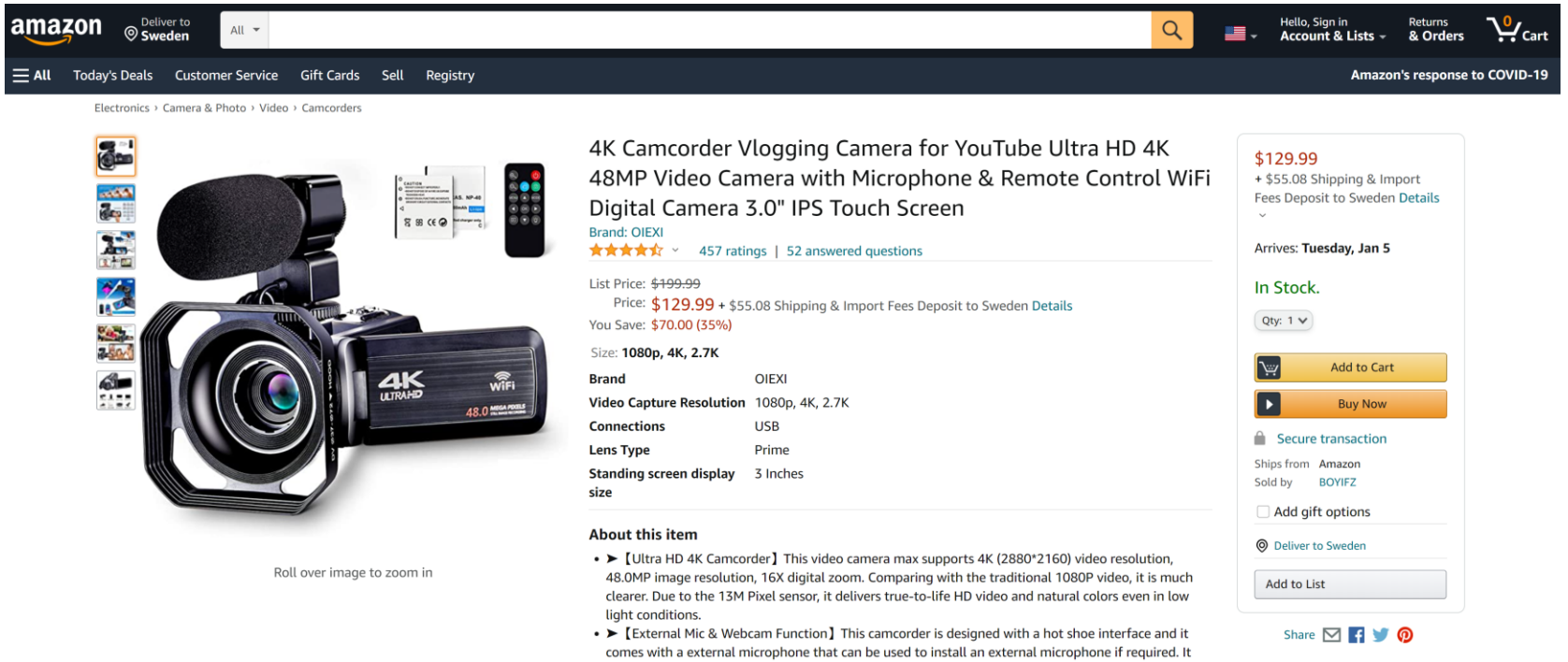


Figure 8: Persuasive tactics, as used by Amazon.com.

Design to influence people's behaviour

The idea that designed objects, spaces and processes 'steer' people's behaviour and thinking is by now reasonably uncontroversial. However, '*The notion of persuasion in design touches fundamental aspects of what design is about'* writes Redström (2006). Design may influence people's behaviours in intentional or unintentional ways, why several theories have emerged to understand better which factors that influences; constrains or enables people's actions or attitudes. In a landmark publication, James J. Gibson, introduced the concept of *affordances*, describing how things and environments can encourage or discourage certain usages and actions (Gibson 1979). Extending Gibson's theories, Donald Norman developed the concept of *signifiers*, which he describes as '*indicators in the social or physical world'*; markings, texts or symbols which 'tells' the user how things are intended to be used (Norman 2008). He emphasises the social implications of designed artefacts which provide cues for possible actions, and implies that designers design social behaviours. Signifiers are further described in fields such as *semiotics*, concerning human meaning-making out of signs and symbols. There are affordances and signifiers everywhere in the physical world, which suggests to us how we should act in an environment or how we should use objects. These make up a physical *choice architecture* that guides people's choices and actions by enabling or constraining their possibilities.

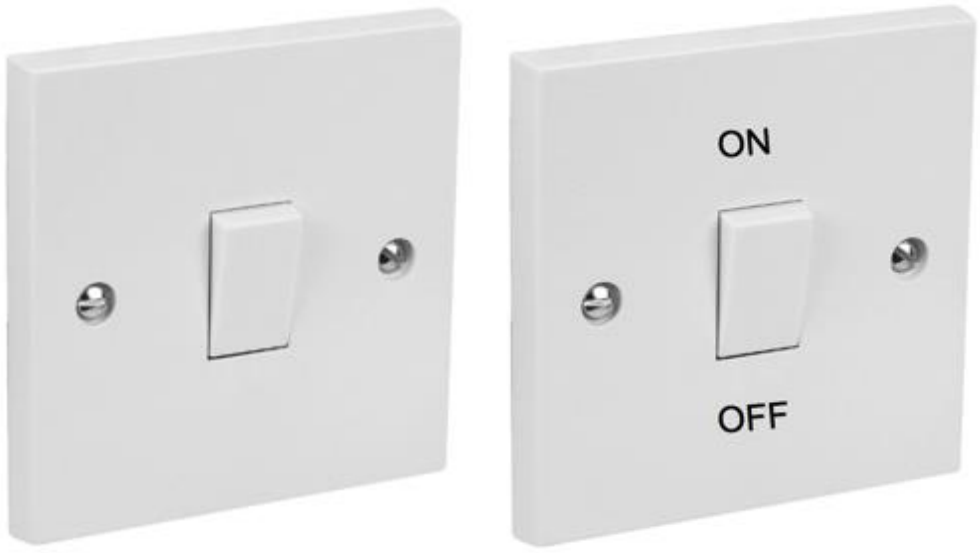


Figure 9: Illustration of affordances and signifiers.
Left: The affordance of the button is that it can *be pushed.*
Right: now with signifiers to explain *what happens when the button is pushed and guide action.*

Affordances and signifiers in the physical world can be considered *passive* modes of persuasion; they are usually static and not perceived as dynamic by people. However, new electronic media opens up for new, *interactive affordances and signifiers*, more adaptive, powerful and invisible ways of persuasion, which are not always obvious for the users (or the designers). Interaction with digital media from a design perspective is studied in fields such as user experience design (UX),

interaction design, and persuasive systems design. As digital media proliferates, new design approaches and methods emerge and old approaches find new relevance. Lockton writes that *'Everything that is designed affects our behaviour, whether it is intended to do so or not. The layout of a room, the order of the options in a list, the colour of a warning sign, the markings on a kettle: they all affect the decisions we make and the actions we take.'* (Lockton 2013, p.23), emphasising the pervasive influence of the artificial world.

To deal with design's ability to influence people's behaviour, there exists a range of approaches, gathered under the umbrella term Design for Behaviour Change (DfBC). An extensive review of DfBC procedures (for sustainable innovation) was done by Niedderer et al. (2016), which revealed that many similar ideas had emerged across different disciplines. Fields such as Design with Intent (Lockton et al. 2008), Design for Behaviour Change (Niedderer et al. 2016), Persuasive Design (Redström 2006), Persuasive Technologies (Fogg 1999) or Mindful design (Niedderer 2013) all explore purposeful design activity, with the intent to influence people's behaviours, attitudes, choices or behaviours. These design approaches differ slightly in methods and theoretical foundations but share the interest in how design generates influence.

However, if all design influences people, why is it necessary to distinguish design for behaviour change? Isn't it all just 'design'? I would argue that even if it is, there is still a need to understand persuasion in design contexts: *who* influences, *why, how and when* arguments in different material forms are made, and not least, *what* are desirable uses? Politics is now played out at the level of design, why designers need to pay extra attention to its mechanisms of influence.

Design to drive social and societal agendas

Entering the 2020's, Design has emerged as a potent force for achieving societal change and driving sustainability and social agendas. Dorst (2019) writes that '*design is being used to solve problems in fields once beyond its traditional remit of practice'*. Many governments and organisations have now adopted design methods as instruments to implement policy and to improve their internal operations, supported by organisations such as the OECD's Observatory of Public Sector Innovation (OECD-OPSI n.d.) and other labs for public sector innovation (McGann, Blomkamp and Lewis 2018). The US government has a cross-governmental in-house agency called 18F that promotes the use of human-centred design principles in government (18F n.d.). The UN-Habitat have established an in-house Urban Planning and Design Lab to focus on participatory design responses to housing issues (van den Berg 2016). The research and development team (RED) within the UK Design Council has led an effort to bring design to government, promoting the idea that anyone can adopt the *attitude* of design, and arguing that *transformation design* should be seen as a new design discipline (Burns et al. 2006). Chick and Mickletwaithe (2011, p. 37) describe transformation design as a new imperative for design, applying design processes to a broader set of issues, moving out of the corporate context into public

service. As public sector institutions and NGOs shifts towards systemic design, design is uniquely positioned to tackle some of the most complex problems that the world faces, helping people and organisations envision, plan for, and deliver desired futures. To describe the changing role of design, Irwin (2015) proposed *transition design* as an area of design practice to address '21st century wicked problems', advocating a design-led transition towards sustainable futures. Irwin characterises wicked problems as complex adaptive systems and suggests that design is uniquely positioned to handle 'transition scale' projects. Designing for the planetary scale requires new approaches, methods and tools, which for example, Bratton (2016) introduces in *The Stack*, connecting design, geopolitics and planetary-scale computing.

A fair share of DfBC research has addressed social issues such as sustainable consumption, obesity, energy use, and healthy behaviour (Niedderer et al. 2016). Other innovative approaches to involving designers influencing people's emotions include Emotionally Durable Design, which concerns sustainable design, suggesting that designers should aim to create products that are technologically, emotionally and physically durable over time, which reduces waste and promotes sustainable consumption patterns (Chapman 2009).

From this brief review, I infer that design is a potent force of change in society and that a multitude of design approaches are moving into mainstream. This may or may not be a result of increasing wickedness of problems and that design methods have proven effective to help professionals and public officials to better navigate an increasingly complex society.

2.1.4 What are persuasive technologies and systems?

As described above, this research concerns persuasion connected to services, which processes are supported by or executed in digital platforms. I assert that service systems are designed with the intent to generate certain user behaviours or attitudes. From a design perspective, digital media has created a new design space of affordances and constraints, unlocking new information flows and possibilities (Lockton 2012). A particular strand of research focusing on technology's abilities to influence people's behaviour and attitudes is the field of *persuasive technologies*, sometimes referred to as *persuasive systems*. Since the persuasive strategies and tactic described above are now being delivered via digital technologies, the field emerged to understand this new design space. The field is considered a subset of Human-Computer Interaction (HCI), which concerns explicitly digital persuasive systems. It has been proposed that it is also a subset of Design With Intent (Lockton, Harrison and Stanton 2008). The field is sometimes called *Captology*, which is short for "computers as persuasive technologies" (Fogg 2002, p.5). Persuasive technologies use insights from behavioural sciences - concepts such as persuasion theory, behaviour design, choice architecture and influence theory. When cross-pollinated with the computer's advantages, it offers new possibilities for persuasion.

The definition of what constitutes a persuasive system has been subjected to debate. Traditionally, persuasive technologies have been defined as technologies which are 1) designed with an explicit intent to influence, 2) to change or alter people's behaviours or attitudes 3) in a non-coercive manner (Fogg 2002, p.20). Recently, this definition of persuasive technologies has been subject to criticism for not being specific enough (Atkinson 2016). Apart from the designer's intent, numerous factors can influence a designer's intent, for example, corporate structures, norms, and religious affiliations (Williams 2018, pp. 45-50). That makes it difficult to separate the designer's intent from other, second-and third-order factors that influence a technology's intent. A service system, such as a social media platform has several different designers, over time. Further, stating that persuasive technologies are non-coercive is not very productive when studying ethical aspects of these technologies, since it excludes analysis of technologies that are potentially unethical Williams (2018, p.52). For these reasons, it has been suggested that the definition of what 'counts' as a persuasive technology must change in order to analyse these technologies and systems better, and an alternative definition of persuasive *systems* has been provided by Williams (2018, p. 56), which is based on a different system's approach. In his definition, a persuasive system is any system that sets and strives towards a goal that:

1) Consists of altering a user's relation to that goal
2) Shapes the system's constraints towards that end
3) Matches the goal specificity with a specificity of the measurement of outcome

This definition shifts the focus of analysis away from the technology-centred definition, to a broader, systems-based definition. Williams also uses the term *adaptive persuasive systems* to describe systems such as common digital services that are static and update and refine its goals depending on feedback it receives from the environment. The term adaptive persuasive systems were introduced by Kaptein et al. (2012), to describe systems which personalise persuasive strategies. Many, but not all, persuasive service systems are adaptive persuasive systems.

Since this thesis's focus is to study issues related to complexity, ethics and governance, I find William's system's perspective more useful than Fogg's original definition to capture the system dynamics of persuasive service systems. Instead of an anthropocentric notion that a person needs to have a persuasive intent to change other people's behaviours or attitudes, the system-centred view allows us to approach persuasive service systems neutral to their nature, whether human, hybrid or artificial systems. A *persuasive service system,* in my definition, is a service system which is designed with the goal to influence people's behaviour or attitudes, by shaping the system's constraints towards that end.

A brief background to the field of persuasive technologies

Many foundational ideas in persuasive technology research have been described in early HCI research. However, the foundations of persuasive technologies as a field of study originated at the Captology Lab at Stanford, founded by BJ Fogg nearly two decades ago. That coincided with the proliferation and mass adoption of new electronic mediums for information, personal computers, mobile phones (subsequently smartphones) and the introduction of global social networks, which opened up for new persuasive experiences. In Fogg's doctoral thesis about Charismatic Computers, he noticed that computers could influence people's behaviours and attitudes independently. (Fogg and Stanford University Dept 1997) At CHI 98, an interest group was formed, which recognized that persuasive computing products weren't covered enough in human-computer interaction, why they decided to establish Captology as a separate field of inquiry (Fogg 1998). Captology also emerged because of a need to separate research on computerized persuaders from persuasion involving human-to-human persuaders, which traditionally was a part of research in psychology and behavioural sciences. Since the field was founded nearly 20 years ago, it has attracted an interdisciplinary body of research. Whilst the core of the field is found in human-computer interaction, computer-mediated communication, information systems, and affective computing, (Torning and Oinas-Kukkonen 2009) the field has also been influenced by fields such as psychology and rhetoric, design research (UX- and interaction design mainly), gamification and behavioural science. Whereas early persuasive technology research focused on *behaviour* change, there has been an increase in research on how also to influence *attitudes and values,* which is considered more challenging to study because of the subjective nature of the topic. Whereas behaviour change is relatively easy to measure and evaluate, feelings and values are difficult to quantify. The research community gathers at the annual Persuasive Technology conference, which also is the primary outlet for peer-reviewed literature on the topic. The outputs of these conferences have been thoroughly reviewed in past literature reviews, why I will only summarize these briefly here.

A systematic state-of-the-art literature review by Torning and Oinas-Kukkonen (2009) of 51 full, peer-reviewed papers from the first three conferences on persuasive technologies concluded that:

1) There was a need for research into persuasive design methods, for how and when to prescribe persuasive technology solutions.
2) Also, persuasive design patterns were needed to understand which design tactics to use to produce desired changes.
3) The audiences of software differ quite a lot, and the field needs to consider how persuasion works differently for the different audiences
4) How to combine epistemologies, primarily as pertained to combining the epistemologies of engineering and rhetoric, which both are central disciplines active in the field.

5) There was a lack of studies on ethics, which could be deemed an unethical act in itself, given the potential impact and controversies related to computer-mediated persuasion.
6) New application domains such as e-Health and knowledge work and collaboration, needs to be considered in subsequent research.

Hamari et al. (2014) published a systematic review of 95 empirical studies in the field. They concluded from that exercise that persuasive technologies seem to work and that most studies describe people's successful persuasion into specific behaviours. However, the authors note that publication bias may be a factor to count with, and that failed studies might not be reported to an as large extent as successful results. The conclusion that persuasive technologies work should, therefore, be viewed with caution. Although persuasive technologies certainly seem to work in specific cases, further empirical work is needed to confirm those claims.

Computers as persuasive technologies

As briefly stated in the introduction, interpersonal persuasion has traditionally been discussed in fields such as psychology and rhetoric. However, the introduction of computers introduced the computer as a persuasive actor, both as a mediator of human communication and sometimes as a persuader of its own. A computerized persuader has several advantages over a human persuader. According to Fogg, these advantages can be summed up in the word *interactivity*, adapting the persuasion strategy depending on feedback from users of a system. Fogg lists six advantages of computer persuaders compared to a human (Fogg 1998; Fogg 2002, p.7). These features can also be interpreted as disadvantages, depending on how the computer persuader is used:

- Computers can be more persistent than human beings
- Computers can offer greater anonymity
- Computers can manage huge volumes of data
- Computers can use many modalities to influence
- Computers can scale easily
- Computers can go where humans cannot go or are not welcome

To further describe the fundamental properties of persuasive technologies, Fogg introduced a ‘functional triad’ describing how interactive technologies can be used in three primary ways: tools, mediums, and *social actors*.

As tools. Persuasive technologies make actions easier to do for users or designers. Depending on the source of the intent, as described in the next section, persuasive technology can be a tool for either the designer, or the user, or both.

As a medium, Fogg proposes three functions, 'simulated cause and effect scenarios', 'simulated environments' and simulated objects' (Fogg 2002, p.25). In Fogg's view, these simulations can contribute to persuading the user, but as Atkinson (2006) suggests, perhaps *educated* is a better word.

As social actors. As human-like technologies become more realistic and commonly used, this category is becoming more central.

To further define computerised persuasion, Harjumaa and Oinas-Kukkonen (2007) describe three types of persuasion, interpersonal persuasion (human-to-human), computer-mediated persuasion (human-to-computer-to human persuasion), or human-computer persuasion. Whereas human-computer interaction is an established field, human-computer persuasion is a natural extension of this field.

However, there are now indications that this perspective is not sufficient to describe the complex and emerging relationships of persuasive technologies. Nowadays, computers persuade each other, social agents and chatbots haggle and negotiate to create good deals for their designers (case in point: phishing malware) or third parties. That raises many interesting questions about how or where persuasion occurs and what the computer medium's role plays as a tool used in the persuasive act. In the next section, I expand the discussion about the characteristics and consequences of rapid computer medium changes.

Locating persuasive intent

Intentionality concerns *planned effects* of a design, which in substance differs from *unintended consequences* of design. However, intentionality is a fairly broad and unspecific concept, which has been notoriously difficult to define for digital systems. Who designs a persuasive service system, such as a social network? Is it the UX-designer who designs the front-end, is it the product manager who sets the priorities, or is it a company's managers who determine the service system's goals? And what role do the rules, norms and constraints offered by the institutional environment play in influencing what is being designed?

The claim that only technologies designed with the specific intent to persuade counts as persuasive technology originates from Friedman and Kahn (1992). They proposed this perspective and which is generally accepted in the HCI community. Expanding on their work, Fogg built a framework for categorizing intentionality based on that claim. The most common standpoint in the persuasive technology community regarding agency and intent is that technology in itself cannot have intentionality, why it inherits the intention of its creator or programmer. Since this is important for the subsequent development of the views in the field, it is worth noting that Friedman and Kahn's article is the only source Fogg cites to support his standpoint that computers cannot have intentionality of

their own. Fogg describes three dimensions of which persuasive technologies' intentionality can be analysed: *endogenous* intent, *exogenous* intent and *autogenous* intent.

Type of intent	**Definition**
Endogenous intent	The intent of those who create or produce interactive technology.
Exogenous intent	The intent of those who give access to or distribute technology to others.
Autogenous intent	The intent of the 'user', the person adopting or using the technology.

Table 3: Fogg's three types of intent in persuasive technologies (adapted from Fogg 1999)

Fogg further argues that Captology research should focus on endogenous persuasion, i.e., persuasion embedded in the design of the technology itself. Berdichevsky and Neuenschwander (2011) built on Fogg's ideas and presented a linear framework for describing the endogenous perspective of intent. In the context of persuasive service systems, the issue with this approach is that 'designer with motivations' is seldom a lone ranger. Instead, a 'designing system' consists of numerous agents, human, technological and institutional, with different motivations that shape the persuasive system, dynamically and over time. Jachna (2019) notes that most design processes involve a range of stakeholders, teams, communities or even societies.

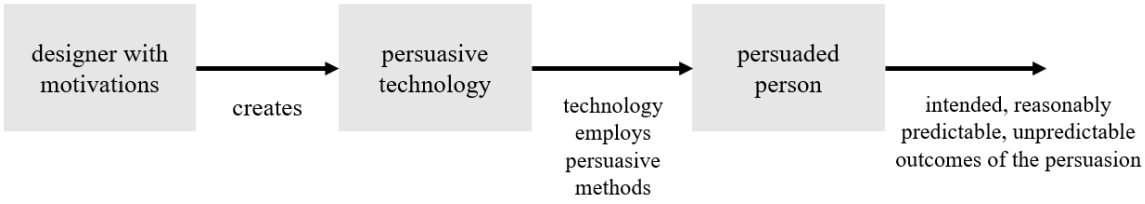


Figure 10: Linear framework describing persuasion using technology. Adapted from Berdichevsky and Neuenschwander (2011)

2.3 Wickedness, ethics and governance

In the first chapter, I explained how technical development is the driver for new forms of persuasion, leading to new challenges related to complexity, ethics and governance. In this section, I will unpack these aspects further. This section makes a case for why complexity drives wickedness for problems in persuasive service system governance and ethics.

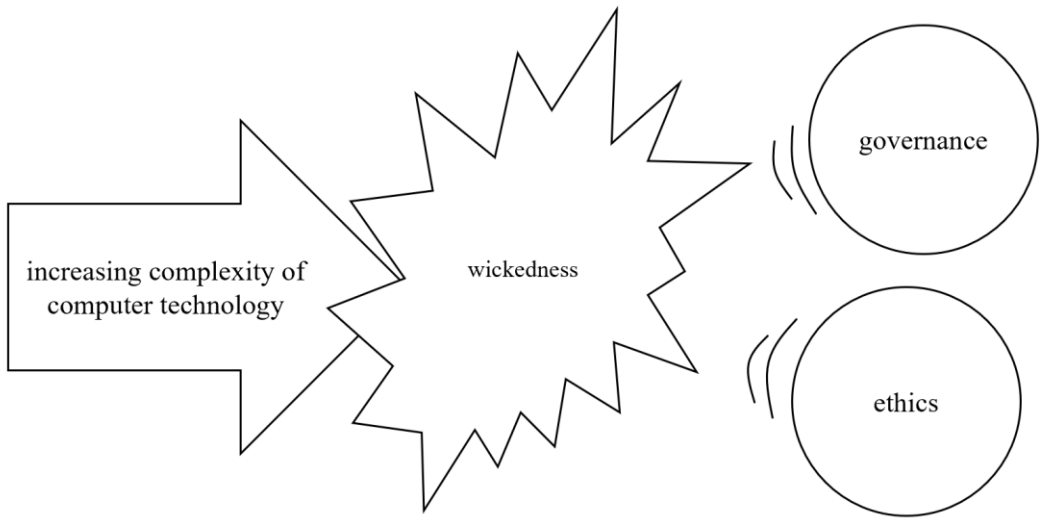


Figure 11: The consequences of more complex computer technology.

2.3.1 Wickedness

As noted in previous sections, computer hardware and software changes have led to greater complexity in services. What are the issues with greater complexity for service designers and users of services as persuasive systems?

Computers, computing methods and computer programs are continuously evolving

Since Fogg laid the foundations of Persuasive Technology research in the early 2000s, computers have evolved substantially, which had profound implications for the field. The online service landscape has been shaped by persuasive systems research and many practitioners in interaction design, UX design and graphics designers are attracted to, and use, models and method from persuasive technology research when developing digital services. For example, Nir Eyal's book *Hooked: How to Build Habit Forming Products*, describing how digital services can get users more addicted to their services has sold in more than 250 000 copies (Eyal 2014, Gothelf 2020). Eyal, and several influential executives of today's influential technology media companies, including Instagram's founder and Facebook's Head of Growth, were BJ Fogg students at Stanford's Persuasive Technology Lab (Stolzoff 2018).

The introduction of computer products and digital services has revolutionized how we live and work in virtually all domains; education, healthcare, dating, consumption and communication. As Marshall McLuhan noted as early as 1964, in the opening lines of his central work Understanding Media, '*the personal and social consequences of any medium-that is, of any extension of ourselves-result from the new scale that is introduced into our affairs by each new extension of ourselves, or by any new technology.*" (McLuhan 2016, p. 7). McLuhan alluded to that understanding the character, properties and consequences of new mediums is more critical than understanding the content they carry, because of the unique patterns of behaviours and perceptions it creates and the new action potential it offers.

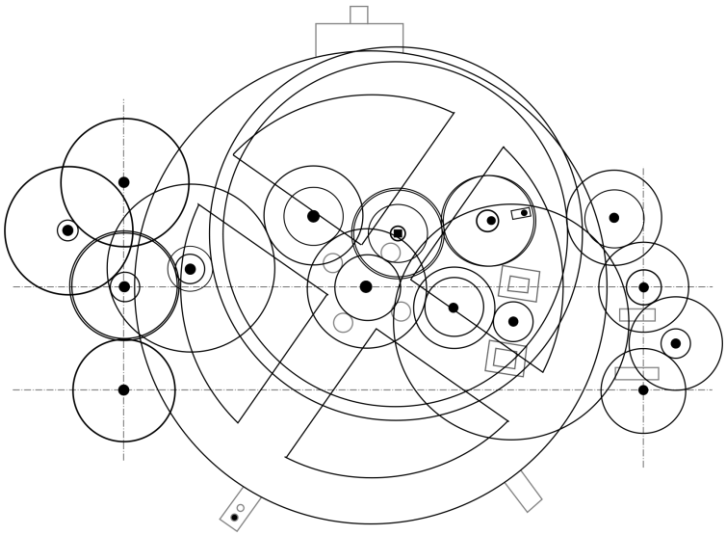


Figure 12: The inner workings of an Antikythera mechanism. Wikimedia, public domain.

The idea of a 'computer' at least goes back to the ancient Greek *Antikythera mechanism*, an orrery described as an analogue computer for predicting astronomical positions estimated to be designed around 200 BC (Moussas 2011). In 1822, Babbage invented a *difference engine* to solve polynomial functions and an analytical engine for general-purpose computation (Bromley 1998). Although neither of the prototypes was finished, Babbage's thinking paved the way for modern computers. It was further built upon by Ada Lovelace who developed what is considered the first 'computer programs'. From WWII, significant progress was made, driven by the demands of war to decrypt enemy codes, where Alan Turing's work in Bletchley Park led to significant advances (Randell 1972). The concentration of talent in Silicon Valley and the establishment of companies such as Apple and Microsoft made USA leading in computer technology until the 2000s when China emerged as a serious challenger to US dominance. In 1993, Marc Weiser from Xerox Computers introduced the idea of *ubiquitous computing*. About the upcoming computer revolution he wrote: "*In the long run, the personal computer and the workstation will become practically obsolete because computing access will be everywhere: in the walls, on your wrist, and in "scrap computers" (like*

scrap paper) lying about to be used as needed." (Weiser 1993). Today, Weiser's vision has become a reality and the emergence of the Internet of Things (IoT), a term coined by Kevin Ashton at MIT in 2009, supports an all-encompassing, global computing structure that expands at a rapid pace (Ashton 2009). '*The world we inhabit is, increasingly, also the world we have made.*' argued Chan (2017), and networked computers make up a large share of the artificial information infrastructure we have created. In 2001, the concept of *pervasive computing* was introduced, which built upon Weiser's ideas but placed more emphasis on the evolution of the software side of computing, rather than hardware. The software layer was interestingly described using the term *intelligence*. In a landmark publication by Aarts and Marzano (2003), they collected a series of articles on the theme of *Ambient Intelligence*. This theory builds upon the ideas of ubiquitous computing and pervasive computing. It adds the "intelligence" layer, which includes anticipation, prediction and reaction to the environment, with Fogg's word, the interactivity. It describes the system elements of ambient intelligence as *context awareness*, *personalization*, *adaptive behavior*, and *anticipatory* and add to that three social elements: *socialized*, *empathic*, *conscious* (Aarts and de Ruyter 2009).

Positioning Ambient Intelligence		
Mobile	**Pervasive**	**Ambient**
• Portable • Wireless • Networked • Location sensitive • Secure	• Ubiquitous • Interactive • Interoperable • Distributed • Scalable	• Embedded • Context-aware • Personalized • Adaptive • Anticipatory

Table 4: From mobile to pervasive, to ambient computing. (adapted from Aarts and de Ruyter 2009)

Complexity flows from technological development

The rapid development of information and communication technologies, such as 5G (connectivity) and microcomputing (more, smaller and cheaper devices and sensors) has led to a surge in the number of connected devices and massive amounts of data being produced globally, often referred to as *Big Data* (Mashey 1998). There is also exponential growth in the number of possible connections between devices if there are more connected devices. These so-called network effects make up a meta-space that creates new dynamics, dependencies and systems to consider (Metcalfe 2013).

For those who have access to the Internet and digital services, digital technology usage increases fast (Nielsen 2020). Similar growth in usage patterns can be observed in most developed parts of the world, but connectivity is not evenly distributed. According to the World Bank, approximately *half* of the world's population has access to Internet services today. This means that a large share of the world's population still is not part of the networks or services offered by the emerging digital infrastructure (World Bank 2017).

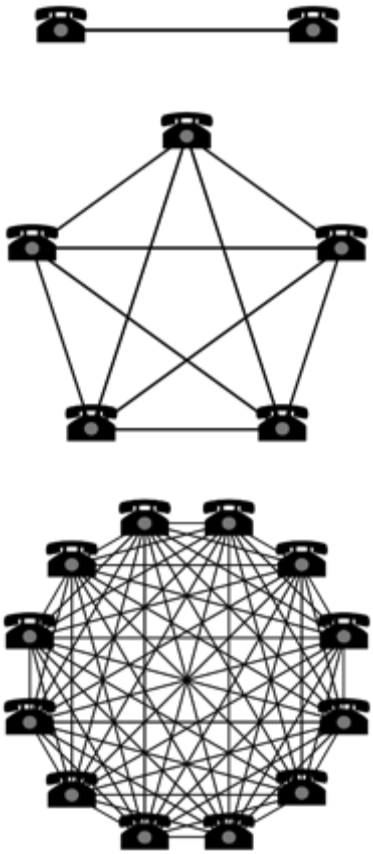


Figure 13: Illustration of network effects.

Artificial Intelligence

Artificial intelligence (AI) has a long and rich history, which, unfortunately, will not fit in this thesis in its entirety. However, it is worth mentioning that it has roots in cybernetics. The introduction of artificial intelligence, allowing *complex adaptive computer systems*, is perhaps the most significant computer software development in the 21st century. Very simplified, AI and machine learning (ML) are software applications which try to replicate the workings of the brain and human learning, to arrive at 'thinking computers' that can augment the cognitive processes of humans, but with the extra advantages that computers add (see section 2.1.4). Artificial intelligence is considered a source of competitive advantage for service providers, allowing them to derive insight from large pools of user data, to model and predict user's future behaviours. As an example, AI is used by digital services such as eBay, Amazon, Facebook and Google to understand which ads to serve to a user. As demonstrated in this section, computers and computer programs are changing form quickly, mediating a larger share of the human experience and simultaneously creating new *persuasion tools*. Service designers must be able to model the new reality, to be able to deliver value given these new circumstances and perhaps, more importantly, to avoid designing actively harmful services.

Wickedness generated by complex persuasive systems

The original ‘computers’ by Archimedes, Babbage or Turing unlocked new matters of governance and ethics, but because their machines were not networked, their direct social impact was limited. However, the recent proliferation of computer hardware and software is of different scope. Bratton (2016, p. 8) describes the novel computer landscape as an ‘accidental megastructure’ that influences everyone and everything and Hillis (2016) talks about the new computer landscape as a ‘jungle’ in which people now need to recalibrate their senses to again be able to discern friends from foes. The introduction of AI has led to *more wicked problems* in digital services, in areas including, but not limited to (Pangaro 2020):

- Mechanisms to manipulate people’s attention.
- Mechanism for manipulating people’s political attitudes and voting patterns.
- Algorithmic bias in algorithms which steer important decisions.
- Facial recognition that can be used for surveillance.
- Deceptive design, with ‘deep fakes’ or ‘dark patterns’
- New forms of invasive data collection.

The issues mentioned above are controversial because they have profound political implications: they can enable certain futures for certain groups of people and constrain futures for other people. They have a deep impact on social dynamics, which have repercussions for society and the environment. Holtel (2016) argues that AI creates wicked problems for companies, comparable to the steam engine's introduction in the 17th century, which had unpredictable and massive societal consequences in a relatively short period.

Service design has also been connected to wicked, social problems Suoheimo, Vasquez and Rytilahti (2020) investigated the connection between service design and wicked problems. They suggested that service design is ideal to tackle these kinds of issues. Service designers know how to facilitate complex processes; they have tools to visualize and create a shared understanding of wicked problems and see the importance of collaboration (Suoheimo, Vasquez and Rytilahti 2020). Darzentas and Darzentas (2014) argue that ‘designers need to utilise the insights that come from retaining complexity, rather than decomposing it’ and argues that systems thinking can provide a valuable perspective to navigate complex design problems.

New technology leads to new forms of persuasion

Persuasive technologies and systems are inseparable from the hardware of software platforms they operate on. Incremental or radical changes in these domains inevitably enable new forms of persuasion. Ambient computing and intelligence open up for numerous, completely new and invisible forms of persuasion. Timmer, Kool and van Est (2015) describe this process of converging technological domains as the *proliferation* of persuasive technologies into different parts of people’s

lives, and *integration* of persuasive technologies with the Internet of things (IoT) and ambient intelligence (smart environments). In the case of ambient intelligence, it has sparked a vivid discussion in the persuasive technology community on the properties, opportunities and threats with persuasion given the changes in the computing environment (Verbeek 2009, Ham, Midden and Beute 2009, Ham and Midden 2010, Kaptein et al. 2010). In persuasive systems research, the concept of *adaptive persuasive systems* was introduced to deal with personalized persuasion and persuasion profiling, a mode of persuasion which is amplified with ML and AI (Kaptein et al. 2012).

Some of the challenges with exceeding complex services and environments stem from people's dependence on the peripheral route (heuristic processing), the 'mental shortcuts' we use to navigate complex environments. It is estimated that up to 95% of our decisions are automated and depending on heuristics, rather than active, reflective choice (Caraban et al. 2017). This means that the more complex the digital world becomes, the more we have to rely on heuristics, designed or not, to navigate in it. From the perspective of persuasive system's theory, if people rely more on heuristics to make decisions, it follows that increasing complexity inevitably enables more deceptive and coercive services, as their mechanisms move into the shadows. As described above, intangibility is a defining property of services, which has called for new approaches to design ethically. It is arguably much more straightforward to discern a tangible product or machine's ethical qualities than a service you cannot see, feel or touch. For service designers, this means increasing responsibility to design in ethical ways. To a lesser extent, the users can discern whether a service is beneficial to them, means them harm, or both.

New forms of persuasion

What new forms of persuasion can we expect? From existing literature, I have identified a few strands of persuasive systems research that have emerged due to recent advances in computer technology. These may or may not become more influential in service design in the next decade.

Domain	Description	Literature (selection)
Personalised persuasion	Selecting persuasive means based on personal data	Kaptein (2012, 2015) Orji, Nacke and Di Marco (2017)
Ambient persuasion	Distorting reality to become more persuasive	Verbeek (2009) Kaptein et al. (2010) Ham, Midden and Beute (2009) Nakajima (2013)
Human-like persuasion	Making things more persuasive by making them more human-like (anthropomorphising)	Borgefalk (2019)
Persuasive games	Making things more persuasive by gamifying them	Bogost (2010) Orji, Nacke and Di Marco (2017) Orji et al. (2013)
Subliminal persuasive technologies	Interactive persuasion targeting the automatic mind	Caraban et al. (2017) Ham, Midden and Beute (2009)
Persuasive transmedia storytelling	Persuading people with data-driven, multimodal narratives	Sakamoto and Nakajima (2013)

Table 5: New forms of persuasion.

In this thesis, due to the limitations of the format, I will not go deeper into the specifics of these novel modes of persuasion. Instead, I refer to the authors and literature listed in the table above, which provides a starting point for anyone wishing to explore these areas further.

2.3.2 Ethics

New and old ethical challenges emerge from the introduction of new computer hardware and software with ever-increasing complexity. Some consequences are expected, and others are unexpected. I discussed how computer products lead to more wickedness in persuasive service systems and more complex persuasive technologies in the above section. This section will describe how it influences common ethical challenges and what new knowledge is needed to navigate increased wickedness in persuasive service systems.

Humans are the only living beings in the world concerned with how one *should* live (Hägglund 2020) and likely, we are the only species which actively discusses ethical issues. *Ethics* is an old and rich philosophical field concerning how people should live, 'right' or 'wrong' behaviour. There are three major areas of ethics: meta-ethics, normative ethics and applied ethics. While *meta-ethics* concern questions of the meaning and nature of moral terms and judgements, *normative* and *applied* ethics concerns prescriptive guidance to moral decisions and actions in general and specific situations.

'All the world's problems get expressed in software'

It has been argued that increasing complexity of people's online environments has led to a *crisis of attention*, too many things trying to get our attention and persuade us to look, read, watch, feel or consume (Johnson 2019, Williams 2018). That would likely not be an issue if it was just a single source of persuasion. Today, however, there are millions of sources of persuasion, making it increasingly difficult for people to distinguish signals from noise. Marshall McLuhan argued in 1964 that 'the medium is the message', meaning that the structure and mediating character which new media offers are often ignored and instead, they are evaluated on the content they carry (McLuhan 2016). McLuhan further differentiates between hot and cold mediums, depending on the degree to which they are 'filled with data', where hot mediums are high-definition and high-fidelity so that they fill up our senses completely. Adaptive persuasive systems, manifested as consumer-facing, pervasive digital platforms such as Facebook, Instagram or Youtube, and computer games or certain productivity applications, certainly fill the definition of 'hot' mediums. To an increasing extent, these are designed to 'fill up' people's attention to influence us.

While traditional slot machines were confined to the physical domain, their digital counterparts made their ways into our homes and bedrooms. Nowadays, casinos or other services are offering instant gratification available at arm's length. Williams makes the case that these technologies, by design, are created to harvest people's attention (Williams 2018, p.111). That is perhaps desirable for the companies that run the virtual slot machines, but less so for the users. It clearly illustrates that the values and behaviours promoted by technology are negotiated already at the design stage.

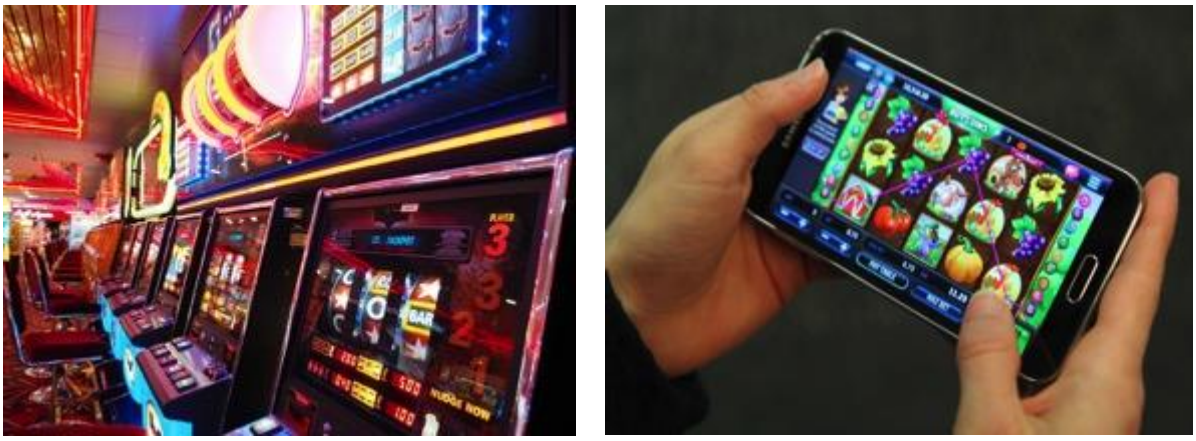


Figure 14: Traditional slot machines and digital slot machines.

Often, people associate persuasion with inappropriate attempts to manipulate people's choices against their will or best interest. Persuasion is a natural part of human interaction, but it is not always easy to discern the boundary between persuasion and manipulation (Berdichevsky and Neuenschwander 2011). Service features that are not in the user's best interest are sometimes referred to as 'dark patterns', a term coined by UX designer Harry Brignull (2010). Dark design patterns are designed to be deceptive to the user and trick them into doing things they would otherwise not have done. Tristan Harris who leads the Centre for Humane Technology which describes the misuse of trust by services as persuasive systems as 'downgrading humanity'. Harris claims that 'When technology exploits our weaknesses, it gains control', and describes at length the different ways in which human capacity is impaired by technologies which are designed to nag on people's attention (Johnson 2019).

Wicked ethical challenges caused by increasing complexity

Societal and ethical issues go hand in hand, and Royakkers et al. (2018) argue that digitalisation now penetrates or physical world, biological world and the social-cultural world, referring to Floridi's notion of 'onlife', the dissolution of boundaries between the digital and physical (Royakkers et al. 2018, Floridi 2015). The authors synthesised the consequences from some of the major technological trends: IoT, robotics, biometrics, persuasive technology, platforms and AR/VR. They divided the communal challenges with these digital technologies into six categories:

Category	Description
Privacy	Pervasive monitoring, losing control of sensitive information, 'little brother' and insights into all platform interactions.
Autonomy	Technological paternalism, control and manipulation through technology, steering preferences, man-out-of-the-loop and filtering, influencing freedom of expression.
Security	Physical dimension of information security and identity fraud.
Balance of power	Everything-as-a-service, paternalistic setting of standards, unfair competition and monopolisation and relations between private and public parties.
Human dignity	Dehumanization and unemployment, instrumentalization, unlearning moral skills, desocialisation and alienation
Justice	Classification and presumption of innocence, exploitation and exclusion, discrimination and unjust exclusion.

Table 6: Ethical challenges with digital technologies. Adapted from Royakkers et al. (2018)

Not all wicked problems are ethical problems. However, many wicked problems have ethical dimensions. Sweeting (2018) describes that the relationship between ethics and design has traditionally been normative and applied ethics, that normative ethical theories concerning how one 'should' act in different situations, has informed design practice. He argues that design activity may also inform ethics, as design practice is crafted to address wicked problems, in which many of the ethical challenges sit. Sweeting argues that: *'…ethical questions or criteria may be part of what constitutes the wicked problem, either in terms of straightforward constraints or questions that are themselves matters of on-going debate amongst those they concern.'* In his view, normative ethics cannot guide wicked problems, because there are no 'right' answers or solutions, only better or worse solutions.

Ethics of persuasive technologies

Before establishing persuasive technology research as a distinct field of inquiry, ethical challenges related to human-computer interaction (HCI) were dealt with in computer science more broadly. Ethical ideas specific to persuasive technology research were introduced by BJ Fogg, who dedicated a chapter of his foundational book on persuasive technologies to ethics (Fogg 2002). He describes six fundamental ethical concerns which are unique to persuasive technologies:

1. The novelty of the technology can mask the persuasive intent.
2. Persuasive technologies can exploit the positive reputation of computers.
3. Computers can be proactively persistent.
4. Computers control the interactive possibilities.
5. Computers can affect emotions but can't be affected by them.
6. Computers cannot shoulder responsibility.

Fogg's writing was inspired by computer ethics scholarships, such as Friedman's work on human values and computers' design (Friedman 1997). Fogg suggested three directions of inquiry for further probing ethical issues: examining the *persuader's intentions*, the *methods* used to persuade and the *outcomes*, whether they are intended or unintended (Fogg 2002, pp. 220-227). Fogg's work has been criticised for disregarding unintended consequences arising from the use of persuasive technologies and for promoting a technology-centred, rather than human-centred perspective on persuasion (Atkinson 2006). As several researchers have noted, there is a thin line between persuasion, coercion and deception - '*Persuaders have always stood on uneasy ethical ground*.', as Berdichevsky et al. (1999) noted, this statement does not capture the whole truth. Everyone persuades, and is persuaded all the time; it is a natural and omnipresent component of interpersonal interaction. However, it was proposed by Harjumaa and Oinas-Kukkonen (2007), and Verbeek (2011) later built his book *Moralizing Technology* on the assertion that information technology is never neutral, it always influences people's behaviours or attitudes in some way. It is not a matter of *whether* a designed, digital service system persuades, but rather, *how* it influences the user and its designed ethical qualities.

Translating guidelines to practice: a persistent challenge

Since the field of persuasive technologies was established in the '00s, it has regularly been criticised for not doing enough to address ethical issues. The field has recognized the criticism; however, current approaches are not sufficiently effective to address persuasive service systems' wickedness. A recent literature review was carried out by Burri Gram-Hansen (2016). As part of her PhD dissertation, she reviewed 133 papers published at the persuasive technology conferences from 2006-2013. Her review's focus was on persuasive technology literature relevant to her research on learning in persuasive design. Like previous studies, she emphasised the importance of recognizing the rhetorical tradition in the field, because its dialectic nature makes ethics easier to integrate into design processes. She especially highlighted the continued need for a focus on ethics. The dialectic approach is certainly interesting, not least given the connection between ethics and dialectics, since ethics is an area in which persuasive technologies still struggle. The field's ethical challenges were raised as an

essential area of focus by Fogg already in 2002 and have since been a big elephant in the room for the field (Fogg 2002, pp. 211-235).

In a paper presented at the Persuasive Technology Conference in 2019, Kight and Gram-Hansen (2019) presented an updated literature review of all 376 papers presented at the persuasive technology conferences between 2006-2018. They specifically highlighted that even though several ethical frameworks with different ethical lenses had been published, there have been no studies in Persuasive Technology literature targeting how designers work with ethics in the workplace, or if any of the guidelines presented are even followed. That was also in line with the findings we (Borgefalk and de Leon 2019) found in our positioning paper, which was presented at the same conference. The paper, which was published in the conference proceedings (Borgefalk and de Leon 2019), was awarded 'best paper', peer-reviewed and selected from 79 submissions. It was written in collaboration with Nick de Leon, my supervisor and Founder of the Service Design department at the Royal College of Art, School of Design. In the paper, we proposed three directions for further research, which I will expand on in this dissertation:

1) Further interdisciplinary research into 'good' *governance* of persuasive systems.
2) Further integration of persuasive technology *ethics* in management and strategy theory and practice.
3) Using service design to translate ethical guidelines from persuasive technology research to practical *tools* for managers, owners, board members and regulators.

The challenge with translating ethical guidelines to real-world impact is also highlighted by McNamara et al. (2018). They experimented to see if reading the ethical code influenced designers' decision making. The result was negative; the authors stating that '*explicitly instructing participants to consider the ACM code of ethics in their decision making had no observed effect when compared with a control group*.'. These recent reviews have revealed that several of the issues raised by Torning and Oinas-Kukkonen had been addressed, but that more works remain. The concerns for design have been partially addressed for example by Davis (2009), Burri Gram-Hansen (2016) and Lockton (2013), however, design issues in persuasive technology research is a moving target, since new forms of computing lead to new forms of persuasion, which require new or modified design methods. Wicked ethical problems, per definition, has no solutions, you can only hope to tame them (Sweeting 2018).

From persuasive technology ethics to system's ethics

As described in the introduction of this chapter, the definition of persuasive technologies has shifted towards persuasive *systems*, from a narrower to a broader definition of the persuasive subject of

analysis (Williams 2017, Torning and Oinas-Kukkonen 2009). Identifying and locating a persuasive intent was perhaps easier when technologies were more narrowly defined. In both academic and commercial settings, services are often designed by teams working together, governed and managed by other people, why allocating responsibility and agency becomes a more challenging exercise. When applying the systems perspective, however, it is not enough to study persuasive technologies as isolated systems. They need to be considered systems on their own merit, as parts of systems and systems of systems.

Williams argues further that to address persuasive systems' ethical issues, there is a need for *infraethics*, an ethics for the digital infrastructure. He states that there should be a focus on that technology should be aligned with our goals and examine how much it constrains our actions. (Williams 2017, p. 152) Based on a compressed version of Meadow's model for leverage points in a system, Williams suggests interventions on different levels. His framework does not limit itself to designers of technology but applies to all parts of society. A summary can be found in table 7.

Leverage level	**Description**
Paradigms	Advance conceptual, normative and linguistical toolsets.
Goals and metrics	Measure what we value rather than valuing what we measure
Rules	Align design incentives with human goals, values and other ethical priorities
Information flows	Including feedback loops, catalyse conversations throughout societies and across silos

Table 7: Interventions to improve ethics in digital services. Adapted from Williams (2017)

Consequences for persuasive service system design

To sum up this section, increasing computers' complexity leads to more wicked problems in persuasive service systems. From the literature review, I infer that ethical challenge exists in several different dimensions and existing approaches to dealing with them have certain limitations.

First, *locating persuasive intent* is becoming increasingly complex, since persuasive service platforms have multiple designing systems. It is no longer feasible to study 'a designer' of a system, but rather a 'designing system', or system of systems where intent and agency is distributed among many different actors.

Second, there are persistent challenges in *translating theoretical guidelines to practice*. There are numerous frameworks for ethics of persuasive systems available, however, there are documented challenges in 'translating' them from theory to practice.

Third, there is a need for further investigating *systemic approaches to 'taming' ethical problems*. It is not enough to study persuasive technologies in isolation, or in lab environments when real-world applications are much more sophisticated. Neither is it possible to address ethical issues by focusing on discrete applications of technology.

That brings us to the issue of *governance*, methods for how to 'tame' and shape persuasive systems to navigate ethical issues in complex environments successfully. The system's approach of service design is useful to achieve this, to understand how to work with infra-ethics on a grand scale. In the next section, I will review literature concerning governance of persuasive service systems.

2.3.3 Governance

In this research, I sometimes use the term *governance* to frame the political design negotiations in and around services as persuasive systems. I reviewed theories related to governance arising from objects or services. *Governance* is an umbrella term for different forms of 'steering', systems that aim to control other systems' behaviours, actions, or attitudes. *Meta-governance* concerns the circumstances in which governance emerges, is designed and implemented. Wherever there exist explicit or implicit ethical policies, there is also a range of *instruments* (broadly defined) applied to implement policies. Governance can be regarded as the *choice architecture* for services that regulate and set constraints by means of design, laws, norms or industry standards. There is no universal definition of governance, and the term is often related to the organisation or domain in which it is applied. For example, *corporate governance* concerns the steering of companies on the highest level, *non-profit governance* concerns the steering of non-profit organisations as their goals differ from those of companies, and *Internet governance* concerns governance of different aspects of the digital domains of the Internet, such as cybercrime.

The term governance can be used to describe a process or a structure and is sometimes described as the political processes between institutions. The term governance was minted in political science; however, recently, there have been arguments for a broader view of governance, capturing the dynamics outside of governments and their institutions. This movement in political science called *governance without government* (Rosenau, Czempiel and Smith 1992, p. 3) alludes to governance mechanisms that reside outside of the democratically elected states; in multinational corporations, secret societies or other dynamics which are not captured by the traditional definitions.

Design as politics implies that ethical, societal and user goals and related product or service affordances are identified and negotiated in the design stage. Woolgar and Neyland. (2013, p. 21) propose *mundane governance* as an object-oriented approach to governance, suggesting that the 'things' we design give rise to relations of governance. They provide the example of how the introduction of waste-bins made waste (and the bins) governable and established new accountability relations, facilitated by the object. Rosenqvist suggests *governance design* as a new field of design,

exploring '*the mindset that the designer brings to the process of designing and builds into the products of design'* (Rosenqvist 2017).

Does persuasive technology imply 'political' technologies?

Previously in this chapter, we learned that design is never neutral and that neither are digital services. In 2020, India banned a long list of Chinese-owned apps, including TikTok, which was one of the country's most downloaded and used apps. The reason they provided for these actions was to protect its 'sovereignty and integrity'. 'Letting someone else build your apps is tantamount to letting them shape your society' wrote Journalist Kevin Roose and indeed, digital spaces are now increasingly being recognized as equally sovereign territories as physical space (Roose 2020). Guy Bonsiepe defined politics as a societal way of living, rather than something connected with party politics, posing the question '*In what sort of society do the members of that society want to live?*' (Bonsiepe 1997).

Aristotle is considered one of the founding fathers of political theory. In his view, politics concerns matters regarding the governance of the city-state: its rules, laws, distribution of resources and the way decisions concerning the common good were made. His writings on *Politica* concern both the *governance* (rule-setting) and *management* (ongoing administration) aspects of the city-state's affairs (Miller 2017, Dubberly and Pangaro 2007). Whenever there are conflicting goals or limited resources, there is a potential political perspective which needs to be accounted for.

I support the theory that persuasive technologies are also inherently political and base this assertion on the widely accepted claim that design is never neutral and that designed services can influence people's behaviours, choices and attitudes. That is also evident from recent developments in society, like in the Sino-Indian app conflict. Similar to the ideas of Horst Rittel et al. (1973) described earlier, Dubberly et al. (2007) argued that *"The design process is more than a feedback loop, more than a bootstrapping process, more even than a "simple" conversation. An approach to design that considers second-order cybernetics must root design firmly in politics"*.

The ideas that design can enable or constrain particular behaviour, as asserted by Norman (2008), Redström (2006), Weinmann, Schneider and Brocke (2016) and others, certainly holds for digital design as well. You cannot pick an item which is not on the menu, why the designer has the ultimate power over which items should be included on the menu. The act of designing these choices is sometimes referred to as *choice architecture*, a common term in service design, interaction design and UX design, and persuasive technology research. By shaping the possible choices and promoting the choices the designer wants people to make, digital services and systems become persuasive and political.

Furthermore, it is now possible to measure a person's emotional state using, for example, facial recognition and select a persuasive appeal based on it. In experience design and other design disciplines, designers already work with 'emotional design' as a tool to influence and persuade users to act, choose or feel in certain ways (Amic and Kin Wai 2012). The advantages of a computer persuader, listed in chapter 3, make these strategies and tactics more impactful and enable deployment at a large scale.

As stated above, persuasive technologies are defined by Fogg as technologies designed to influence people's behaviours or attitudes. That makes them political-by-design, systems with embedded goals and clearly, pervasive industry platforms which use persuasive technologies, are highly political. In contrast to the political discussions, we see on TV every day, these are often non-transparent processes, seldom negotiated in the public space. Some digital services today have several billions of users, and thousands of platforms have millions. That can be comparable in size to nation-states, why it is relevant to look towards the concept of governance to understand how these platforms should be designed, managed and regulated.

2.4 Approaches to Persuasive Service System Design

The literature review led me to investigate *models* used to design persuasive service systems (which is not equal to digital software development on the tactical level where most interaction design, graphical design, or UX/UI-design operates). Service design operating at systemic level is necessary and needed to tackle increasingly wicked problems. The above review confirmed persistent governance issues and ethics driven by complexity in persuasive service systems (Sangiorgi 2009, Suoheimo 2020). As Williams (2018, p. 45) suggested, the definition of what 'counts' as a persuasive system needs to be updated, which led me to believe that a 'systems' approach was worth further exploration. We need approaches that bridge the physical and digital domains, connecting the technological, with the social and capturing the emerging complexity of service systems, and the systems that 'steer' them: which designs, manages and maintains them. As described at the beginning of this chapter, service design operates on a different logic than product design. Services are *processes* rather than material objects which can be touched and seen, why service design must make tangible the intangible materials of services (Shostack 2007). To design services, *models* are used to communicate certain aspects of service systems and create shared understanding and language for designers working together on designs. This section accounts for common design models used by service designers to *understand*, or *design* aspects of persuasive systems. The purpose of including this section is to account for existing models, account for limitations of existing models and make the case for why new approaches are needed.

What are models, and what are they good for?

Models accelerate the design process in two ways, (1) they help team members to create a shared language of the elements of a system and how they relate to each other and the environment which the system operates in. (2) A common language/model also reduces the risk of misinterpretations and misunderstandings caused by different views about the system (Dubberly, Evenson and Robinson 2008). Do existing models or frameworks have sufficient *range* to deal with increased wickedness of persuasive service systems? Are they practical or impractical abstractions? The evolving complexity and level of abstraction of persuasive systems may have generated a need for new components to enrich these models, which can respond to the emerging needs for designers, regulators, executive managers and other stakeholders to understand second- and higher-order ethics and governance perspectives on persuasive systems and have rewarding conversations about their properties. What is needed, and which Dubberly et al. allude to when they discuss common languages and models, are *practical abstractions*, concepts that are theoretically sound and *useful* in design practice. However, for persuasive service systems, the audience is broader than just designer; they need to be understandable for the other stakeholder groups mentioned above. In the article *Models of models*, Dubberly (2009) emphasises the importance of studying not only the primary activity (in this case, services as persuasive systems) but the model used for understanding and conversing *about* the primary activity: '*Creating or revising a model is meta-activity, taking us outside the primary activity in which we were engaged. It requires attention, energy, and time.*'. He further suggests that *learning, i.e.,* creating new personal knowledge, can be seen as *forming and reforming models*.

By examining the models and tools that designers use to understand and work with persuasive systems, I could uncover new knowledge about these models' deficits and the opportunity to contribute. Interesting questions appear when you start probing into the area of modelling and mapping of persuasive systems. How do you measure salience, just how persuasive a system is? How do you create a map of the intents of (or in) a system? If there are a hundred or more decision-makers involved in designing a system, who is the persuader, and how do you define and locate the 'designer's intent'? As described earlier in the chapter, persuasive systems are complex and abstract beasts, why their properties can be challenging to capture, measure, model, simulate, communicate or evaluate. That is echoed by Torning and Oinas-Kukkonen (2009), in their review, they explicitly point out the lack of persuasive system design methodologies, empirically proven models and clear measurements for successful design.

2.4.1 Approaches to Persuasive Service System Design

This section will discuss useful abstractions (models) for service design of persuasive systems that have informed my design process and research. I will discuss and contrast their strengths and weaknesses. *Approaches* describe theories and high-level strategies which informs and guide design,

which can be refined into design methods (Treu 1994, pp. 211-212). Design *methods* are organised procedures for accomplishing specific ends. *Tools* are models and artefacts, digital or physical, which are used to support methods. Most methods come with tools in the form of models, which designers use to navigate certain problems. Simply put, tools are the operational front-end of methods, which provide cognitive leverage to implement the method.

Due to the interdisciplinary nature of the enquiry and object of study, I found it necessary to extend the search outside of the domains of persuasive systems to find useful system approaches from other academic traditions. Theories for behaviour change inform all models herein, and I have subjectively categorised them as 'engineering-led' and 'design-led', to describe the research tradition they belong to.

2.4.1.1 Engineering-led approaches

Engineering-led approaches to persuasive systems design have roots in fields such as computer science (CS), information systems (IS) and human-computer interaction (HCI). These areas focus mainly on technology design, the design of computer hardware and software artefacts, and information system that can support service delivery.

Fogg's work (Fogg 1999, 2002) which Torning and Oinas-Kukkonen (2009) subsequently developed emerged from this tradition, imported frameworks from psychology and behavioural science into HCI and IS Design. These approaches positivist epistemological foundations, which influences the methodologies, methods and tools. *Gamification*, with sub-fields such as *serious games* (the application of games to solve real-world challenges (Bogost 2010), *gamestorming* (the application of games for facilitating innovation in the business world) also belongs to this tradition, applying the logic and mechanisms of play and games to system's design (Gray, Brown and Mafuscano 2010).

Early models merging behaviour change theories with information system design

BJ Fogg developed the earlier models for describing persuasive computer systems. From the Captology Lab at Stanford, he directed research in the area that resulted in a textbook (Fogg 2002) and many frameworks, which has been used extensively in subsequent scholarship. Fogg's framework is useful because of its simplicity and is easy to use and understand, but does not aspire to capture broader service systems, but specific processes within service systems. Building on Fogg's work, The Hook model was proposed for describing persuasive feedback loops in persuasive platforms. It was developed by Nir Eyal, who was a former student of BJ Fogg in the Captology Lab (Eyal 2014). The Hook model describes a feedback loop where variable rewards are used to trigger people to invest more time or effort into a platform, which increases the value of the platform for the user. Like other similar models, such as the CAR model (Combs et al. 2018), the Hook model provides a practical understanding of simple, first-order feedback-loops. However, it does not weight in second-order

factors concerning ethics or governance or aspire to describe service systems more broadly. The Hooked model is not a holistic framework for persuasive service systems, but a description of a single behaviour found in persuasive systems. It is useful to recognise the value and usefulness of 'zooming in' on a particular mechanism in the system.

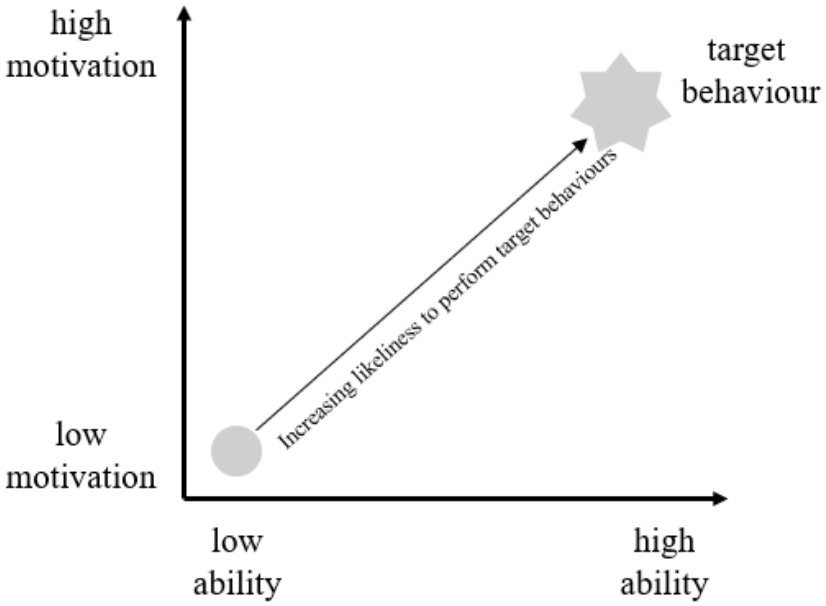


Figure 15: Fogg Behaviour Model (FBM) Adapted from Fogg (2009)

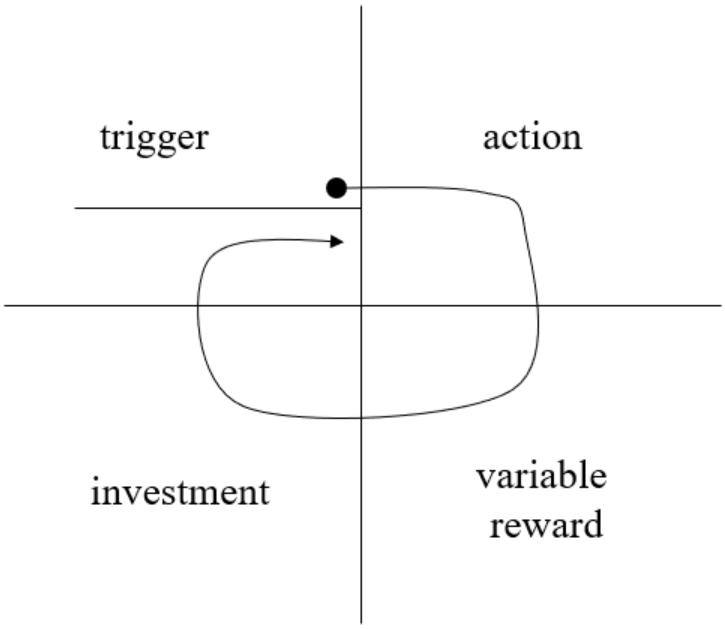


Figure 16: The Hook Model. Adapted from Eyal (2014)

Figure 17: The CAR model. Adapted from Combs et al. (2018).

Persuasive System Design (PSD) model

Following Fogg's seminal textbook published in 2002, Torning and Oinas-Kukkonen (2009) developed the comprehensive *Persuasive System Design (PSD) mode*l, to facilitate the translation of the theoretical findings of Fogg and other contributors, to features in software systems (figure 18). The PSD model has for example been applied to design services which target weight loss (Segerståhl, Kotro and Väänänen-Vaino-Mattila 2010), to increase people's physical activity Bartlett, Webb and Hawley (2017) or for evaluating streaming media services such as Netflix (Adaji and Vassileva 2016). They provided general guidelines and insights to consider when analysing or designing software in seven postulates, and specific tactics and features to influence the user's behaviours or attitudes.

The postulates are as follows:

1) Information technology is never neutral. It always influences people's behaviour or attitudes in some way.
2) People like their views of the world to be organized and consistent. If a system helps someone commit to something, it will be more likely to reach its persuasive goals.
3) Direct and indirect routes are key persuasive strategies. That concerns the choice between direct communication and indirect cues and the choice or mix of strategies used in a persuasive system.
4) Persuasion is often incremental. Persuasion should be seen as a process, rather than a momentary action, which unfolds over time. Persuasive models should thus be designed with this in mind. That is also founded on the premise that small steps towards a goal are more effective for changing behaviours or attitudes than making dramatic changes.
5) Persuasion through persuasive systems should always be open. Voluntary change is at the core of persuasive technology ethics, and simulations or systems which try to conceal its persuasive intent may be deceptive and misleading.
6) Persuasive systems should aim at unobtrusiveness. Persuasive systems should try to time its interventions and not interrupt the user when he/she is busy performing some task.

7) Persuasive systems should aim at being both useful and easy to use. The authors emphasize that the system should seek to serve the user's needs and be loyal to the user, which also reinforces the idea that persuasive systems should not be deceptive about their persuasive intent.

The authors also emphasise that the postulates concern *entire software systems*, not only the systems' persuasive parts. That is why they use the term persuasive *systems* in the broader sense rather than persuasive *technologies* to describe the systems. They propose persuasive system features divided into four broad groups: primary task support, dialogue support, system credibility support, and *social support*. The framework has been applied in several subsequent studies (see for example Wiafe et al. 2011, Langrial et al. 2012). It has proven its academic value-in-use and is frequently used to evaluate persuasive systems. Despite its qualities and solid empirical testing, the model is still not very well known among service designers outside of the academic community. The PT Navigator was developed to integrate persuasive technology research into participatory design (Jalowski, Fritzche and Möslein 2019). It offers designers three starting points, based on Fogg's frameworks, the PSD model, and practice-based (figure 19). The users can explore persuasive technology research and ways to integrate it into participatory design activities such as workshops. The navigator provides a useful, curated guide to persuasive technology research, but it does not aspire to provide a broader description of persuasive service systems. The model demonstrated a useful approach to 'translating' theory to practice. Building on the PSD model, a model for socially influencing systems (SIS) was developed by Agnis Stibe (Stibe 2015). Stibe's model draws on socio-psychological theories, thereby adding new dimension to the PSD model, extending its usefulness into the social domains (figure 20).

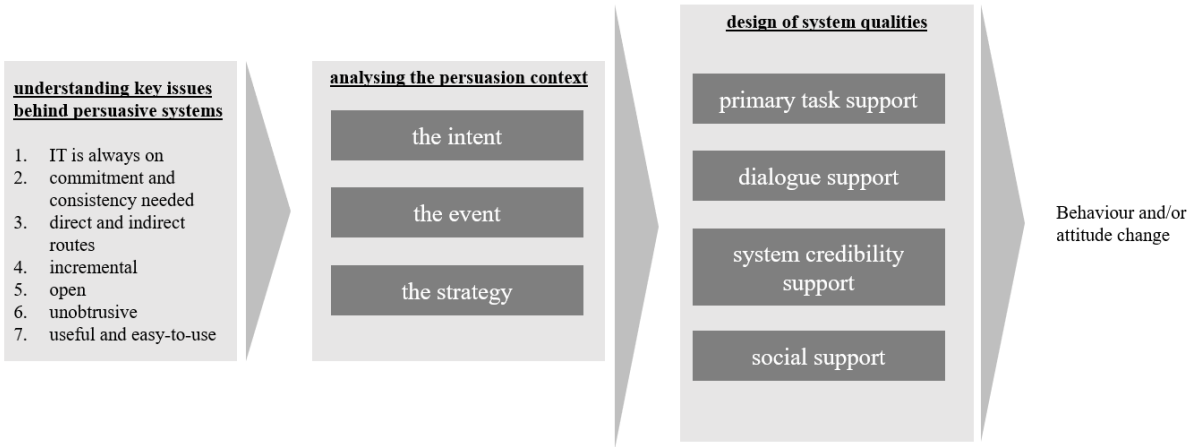


Figure 18: The Persuasive Systems design model (PSD). Adapted fromTorning and Oinas-Kukkonen (2009).

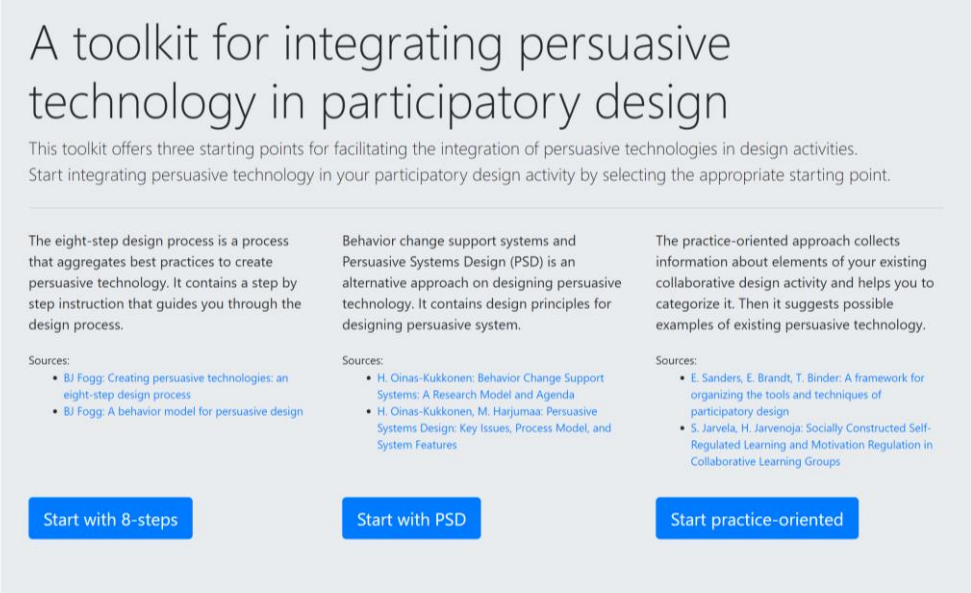


Figure 19: The Persuasive Technology Navigator (Jalowski, Fritzsche and Möslein 2019)

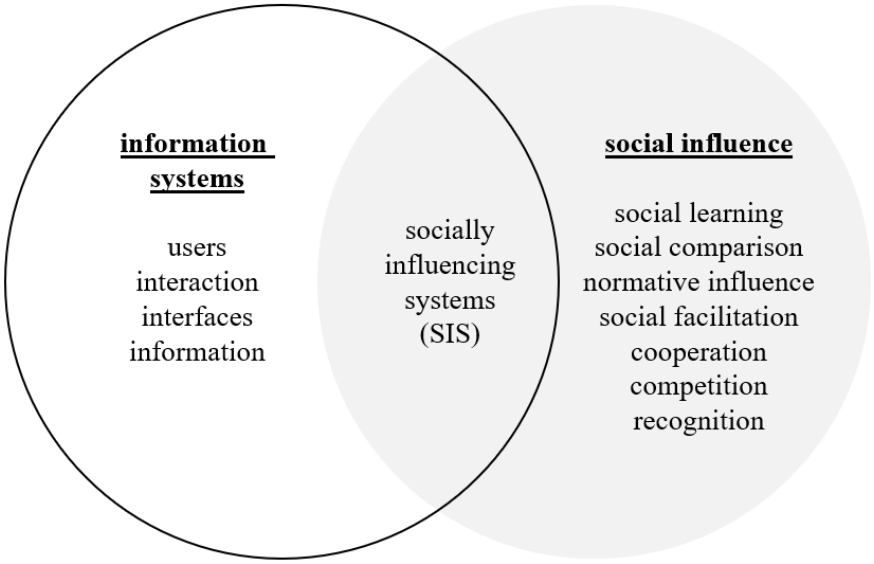


Figure 20: Socially influencing systems. Adapted from Stibe (2015).

Behaviour Change Support Systems (BCSS)

BCSS expanded the PSD model scope to describes a set of systems designed specifically to support behaviour change interventions. BCSS is considered a subset of persuasive technology studies and has a broader scope than the PSD model. The model is grounded in Ajzen's theory of planned behaviour and has imported elements from Social Learning Theory (SLT) (Ajzen 1991, Oinas-Kukkonen 2012). BCSS was introduced with high ambitions, to be 'treated as the core of research into persuasion, influence, nudge and coercion' (Oinas-Kukkonen 2012, p. 1223). The framework has had some impact outside of the Persuasive Technology community, notably used in health-applications

(Karppinen et al. 2016, Wilderboer 2016) under the devise Health Behaviour Change Support Systems (HBCSS) (Kelders et al. 2016). In parallel with the development of PSD and BCSS, various approaches and frameworks for gamification have emerged, and been used in the persuasive technology community. The concept of using games to influence people's behaviours is not new. However, the interactive computer-game context has enabled new forms of engaging gaming experiences. To formalize these theories, Ian Bogost (2007) published *Persuasive Games: the Expressive Power of Videogames* where he described the unique persuasive properties of video games. Bogost bases his analysis of this specific type of persuasive service system (games) in the study of rhetoric, and the combination of visual storytelling and interactive technologies which is characteristic of video games. The sub-field of *serious games* opened a line of research investigating game dynamics' application to real-world problems. For example, these methods and tools have been used in practical coaching with the *Superbetter* method and been used for surgical skills training. (McGonigal 2015, Graafland, Schraagen and Schijven 2012). *Gamestorming* extended game dynamic theory to practice. introducing co-creation tools for designers to engage people in the design process (Gray, Brown and Mafuscano 2010).

Klapztein and Cipolla (2016) made the specific connection between video games and service design and presented a gamification framework that catered to service designers' needs. The framework uses standard service design tools (service utilization, service journey mapping) to support its implementation into a service design journey, applying an 'experience-centric strategy'. Gamification provides valuable insights into how game-elements can strengthen a service, but it does not provide a holistic view of persuasive service systems that are not games.

Though the ethical debate is picking up speed, few visual models still exist in the persuasive technology community for communicating ethical theories to service designers. As described above, there are numerous approaches and guidelines available for persuasive systems designers. However, it has been recognized that few seem to make it to practice.

One of the most common frameworks cited in persuasive technology community is (still) the ethics model by Berdichevsky and Neuenschwander (1999), which depicts the relationship between the persuader, the persuasive technology and the user. This model can reasonably easily be mapped to our model, where the 'Designer with motivations' equals the Designing System, and the Persuasive Technology denotes the Persuasive Service System. The model has been criticised for not being dynamic and properly capturing the complexity of emerging persuasive systems. Fogg's model for ethics in persuasive technologies (Fogg 2002) originated in dialogues with his former students Berdichevsky and Neuenschwander (1999). The framework does provide high-level guidance on ethics to designers, but since the definition of what is considered ethical and unethical varies substantively depending on the context, the framework does not provide sufficient guidance in complex ethical situations.

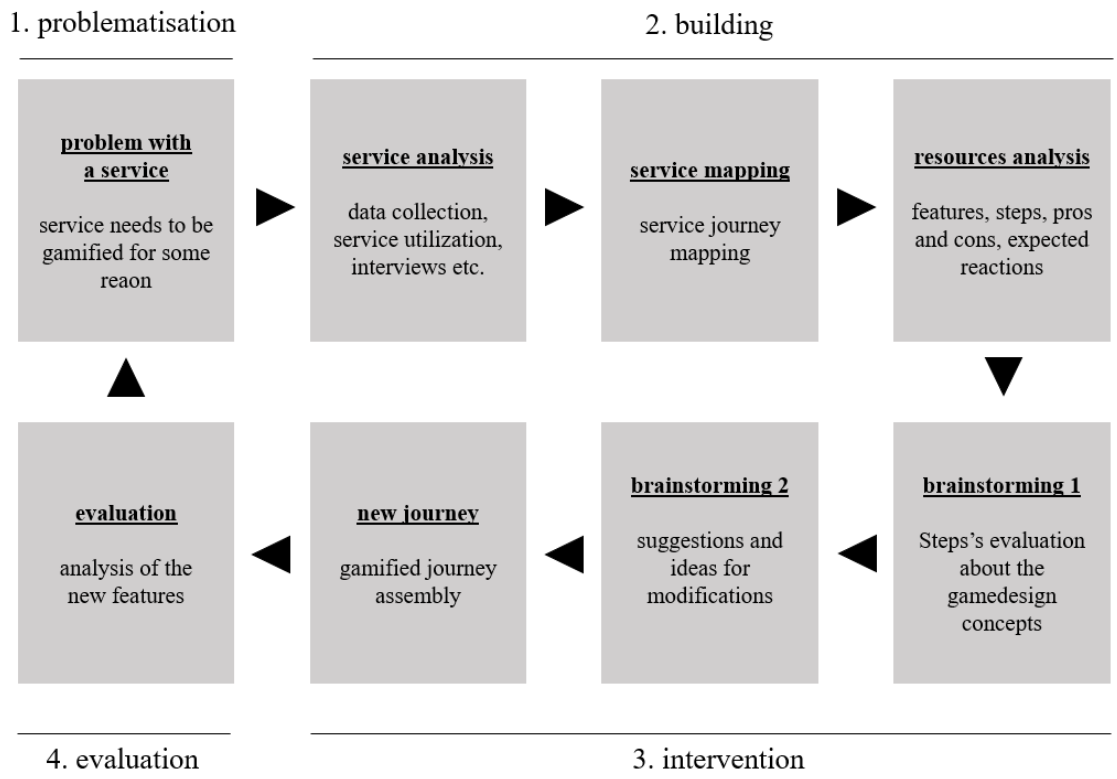


Figure 21: Framework to integrate game dynamics in services. Adapted from Klapztein and Cipolla (2016).

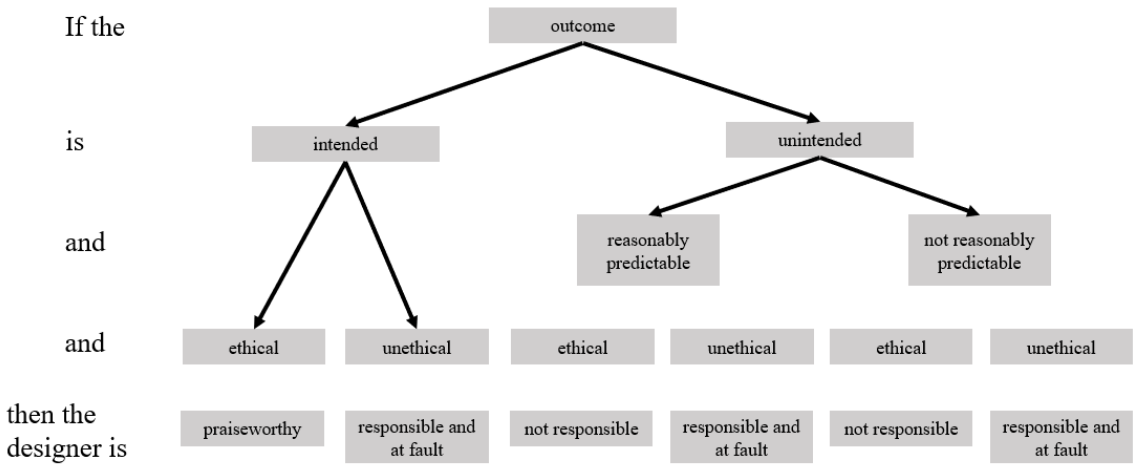


Figure 22: Fogg's model for ethical intent in persuasive technologies. Adapted from Fogg (2002, p. 227).

2.4.1.2 Design-led approaches

Design-led approaches have gained popularity in the design of persuasive service systems to capture persuasive systems' human-centred perspective better. As described above, design research has tried to 'break free' from scientific paradigms, developing its epistemological foundation to justify its existence. Most design-led research approaches have constructivist epistemological foundations, offering substantially different methodologies, methods and tools than those of engineering. Persuasive service system design is interdisciplinary and often applies broad, systemic perspectives to solutions, integrating social-, cultural-, technological and science-related knowledge, searching for solutions to problems.

2.4.1.2.1 Design for Behaviour Change

Design for Behaviour Change is perhaps the area which is closest connected with persuasive service systems design. It has been widely adopted in the context of social change through focusing design activity on generating desired behaviours and attitudes in groups of people, to achieve social, environmental or otherwise ethical goals. It is worth noting that not all DfBC theories have been used to design persuasive service systems, but that many have been applied in various contexts.

Niedderer et al. (2016) reviewed 21 frameworks for BfBC and a few of them are accounted for here because they have informed my research and practice. The thesis's focus is less on the actual mechanisms for behaviour change, and rather on the design of systems, why I picked approaches that described interesting systemic aspects of persuasive service systems. The authors classify behaviour change frameworks in three categories: *individual*, *contextual* and *middle-ground*, referring to the locus of the desired behaviour change. Individual DfBC frameworks concern design that influences individual behaviours, contextual concerns, environments (ex. nudging), and the middle-ground concern framework, combining the two dimensions.

Design With Intent

Breaking a tradition of persuasive systems design methods developed in computer science departments, Dan Lockton's Design With Intent Toolkit was one of the first toolkits that could be applied to the design of persuasive technologies and systems which came out of a design school (Lockton 2008, 2013). As opposed to the previous frameworks that were mainly theoretical constructs or models, the toolkit was designed to be used in practice by designers to guide them in their practical work. The Design with Intent method is a collection of concepts that can be applied in any design projects to discuss its persuasive aspects (figure 23-24). Although the concepts and card deck have proven useful for designers, it does not explicitly address persuasive systems holistically, but rather as support in the early ideation phases. It is a collection of design patterns, aimed mainly at social and environmental beneficial behaviour change, not at mapping existing persuasive systems, but rather to

be used as workshop tools and starting points for exploring the field. Furthermore, the deck does not explicitly include the designer/observer's point of view or why he/she holds those views. Neither does it attempt to define the 'designer' to any depths.

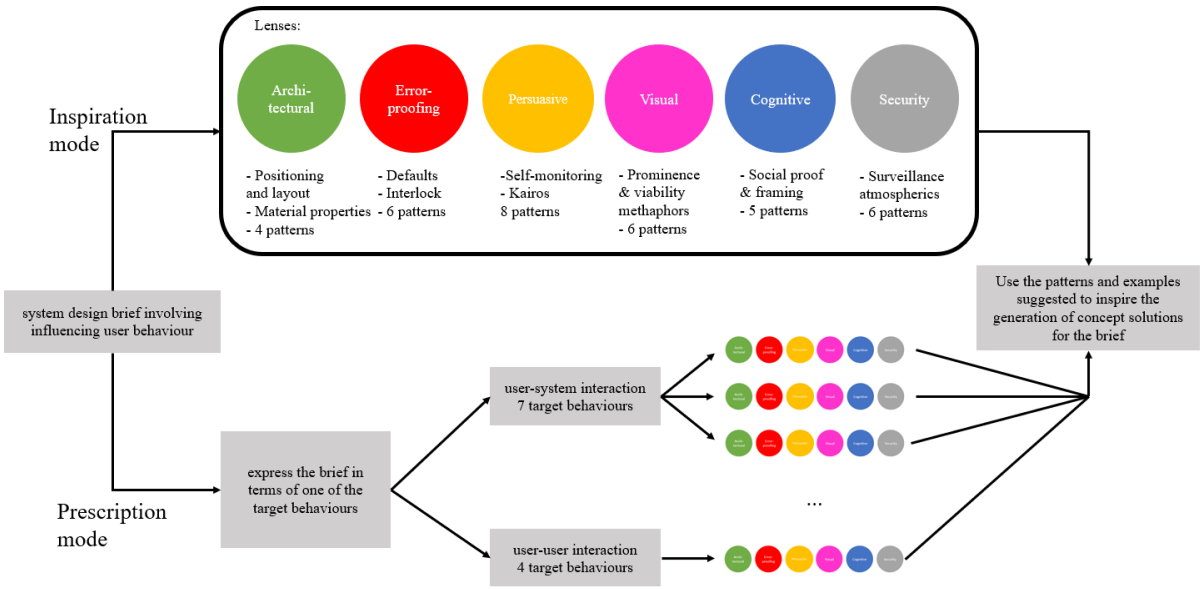


Figure 23: The Design With Intent Method. Adapted from Lockton, Harrison and Stanton (2008).

The image has been redacted.

Please see Lockton, D. (2016). Design with Intent and the Field of Design for Sustainable Behaviour. Retrieved from https://www.researchgate.net/figure/Selection-of-Design-with-Intent-toolkit-cards_fig1_311997996

Figure 24: Design With Intent - cards. (Lockton 2016, p.80)

EDIE framework

As a reaction to the perceived lack of a 'middle way' between the expert-led design methods of Fogg and Oinas-Kukkonen and the participatory, co-creating methods of Davis (2009) and Lockton (2008, 2013), Burri Gram-Hansen began formulating a framework called EDIE, an acronym for Explore, Design, Implement and Evaluate (Burri Gram-Hansen 2016). The EDIE method is designed to be iterative and circular, a hallmark of Design Based Research (DBR) which inspired the author. The EDIE framework has had limited impact in design practice this far but is one of few models that properly recognise the iterative, circular design process. However, it lacks tools to operationalise the model, why it is not very well known among designers. In describing the EDIE framework, Gram-Hansen writes that '*In consideration that the implementation alters the context, I argue that the designers and developers should aim to release the system and quickly withdraw to a more observant position. However, also the implementation itself may benefit from the insights of the domain experts, in order to ensure that the time and place of implementation is both suitable and effective.*'. Burri Gram-Hansen clearly recognizes the action researcher's dilemma, shared by many designers, which is the observer's ambiguous role. A passive observer is detached from the system, or, an actor inside the system is active in driving change. The EDIE-model is an academic product that acknowledges several useful concepts, including the observer's role in the design process. It needs to be delivered as tangible tools to be more useful in applied service design practice.

The Behaviour Change Wheel (COM-B)

A model with roots in health- and psychosocial science, COM-B, was proposed to capture a more holistic view of the factors leading to behaviour change (Michie, van Stralen and West 2011). It is not explicitly developed for persuasive service systems; however, it has been used in that context and combined with the Fogg Behaviour Model (Silva et al. 2019). It synthesises 19 behavioural change frameworks, persuasive technologies COM stands for capabilities, opportunities and motivation (figure 25). The COM-B model has been used in persuasive systems design, notably by Sari, Othman and Sulaiman (2020). They designed mobile health applications using the behaviour change wheel as a foundational theory of behaviour and attitude change. It has been used to create 'exergames' (exercise games) for children, to fight child obesity (Cibrian 2016).

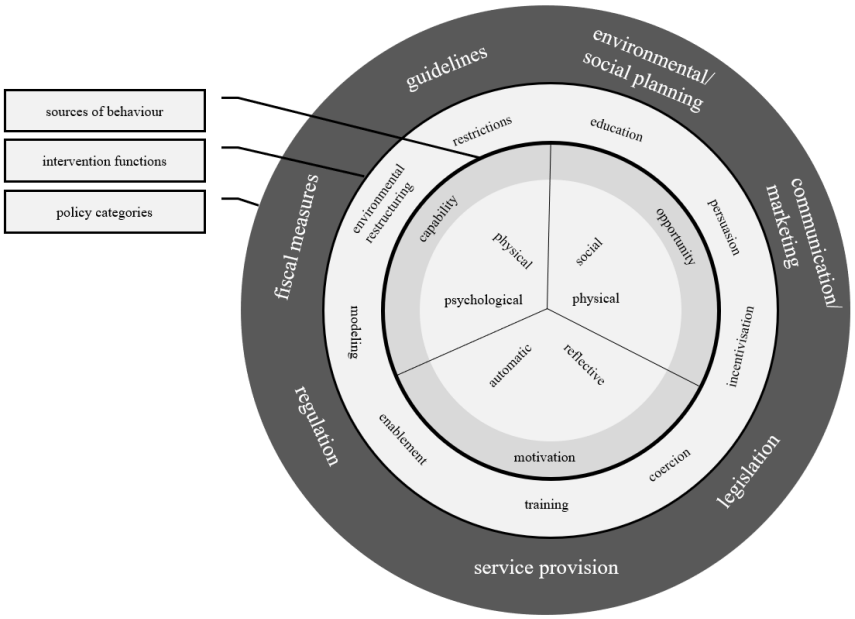


Figure 25: COM-B, Behaviour Change Wheel. Adapted from Michie, van Stralen and West (2011).

The MINDSPACE framework

The MINDSPACE framework is a reduced model for changing behaviour, which it is not specific to persuasive service systems (Dolan et al. 2010). It was developed by the UK Behavioural Insights Team, the so called 'Nudge unit', to 'influence behaviour through public policy'. Rather than changing people's minds, the methods aim to alter people's environments to influence their behaviour indirectly. The methods target the 'automatic', non-reflective mind. Mindspace was specifically designed to implement policy and improve well-being and social welfare (Dolan et al. 2010, pp. 8). The model consists of nine dimensions:

Dimension	**Details**
Messenger	People are influenced by who communicates information
Incentives	People react strongly to incentives, carrots or sticks
Norms	People tend to do what other people do
Defaults	People tend to go with pre-set options
Salience	People are drawn to novelty and relevance
Priming	Our sub-conscious life influences our actions
Affect	Emotional associations can shape our actions
Commitments	People like to be consistent in their acts and public promises
Ego	People often act so that we feel better about ourselves

Table 8: Dimensions of the MINDSPACE framework. (Dolan et al. 2010)

Persuasive by Design Behaviour Change Model

System mapping is a tool for service designers to describe and visualise systems, entities or relationships within or between systems. System maps are reduced abstractions, often describing the mechanisms and workings of systems. It is possible to draw system maps to describe persuasive systems an approach which Hermsen, Renes and Frost (2014) used and named the Persuasive by Design Behaviour Change Model, which they presented at CHI Sparks 2014. The authors pursued an iterative design process and eventually arrived at a model, which was relatively complex and dense (figure 26). By taking out some complexity, they developed a more simplified model which lost some nuances, but that is more understandable. Hermsen's model is an excellent example of how a model can be simplified and reduced, but still keep its significance, however, '*There is a tension between usability and exhaustiveness.'*, wrote Hermsen. The model also uses different colours to highlight different flows in the model and illustrates the various feedback loops at play in the model, almost in a cybernetic way. Hermsen's framework clearly exhibits circularity but is still relatively complex to apply for a designer who is not deeply invested in persuasive systems research. The model is an academic product but needs to be repackaged to be more useful in applied service design practice. However, the model accounts for a first-order goal-oriented system that does not account for the designer/observer's intents or goal. Neither does it consider where the desired 'target behaviour' originates.

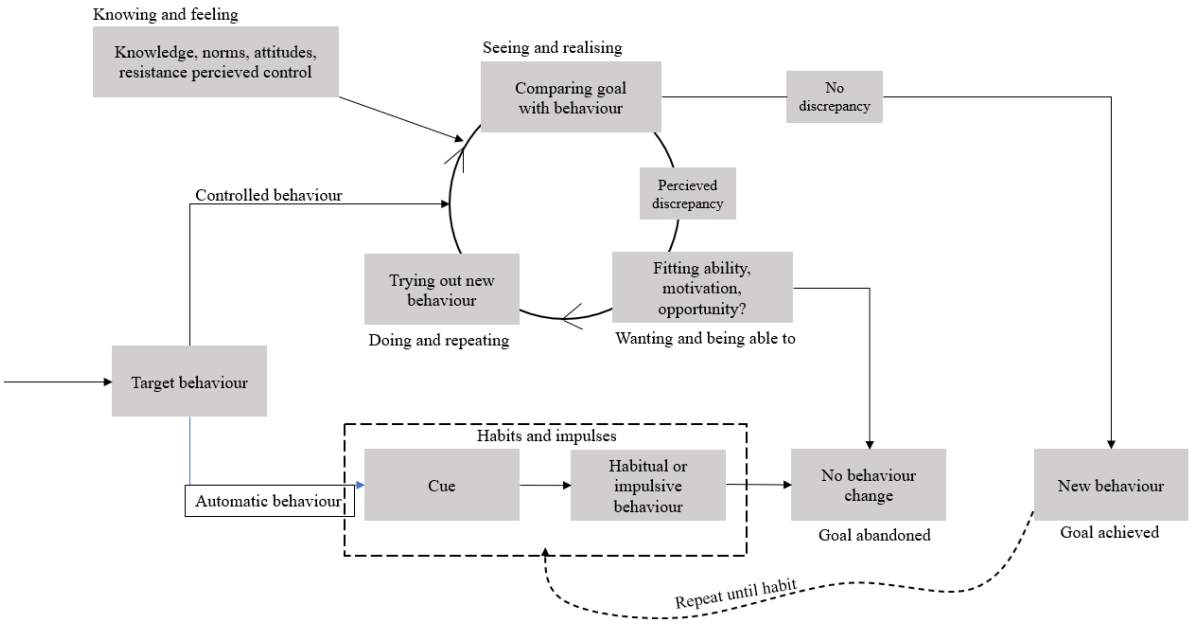


Figure 26: Persuasive by design behaviour change model. Adapted from Hermsen, Renes and Frost (2014).

Digital Nudging and Online Choice Architecture

Nudge theory concerns modifications to the choice architecture of the environment to steer people's behaviours towards preferred choices. Based on the theory introduced by Thaler (2018), a digital nudge theory was developed by Weinmann, Schneider and Brocke (2016), to describe how the digital choice environment can be designed to influence behaviours.

Actor-Network mapping

Actor-network maps are a design method that identifies all actors and stakeholders, human- and non-human entities, which interacts within a service system. It is based on Latour's influential actor-network theory. In the ANT perspective, agencies can be found anywhere and are not exclusively ascribed to human beings, 'every actor in an actor-network is doing something'. Latour denotes the interacting 'actants'. The perspective is one of few that applied a non-anthropocentric perspective on persuasion. Morelli (2007) described how the shift from products to services created the need for designers to provide essential tools to support the design of systemic solutions. She expressed how system tools can better represent the dynamic and systemic nature of services. In *The Persuasive Qualities of Maps*, the authors apply an ANT perspective to persuasive design. In another example, an actor-network is used to describe the actors involved when planning the introduction of electronic health record software at a hospital (Cresswell 2010). The diagram shows relationships between social and technical dimensions of the landscape in which the service system sits (figure 27).

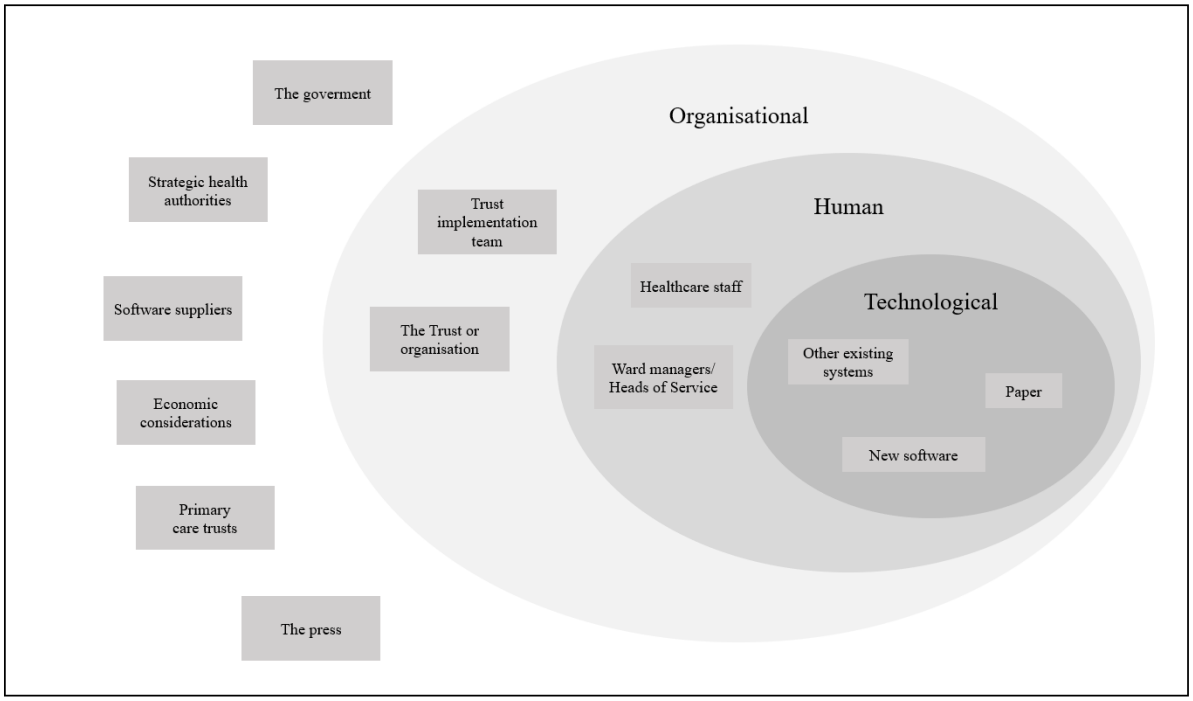


Figure 27: Actor-network diagram. Adapted from Cresswell (2010).

2.4.1.2.2 Service design tools

Systems mapping

While CS/HCI-led system maps focus on the software systems and their environments, there is also a range of service design system maps that visualise the service and its environment. These include *stakeholder maps, journey maps, service blueprints, servicescapes, actor-network maps, value network maps* and *service ecosystem maps*. Depending on what aspect of the service system the designer wants to focus on, these tools can either provide the big picture or zoom in on a specific perspective or service mechanism.

Systems Oriented Design is a service design approach to help designers navigate complex problems (Sevaldsson 2011). SOD is considered one of the most design-oriented approaches in the field of systemic design. *Sevaldsson introduced Gigamapping* as a visual tool for visualising complex systems in design (figure 28). A design team used the technique to redesign the first-line offices for the Norwegian Immigration authorities (Brochard and Aveni 2012).

Gigamapping has been used to some extent in service design to describe the contexts in which service systems operate. There are some examples of giga-maps concerning service systems more broadly. *Stakeholder mapping* is a method and tool for *stakeholder analysis*, which is often used to describe influences on an activity, project, service or venture. In service design, stakeholder mapping is frequently used to understand the relational landscape around a service (figure 29). In the context of persuasive systems, stakeholder maps provide a useful overview of interests and power relations, both formal and informal, which the designer needs to consider. These insights can be used to develop *stakeholder management plans*, to design communication with different groups depending on the type of influence one wants to have on that particular group. Stakeholder maps can be used in participatory design workshops, such as participatory design of public services (Giordano et al. 2018). A version of stakeholder mapping is *power mapping*, which focuses on identifying individuals or actors to influence to create desired change (Hagan and Smail 1997).

Another way to map the stakeholders according to their perceived interest and power is *Mendelow's Matrix* (figure 30), which also can help service designers to understand the dynamics of a persuasive service system (Mendelow 1981). While actor-networks does not distinguish between human actors and non-human actors or describe their agencies, *social network theory* can clarify the social power and interest of different actors. Social networks emphasise the relationships between people, or groups of people, in a service system.

The *systems leverage canvas* (figure 31) developed by Adam Grover is an alternative way to describe power relations, which may be useful when designing persuasive systems (Grover 2018). Grover blends the concepts of leverage points, introduced by Donella Meadows, and describes a hypothetical service to support young people at risk for criminal exploitation. It visualises the system's

potential impact, depending on which level in the ‘leverage point hierarchy’ its touchpoints intervene. The framework could be useful for visualising the ‘ambition’ of a persuasive service system. *Service blueprints* are standard tools for describing describe service processes (Shostack 1984). Service blueprints are a system’s map which depicts the end-to-end journey a user makes through a system. It illustrates the ‘front-end’ and ‘back-end’ of the service, describing what the user sees and what goes on behind the scenes to deliver the experience (figure 32).

The image has been redacted.

Please see Brochard et al. 2012, Retrieved 2020-12-27 from https://www.systemsorienteddesign.net/index.php/giga-mapping/giga-mapping-samples

Figure 28: Gigamapping. (Brochard et al. 2012)

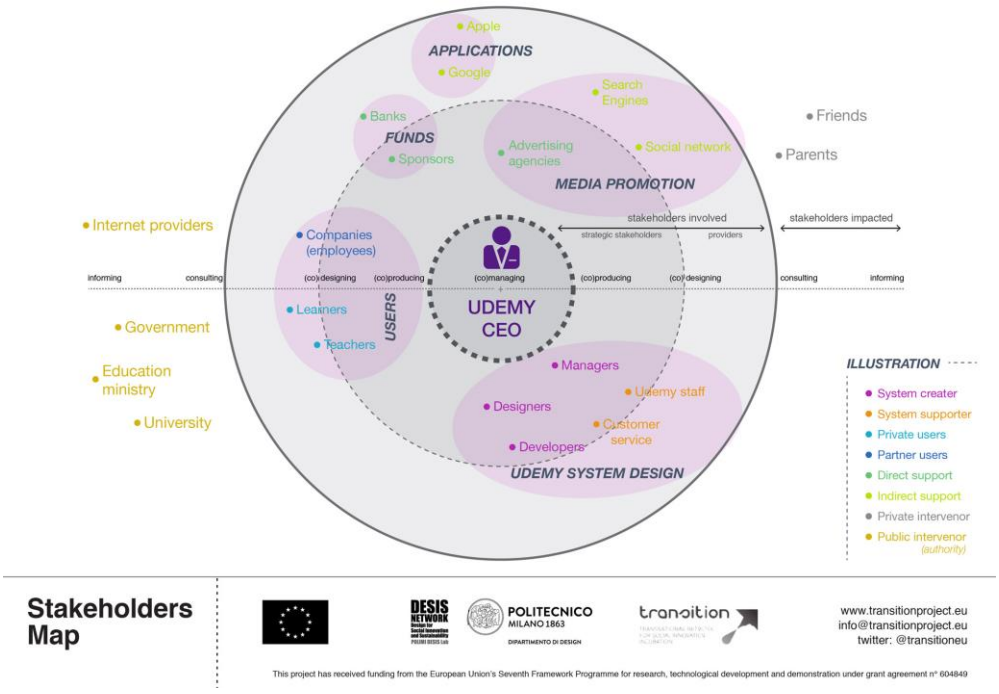


Figure 29: Stakeholders map, Udemy. (Service Design Blog, retrieved 2021-01-02 from https://servicedesignblog.com/service-design-analytical-tools/stakeholder-map-for-udemy/)

Power	Dynamic	Static
High	Continuous scanning	Irregular scanning
Low	Periodic scanning	NIL

Figure 30: Power mapping, Mendelow's matrix. Adapted from Mendelow (1981).

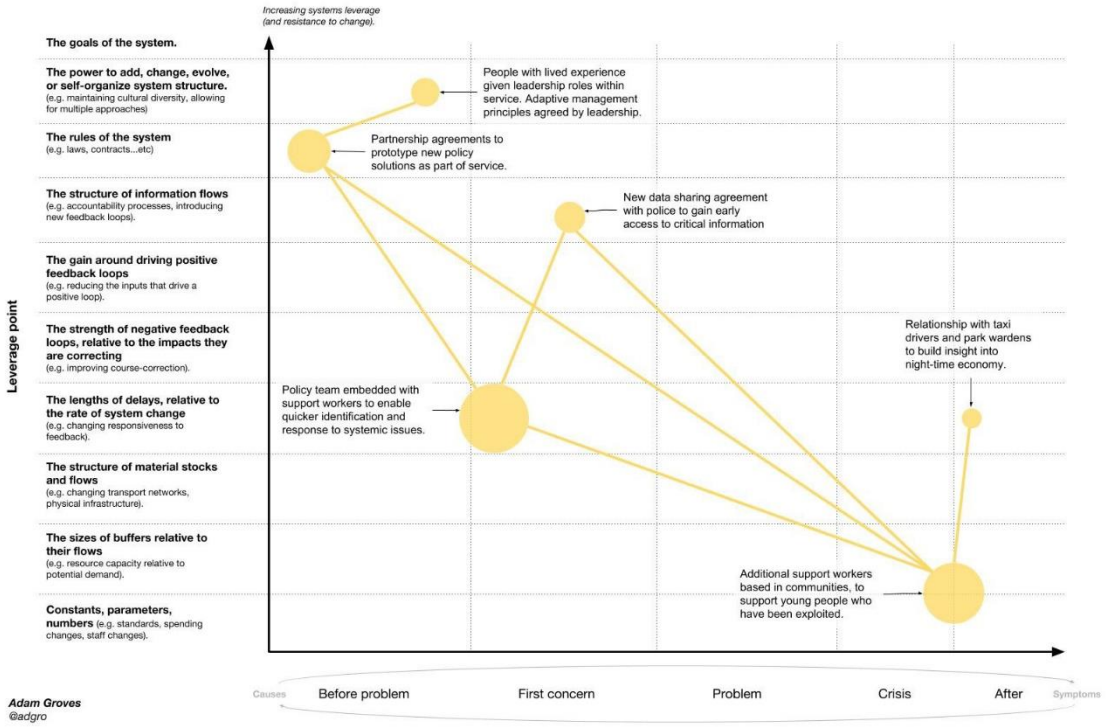


Figure 31: System's leverage canvas. (Grover 2018) CC BY-SA 4.0 license.

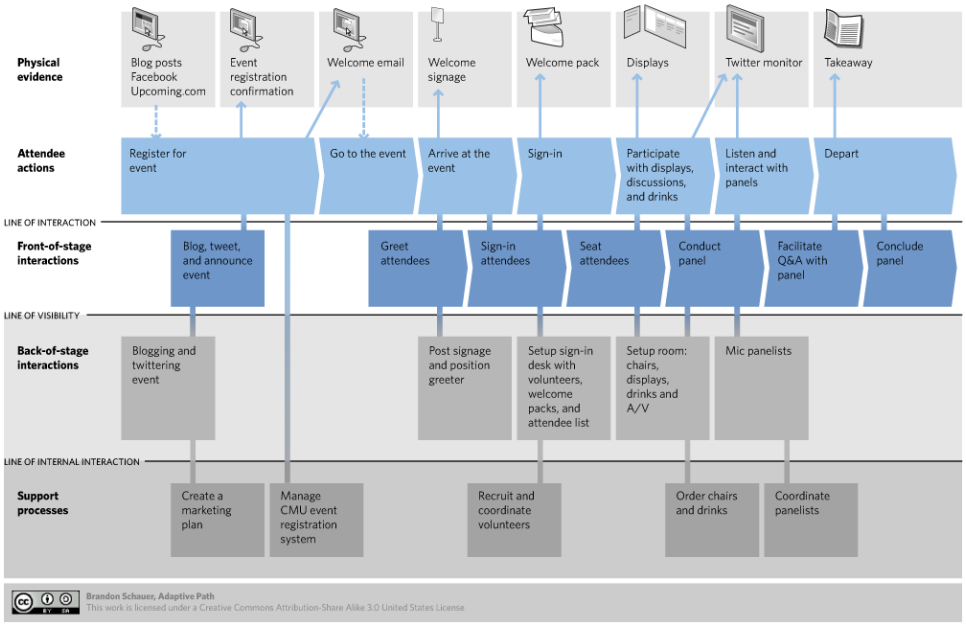


Figure 32: Service Blueprint for a conference. (Schauer 2009. Retrieved 2021-01-02 from https://www.flickr.com/photos/51035764102@N01/3363169836) CC BY-SA 2.0 license.

2.4.3 Summary of frameworks: gaps in knowledge

At the beginning of this section, I set out to answer:

What models are used to create a common understanding of a persuasive service system, for service designers?

I performed a review of frameworks and models for design of persuasive systems from the three main research traditions, which differ in methodologies and approaches (table 9). The models which stem from an engineering tradition generally concern features of digital systems (*what* is designed), although the PSD and BCSS models also describe the context in which the systems operate in a limited way. The reviewed models that stem from a design tradition I perceive as less robust for describing the technical aspects of systems, but provide useful guidance to the meta-aspects of services (*why* they are designed the way they are). I bring these insights to my reflective practice.

	Engineering tradition	**Design tradition**
Characteristics of the approach	Positivist Linear	Constructivist Circular
Methods	Fogg Behaviour model Persuasive Systems Design model BCSS Gamification The PT navigator Hooked model	EDIE-model Participatory Design/VSD Design With Intent PET Design Toolkit Service Ecology COM-B MINDSPACE Digital Nudging and Online Choice Architecture Stakeholder Network Theory Persuasive by Design Behaviour Change Model Actor-Network Theory

Table 9: Summary of theoretical approaches.

The review pointed to several gaps in knowledge which are relevant for this research.

1) **A more holistic approach to persuasive service system design is needed.** The systemic approaches which exist to describe and design persuasive service systems only address parts of the systems. While the CS/HCI approach is robust on the service system level and the design level, it is less useful to describe service's purpose or value for society or for its users. Design approaches help understand the why, the usefulness and value of services for people, but are less useful to deal with service system mechanisms. Lastly, approaches and methods from the social science-tradition inform both the CS/HCI-approaches and design approaches but are not very practical to use for designers.

2) **There is a lack of systemic approaches for designing a service's purpose.** As service systems become more complex, it is increasingly difficult to discern the designer/observer's *intents* or *goals*, especially as this may be dynamic and vary over time. It is also challenging to capture the nature of 'the designer' if there is one designer or a 'designing system' consisting of many different actors. These factors are important because they support the analysis of governance and ethical elements of persuasive service systems.

2.4.4 Summary of chapter

The first part of the literature review resulted in a deeper knowledge about the challenges identified in the first chapter. In the second part (chapter 3), the literature review will continue with a review of design cybernetics. In this section, I expand on the question posed at the beginning of this chapter:

What areas of the design of services as persuasive systems, in which design cybernetics can add value?

Initially, I reviewed design, service design and the design of persuasive technologies and systems more specifically. I described what persuasive systems are and their properties. Next, I explained in greater detail how the introduction of new computer hardware and software leads to increasing complexity and enables new forms of tools for digital persuasion. Expanding the opportunity space for persuasive tools has immediate consequences for governance and ethics of persuasive systems. Next, I discussed governance means in this context and discussed existing approaches to 'tame' persuasive service systems. Finally, I evaluated a range of frameworks and models used by service designers to design persuasive service systems. I discussed their usefulness for a team working on or with a persuasive service system to address those mentioned above ethical and governance challenges.

Why design cybernetics?

When reviewing literature about persuasive service systems, I arrived at several insights which led me to believe that there was merit in investigating the usefulness of cybernetics and second-order cybernetics.

First, it was apparent that persuasive systems were *goal-oriented systems*, but the general approaches did not use goal-oriented systems thinking to describe them. The approaches that used system's thinking failed to adequately capture the nuances and complexities of persuasive service systems, which may contribute to unsolved wicked problems. The approaches were not holistic or just plain impractical to use for a service designer. Among existing systems languages, cybernetics focused on purposeful, intentional systems, which led me to read up more on the topic.

Second, few frameworks consider the observer in persuasive service systems and those which do (ex. EDIE) are still too theoretical to be used in practical service design. Second-order cybernetics had several benefits. Adding second-order persuasive systems that lower-order persuasive system could 'converse' with regarding goals and methods, intersystemic conversations about ethics and governance issues could be addressed. Working simultaneously with first- and second-order cybernetics systems were compelling since the wicked problems in persuasive service systems belong in ethics and governance domains. As Dubberly and Pangaro (2015) wrote, '...design for wicked

problems, and the required (re) framing, calls for second-order cybernetics, which makes the role of the observer explicit, which in turn makes explicit the subjective position of every design rationale.'.

Third, cybernetics offered a conceptual world where some concepts were already used in the persuasive systems community. The Hooked-model, for example, is based on the feedback loop and Fogg's FBM model could be mapped to the theory of requisite variety. By introducing a new, coherent and rich system's language, with concepts, I could lower the barrier to adaption by persuasive service system designers and open up for new ideas and thinking.

I concluded that existing models and frameworks have several design challenges which together makes up a knowledge gap:

1) **A lack of systemic design approaches necessary to address wicked ethical problems in persuasive service systems.** Cybernetics is not the only system's theory available to describe persuasive systems. Still, from the review, I conclude that it is a language that has a high potential for supporting and guiding persuasive service system design and bringing a valuable perspective to service design.

2) **More complex systems make it challenging to locate and value persuasive intent.** Design cybernetics offers that, while Cybernetics focuses on goal-oriented systems, second-order cybernetics allows reflection on value (ethics) and goal-formation (governance) – persistent issues for persuasive service systems.

3) **New approaches are needed to translate ethical guidelines to practice.** To enable real-time design of solutions, service designers must be able to act and observe at the same time. Design cybernetics offers a design philosophy which operates on both an abstract-theoretical and applied level simultaneously. As I will describe closer in the next chapter, design cybernetics provides an approach to design which can be considered empathetic and ethical.

In the second part of the literature review (chapter 3), I argue that design cybernetics can address the gaps listed above and offer a holistic framework grounded in solid theory, which is suitable for designing persuasive service systems. Cybernetics allows us to 'steer' persuasive service systems simultaneously on a design level *and* meta-design level. If persuasive service systems are considered cybernetic systems, then second-order cybernetics is a useful consequence.

3. The (Design) Cybernetic Vocabulary

This thesis's central proposition is that *design cybernetics* is a useful language for extending the vocabulary of service design of persuasive service systems. In this chapter, which is the second part of the literature review, I account for design cybernetics through the lens of service design and point to areas where it can fill the gaps of knowledge identified in chapter 2.

3.1 Cybernetics and second-order cybernetics

In this chapter, I introduce *cybernetics* and *second-order cybernetics*, as these are foundational concepts upon which design cybernetics rest. Next, I make a deeper review of the interplay between design and cybernetics, which led to the novel field of *design cybernetics*. I focus on aspects of design cybernetics that can be useful in persuasive system service design projects. Third, I present cybernetic concepts and discuss their usefulness in service design of persuasive systems. I will explain selected cybernetic concepts and how they can be useful for service design. Finally, I connect design cybernetics with service design of persuasive service systems and arrive at an updated brief, the knowledge gap, which this thesis addresses.

3.1.1 Why use design cybernetics to describe persuasive service systems?

From the previous section, we inferred that persuasive service systems can be considered goal-oriented systems. At least two different governing feedback loops are operating on different meta-levels: a reflexive design level and a service system level. To establish the argument for why design cybernetic ideas can be useful in design, I account for Dubberly and Pangaro (2019), who argued for a cybernetic approach to design. In 'Cybernetics and Design: conversations for action', the authors summarized their logic as follows:

If design, then systems.
If system, then cybernetics.
If cybernetics, then second-order cybernetics.
If second-order cybernetics, then conversation.

If design, then systems mean that design has turned from a discipline focusing on handicraft and product development, towards a general approach to problem-solving (ref. design thinking), designers now deal with product-service ecologies, and complex problems are sometimes wicked or even super-wicked to their nature. Besides, technology is evolving at a rapid pace generating even

more complexity and artificial systems to navigate. That has led to systemic design literacy to become essential skills for designers in the 21st century. Design is less about form-giving and more about designing interventions in systems that change the way they operate to produce desirable effects (Dubberly and Pangaro 2019).

If systems, then cybernetics means that cybernetics is useful to understand complex systems. Systems dynamics (SD) was popularised by the Club of Rome and evolved as a language for describing systems' dynamics (Dubberly and Pangaro 2015). However, SD does not provide a good understanding of why systems work the way they do, or the various agencies embedded in the systems. It is simply not enough to describe a system's goals to understand it. As a designer, one also needs to understand the underlying intents and purposes of why the system's goals are shaped the way they are, how they are formed and where they are negotiated. "*Because design involves human beings - what we want and how we might act to get what we want - systems literacy for designers must go beyond SD and incorporate goals and agency.*" writes Dubberly and Pangaro (2019). Cybernetics is optimal for describing such systems.

If cybernetics then second-order cybernetics means that the designer becomes part of the design process, simultaneously as an observer and actor. Or as the authors write, '*...the observer - the modeler, the problem-framer, the participant in design conversations - is aware of her observing.*' As we recall, second-order cybernetics is essentially applying cybernetics to itself, placing the observer of a system inside the system. (the system is created by whoever observes it)

If second-order cybernetics, then conversation grounds second-order cybernetics firmly in design practice: a conversational, circular activity where novelty is created. Glanville wrote that 'design is a circular, conversational process' (Glanville 2009). Conversation, in the cybernetic sense, is not limited to a conversation between human beings (although it could be), but a mutual interchange between agents, materials, texts or artefacts, where each influence and updates the structural composition of the other in the exchange. In this process, novelty is created. Design cybernetics is thus uniquely positioned to describe systems with goals, and as inferred from the literature review, no other systems languages have this approach.

3.1.1 History and context

To set the stage for the chapter, a brief overview of Cybernetic history is provided. Cybernetic ideas have profoundly influenced computer hardware, and software and computer products are also integral parts of most service systems today. Cybernetics explores similarities in mechanical, biological and social systems. It is considered a *meta discipline*, like mathematics, to describe and understand dynamic, *goal-oriented* systems (Scott 2002). An early trace of cybernetic ideas was presented in a paper in *Philosophy of Science* on 'Behaviour, purpose and teleology' (Rosenblueth, Wiener and Bigelow 1943), by the interdisciplinary trio Arthur Rosenblueth (physiologist), Norbert

Wiener (mathematician) and Julian Bigelow (engineer) (Dubberlyand Pangaro 2015). *Teleology* refers to the description of something as a function of its goals or purpose. Teleology is considered somewhat controversial in science and promotes that beings or objects have a 'will', a self-generated purpose, rather than a purpose derived from a causal chain of events (Allen and Neal 2020). Von Glaserfeld writes that cybernetics 'rehabilitated the concept of purpose' which 'opened the path to studying *purposive agents*, the domain of second-order cybernetics' (von Glaserfeld 2002). Second-order cybernetics is an axiological epistemological approach that opens for value judgments concerning ethics and aesthetics and operational descriptions of how these are formed and reformed.

A proposed definition of cybernetics was formulated by Norbert Wiener in 1965, stating that cybernetics is the science of 'communication and control of the animal and the machine' (Wiener 1965). In this context, control alludes to the patterns of constraints that regulate a system's abilities to fulfil its goals or intent, whether biological, physical or mechanical systems. The words 'govern' and 'cyber' both stem from the same Latin word, *kybernan*, which means 'to steer'. The concepts of governance and cybernetics are related to steering, people, machines, systems, nations or organisations. Paul Pangaro even refers to Cybernetics as "the science of steering". He makes the analogy to a helmsperson trying to keep a boat on course, by observing, acting (adjusting the course), observing again and altering the course, in a recursive, circular process (Pangaro 2019).

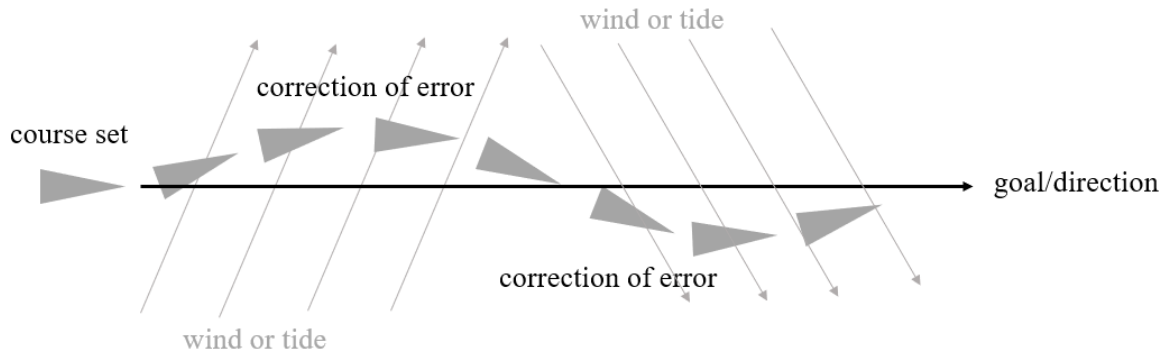


Figure 33: Steering in cybernetics. Adapted from Pangaro (2014).

The original cybernetic ideas were formulated in the post WW2 era and have since influenced contemporary research about computer systems, artificial intelligence and human-computer interaction research. During WWII, it became imperative to deal with complex systems beyond human understanding, driven by the 'space race' and more complex computer products. Cybernetics' philosophical background formed at the end of the era of modernism, characterized by a belief in modernity: science, rationality, and efficiency. The term cybernetics has been ascribed to Norbert Wiener, a mathematics professor at MIT who published *Cybernetics: or Communication and Control in the Animal and the Machine* in 1948, describing self-regulating mechanisms (Wiener 1985).

Cybernetics was firmly established at the Macy conferences (1946-1953), funded by the Josiah Macy Jr. Foundation. The Macy conferences attracted a truly interdisciplinary crowd including Gregory Bateson, John von Neumann, Margaret Mead, Warren McCulloch, and Rosenbleuth, Bigelow and Wiener. Key concepts such as second-order cybernetics (the cybernetics of cybernetics) were introduced by Margaret Mead and Von Foerster (Mead 1968).

After its heydays in the ’60s and ’70s however, cybernetics was largely absorbed by other domains. Some claim that it ‘lost the battle’ with artificial intelligence (AI), which could demonstrate higher practical value and attract more investments than the more theoretical field of cybernetics. (Pangaro 2017b) Cybernetics was dispersed as a discipline. However, it lived on in different corners of academic counterculture, to eventually re-emerge in the context of design.

3.1.2 Second-order cybernetics and metadesign

The introduction of second-order cybernetics is considered a pivotal turn in cybernetics. While first-order cybernetics focuses on systems that act according to its established structure, second-order systems apply the study of cybernetic systems to itself. Von Foerster phrases it that first-order cybernetics as ‘the science of observed systems’ while second-order cybernetics is ‘the science of observing systems (Von Foerster 2003). Second-order cybernetics follows a *constructivist* view of the world, which suggests that there is no independent reality, what exists are different perspectives, constructed by different observers. In a radically constructivist worldview, the reality is not *the* reality but *a* reality (Hohl 2019). There is no objective truth, but a constructed reality, that exists in the language, descriptions and understanding of the actors, subjective observers who are part of it.

Second-order cybernetic systems can thus be considered *meta-systems* that influence first-order cybernetic systems' structures, goals, and functionality. As an example, Sweeting frames design research itself as a second-order cybernetic practice (Sweeting 2015, 2016), where design is considered a first-order cybernetic activity. Using a mechanical system as an example, Dubberly and Pangaro describe the first-order system as nested within a second-order system (figure 34). The second-order system influences the first-order system's goals, thereby ‘controlling’ or ‘regulating’ it, in a cybernetic sense. The classic example of a first-order cybernetic system is a *thermostat*, keeping the temperature constant, sensing changes in the environment and regulating the heater accordingly. The second-order system, in the example of the thermostat is the human being setting the temperature, according to her desires. Higher-level systems can be higher-order systems which influence what is perceived as comfortable: whether the human is cold, warm, et cetera, why it sometimes makes sense to discuss hierarchies of *nested* second-order systems (Dubberly and Pangaro 2015). Although higher dimensions of cybernetics are sometimes proposed, they are often allocated to second-order cybernetics domains.

While first-order systems are rules-based, second-order cybernetics invites for value judgements. As second-order systems define goals for first-order systems, they deal with value judgments of what constitutes desirable goals. Value judgments are fluid and subjective, and through conversation between agents, second-order goals can be influenced.

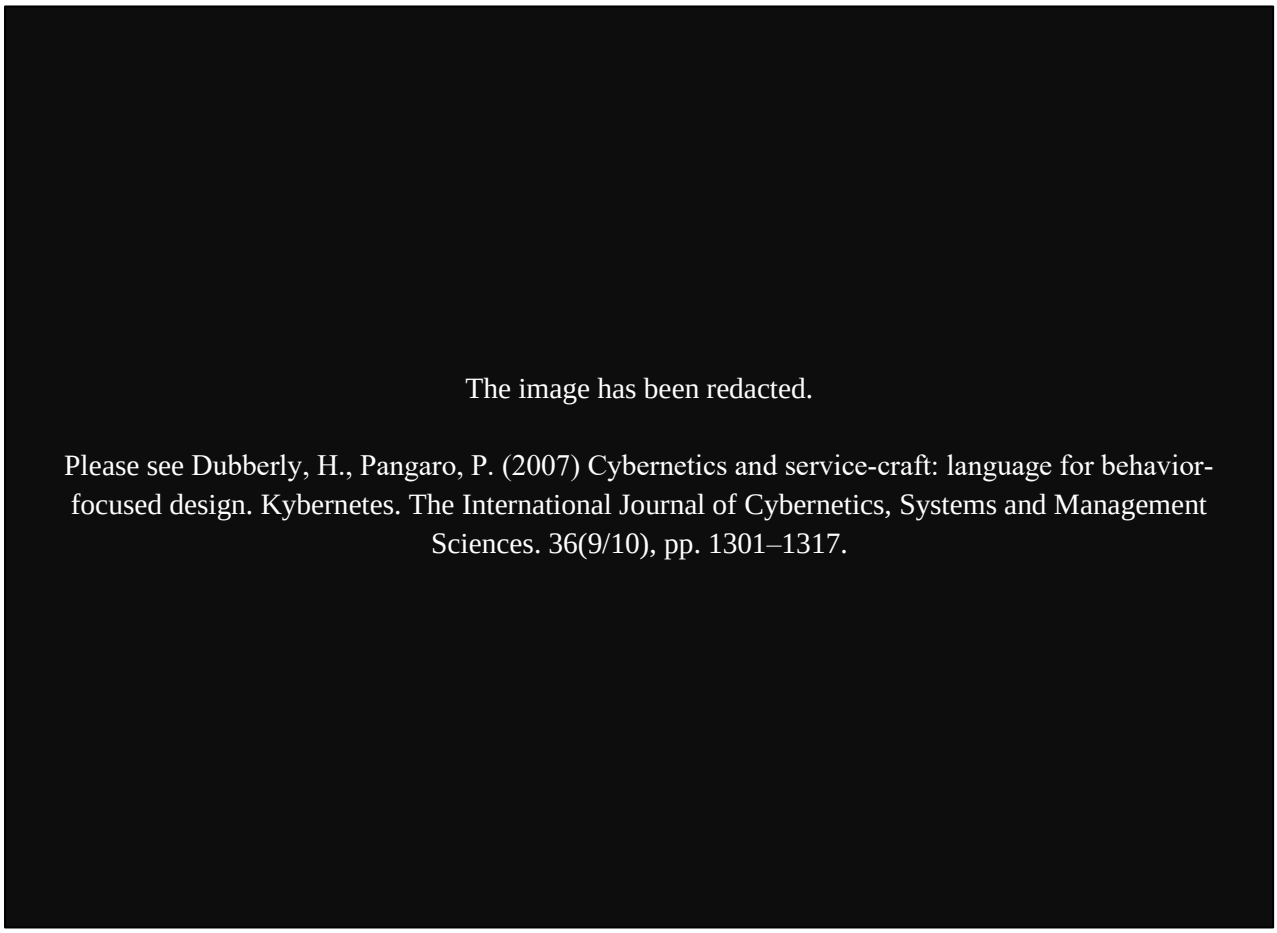


Figure 34: A second-order system, reprint of Dubberly and Pangaro (2007)

The rise of second-order cybernetics

In 2018, Riegler, Müller and Umpleby published *New Horizons for Second-Order Cybernetics*, in which they argued that second-order cybernetics had failed to fulfil its potential (Riegler, Müller and Umpleby 2017). In the anthology, Müller and Riegler (Müller and Riegler 2017) outlined a fivefold agenda for second-order cybernetics to renew its relevance:

1) Building an alternative general scientific methodology
2) Building specialized endo-methodologies for different scientific disciplines
3) Offering foundational frameworks as well as reframing and contextualizing research problems across all scientific disciplines
4) Creating reflective circular practices within applied disciplines
5) Building special circular reflexive approaches for special niches within artistic domains

This research contributes mostly to agenda points 2-5, where I continue to explore how second-order cybernetics can be applied in design domains. Further on in the anthology, Umpleby (2016) provided a helpful table describing common distinctions between first- and second-order cybernetics. As a design researcher, you recognize certain pairs, such as the analysis-synthesis dichotomy which is commonly used in design research (Dubberly 2014) and a shift from unreflexive to reflexive points of view. Among the ‘common conceptual rubrics’, we find the dichotomy between engineering and natural sciences (the ‘hard’ sciences) and the social sciences, humanities design and arts (the ‘soft’ sciences).

Dimension	First-order	Second-order
Commonly cited distinctions		
Approach	Reductionism	Holism
Method	Analysis	Synthesis
Primitives	Entities	Relations
Processes	Deterministic	Probabilistic
Relation to designer	Controlled	Autonomous
Relation to designer	Designed	Self-organised
Embeddedness	Context free	Context dependent
Role of observer	Observer-free	Oberver-dependent
Position of observer	Outside observed systems	Embedded in pbserved system
Theory dependence	Theory-free phenomena	Theory-determined phenomena
Metaphysics	Ontology	Epistemology
Working framework	Naïve or critical realism	Pragmatism, social constructivism
Aim	Understanding (prediction)	Action (intervention)
Definition	Clarity, operational definitions	Ambiguity as opportunity
Subjects	Inanimate objects (nonhuman)	Thinking participants (human)
Reflexivity	Unreflexive	Reflexive
Medium of interaction	Physical	Language
Mode of interaction	Communication	Conversation
Common conceptual rubrics		
Historical period	Early cybernetics (1930-1975)	Late cybernetics (1975-present)
Target system	Artificial devices	Human systems
Diciplines	Engineering and natural sciences, medicine (biological)	Social, psychological, therapeutic arts and sciences, management, arts, organisational and social change
Umpleby's perspective		
Purposive systems (systems with embedded goals)	Study, design, construction and use of purposive systems (natural or artificial)	Study, design, construction and use of interactions between purposive systems (natural and/or artificial)

Figure 35: Proposed dimensions of first- and second-order concepts, adapted from Umpleby (2016)

The book by Riegler, Müller and Umpleby (2017) can be contrasted with the book by Fischer and Herr (2019) on Design Cybernetics, where the latter paints a hopeful picture of an emerging, exciting and vibrant area of research.

Sociocybernetics

Like design cybernetics brings a cybernetic perspective to design, *sociocybernetics* concern the application of cybernetic thinking to social sciences. The book *Sociocybernetics* by Geyer and van der Zouwen (1978) consolidated ideas about cybernetic 'steering' in social systems. Although not explicitly concerning design and behaviour change, sociocybernetics has some notable ideas relating to human purposive behaviour relevant in this context. It has been suggested that second-order cybernetics can be used to address wicked problems such as climate change, species extinction and food shortage (Scott 2009). The author denotes these problems 'first-order problems', while 'second-order problems' concern governing human beliefs, values, and behaviours regarding the global challenges. It has also been proposed that conversation theory is useful in learning design and that designers can apply conversation theory in their personal practice as reflective, participating observers (Scott et al. 2007).

Higher-order cybernetics

Several scholars have discussed whether there are also reasons to add a third- and even fourth-order cybernetic systems. Mancilla (2011, 2013) describe third-order cybernetics as sociocybernetic systems, mutually observing systems such as people interacting in society, while he describes fourth-order cybernetic systems as *self-observing systems*. Von Foerster's opinion about higher-order cybernetic systems, supported by Glanville (2002), was that 'It would not create anything new, because by ascending into the second-order, as Aristotle would say, one has stepped into the circle which closes upon itself. One has stepped into the domain of concepts that apply to themselves.' (von Foerster 2003, p. 301), essentially dismissing any order higher than second-order cybernetics, because they are already implicit in second-order cybernetics. Although I understand the desire to add more layers of analysis to systems, I find Von Foerster's and Glanville's arguments more convincing. In our case, even though our model of a persuasive service system has more than two hierarchical levels, they can be analysed using the same concepts, by merely applying another recursive layer of the same principles.

3.1.3 Design Cybernetics

In the past decades, cybernetics has been revived as a (trans) discipline and an intimate relationship has emerged between cybernetics and design. The circular, iterative creative process is central to cybernetics, and more and more evidence suggests that it is also central to design. The cybernetician

and architect Ranulph Glanville went so far as to state that cybernetics is the language of design and design is the practice of cybernetics. Sweeting (2015) dissected Glanville's writing on this topic further. He emphasised that cybernetics should be seen as a way to understand design, as an *epistemology*, rather than as a means for applying more 'scientific' methods to design. He states that cybernetic theory can inform design and that design practice can also inform cybernetic theory (Sweeting 2015). Glanville further writes that Cybernetics has found a new home in design, not least because of its usefulness as a theoretical, substantial language for design, which is otherwise mostly practice-based research (Glanville 2007). Sweeting (2017) lists a few other parallels between design and cybernetics.

- It is conversational, i.e., cybernetic, structure to the way designers work.
- Both are constructivist activities, 'forward-looking searches' to create new ideas or opportunities, rather than replicating what already exists.
- Modelling is done as part of thinking, rather than as a representation of thought.
- Epistemological questions in design correspond to those in second-order cybernetics.
- Design is a self-reflexive activity and, as cybernetics, a discipline which can be applied to itself.

The groundwork for merging the two disciplines was led by researchers who have contributed strongly to making Cybernetics more accessible to a broader audience, by packaging key concepts in more accessible, communicable formats and articulating the links between cybernetics and design. (Dubberly and Pangaro 2009a/2009b/2010/2015/2019, Pangaro 2019, Glanville 2007/2009, Krippendorf 2019, Sweeting 2015/2017, Fischer and Herr 2019) Dubberly and Pangaro argue that design offers a foundation for 21st-century design practice and recognises that design has shifted towards studying systems and ways of influencing them. (Dubberly and Pangaro 2015) Since design research and practice has embraced systems thinking as an approach to problem-solving, the cybernetic understanding of systems follows naturally.

Sweeting also argues that design research is not just a field influenced by second-order cybernetics, but a variety of it. In the light of a renewed interest in second-order cybernetics and second-order science (http://www.secondorderscience.org/), the three modes of design research which Frayling summarized as research *for* design, research *about/into* design and research *through* design could all prove to be relevant research modes for second-order science as it develops going forward (Sweeting 2017, Frayling 1993).

As we enter 2020, *design cybernetics* is emerging as a discipline of its own, and leading arts, design and technology institutions are taking the ideas of cybernetics in design seriously. There have been several PhD dissertations at the Royal College of Arts in the 2010s applying cybernetic tools to understand complex design processes, including Tibor Balint's work with NASA on second-order

cybernetics (Balint 2017) and Delfina Fantini van Ditmar's exploration of cybernetic home appliances. (Fantini van Ditmar 2016) In the United States, Hugh Dubberly and Paul Pangaro taught a course in cybernetics and systems between 2002-2007, and around 2016, design cybernetics and second-order cybernetics was adapted by MIT Media Lab's former director Joi Ito, who based the Lab's operating philosophy on cybernetic ideas, which he outlined in the article *Design and Science* in 2016 (Ito 2016). In 2019, the anthology *Design Cybernetics* was published, edited by Thomas Fischer and Christiane Herr, to establish design cybernetics as a 'foundational perspective on design research', a design philosophy to guide theoretical and practical development (Fischer and Herr 2019). The narrative of cybernetics and second-order cybernetics is compelling to designers. In the next section, I will provide a more extensive background, to make a case for why design and cybernetics go well together.

3.1.4 Cybernetics - a theoretical operating system for design

The digital revolution generated several *systems approaches* across disciplines and notably, in design. However, the turn towards systems approaches in design has sometimes been accused of being science-led: reductionist, relying on a mechanical, linear engineering mindset and a deterministic world with automata and machines. On the other hand, design is messy and inherently non-linear and connecting the two domains may seem unintuitive. Is there not a risk that a systems approach threatens the unique identity which design research has managed to carve out? However, Dubberly and Pangaro point to the *dual nature of cybernetics and second-order cybernetics*, where the former aids designers in modelling linear, structured first-order systems. In contrast, second-order cybernetics deals with the observer's subjective and sometimes messy role in systems that determine what is good and bad, beautiful or ugly. In their view, cybernetics does neither require, nor promote, a reductive stance. Rather, it gives designers tools to understand complex challenges and work with uncertainty, ambiguity and values. Whereas first-order cybernetics are objective descriptions of rules-based systems, second-order cybernetics adds a layer of subjectivity on the system, by including the system's observer as a non-negligible agent. As Dubberly and Pangaro write, cybernetics is a way of framing *both* the design process *and* the thing being designed (Dubberly and Pangaro in Fischer 2019), meaning that it can both capture the dynamics of first-order cybernetic systems and reflective, learning, second-order cybernetic systems. Herr (2019) argues that radical constructivism is an appropriate epistemological foundation for design cybernetics. Whether the construction concerns a thing, a thought or a concept, the design process is a construction of new understanding and knowledge. This epistemological stance places science and its approach as a subset of design, which also Glanville subscribed to (Glanville 2009).

The authors argue for the epistemological advantage and value of the cybernetic approach to design. It was created mostly by scientists and is firmly grounded in science. However, it *also* allows

researchers across disciplines to have a conversation about complex, ambiguous and subjective domains which traditionally have been ascribed to the domains of arts and design. Thereby, it becomes genuinely interdisciplinary, without patronizing any discipline. As Müller and Riegler (2017) write, '*Second-order cybernetics can move away from these battles and into the core of science by offering general and special methodologies for research and new instruments for reframing and contextualizing research problems across all scientific disciplines.'*. The 'hierarchy of sciences' with natural sciences at the top and social sciences at the bottom has been described by Cole (1983), and unfortunately, the sentiment that arts, design and humanities are less 'scientific' and thereby less valuable still prevails. The inability of certain scientists to embrace subjectivity in research may hold back scientific progress, Lissack (2017) writes, '*hidden values—precisely because they are hidden and not made explicit—can get in the way of the public's acceptance of a scientific claim.*'. When Herbert Simon proposed a science of the artificial (Simon 1996), he began formulating a bridge between pure and applied sciences, which eventually emerged as the transdiscipline design. Design is perhaps the ultimate meta-science, a framing of the ongoing second-order conversation about how things, theories and life come about in the world, deeply grounded in practice and theory.

If computerized control systems and automated factories were all the rage in the '50s and '60s, Artificial Intelligence (AI) is arguably the contemporary equivalent. Designers are now working with AI as materials for new applications, services and experiences, why original cybernetic models are now reintroduced to understand the emerging phenomenon of purpose-built AI such as goal-orientation, feedback loops, learning and recursiveness. AI, or more precisely, developing theories of the human brain (or hypothetical artificial brains) and its ability to learn, has its roots in cybernetics (Pickering 2010a). There exists extensive cybernetic literature about the nature of cognition and the brain, however, there is unfortunately not enough room to cover that in this research. As we enter the Anthropocene (a proposed term for a new geological era when human activity influences the planet's climate and terrain), the expansion of the domains of the Artificial, as embodied in exponentially accelerating technological development, has led to increasing complexity in the domain, answering a few questions, but leading to many, many more new questions for researchers to answer (Steffen et al. 2011).

Next, I will describe the following relevant bodies of work which have contributed to defining the domain of design cybernetics. The purpose is to give the reader an overview of concepts that inspired the design process and contributed to the evolution of the ideas. Based on these accounts of design and cybernetics, I have distilled vital concepts, which will be discussed in greater detail in the next section. Due to the constrained format of the thesis, this section is intentionally kept brief, for more extensive accounts, I refer to for example Pickering (2009), Glanville (2014) or Dubberly and Pangaro (2015).

3.1.4.1 Earlier connections between design and cybernetics (1946-1975)

Although not explicitly so, cybernetics and design have been intimately connected since the conception of both disciplines. For a long time, design as an activity was siloed in disciplines such as arts, crafts and architecture and during the modernist era (late 19th to early 20th century) there were numerous attempts to 'scientise' design, i.e. trying to apply tools of rationality and objectivity to the field. In 1923, Le Corbusier wrote that a house is a 'machine for living in' and he implied that the ultimate goal for designers was to make *effective and efficient* systems. The '60s, however, was the decade when a distinct design research domain came together with the conference on Design Research at Imperial College in 1962 and the subsequent founding of the Design Research Society in 1966. Also, Bruce Archer, the first Professor of Design Research, was installed at the Royal College of Art. Archer's PhD thesis built on second-order cybernetic concepts developed by Tomás Maldonado at Hochschule für Gestaltung Ulm in the 50's already (Boyd Davis and Gristwood 2016). At the time, the prevailing paradigm was that of design-as-science, where a scientific, rational approach was still heralded (Cross 2001).

Interdisciplinarity was generally not encouraged at the time although a few pioneers were breaking new grounds. Between 1968 and 1972 Stuart Brand published *The Whole Earth Catalogue*, a magazine situated in the interdisciplinary nexus between systems science, design and computing. The publication was pioneering at the time in connecting different disciplines of research.

However, the '60s was also a time of turbulence in the world - the Cold war and the Vietnam war led to the rise of anti-establishment countercultures. Campus revolutions and radical political movements emerged across the US and Europe (Cross 2001). There were voices raised that design should find its voice and break free from scientific hegemony. In 1968, Herbert Simon offered a new distinction between design and science, where he positioned design as 'The science of the artificial'. He wrote that 'the natural sciences are concerned with how things are [...] design, on the other hand, is concerned with how things ought to be' (Simon 1968, p.114). This distinction has stuck and is now a clear differentiator which defines the design discipline. Donald Schön and others proposed that design was a purely constructivist activity and needed to find its epistemological grounds to build a reputation from. That was echoed at the Design Research Society's 1980 conference, where the consensus was that the discipline should move away from a scientific approach and instead seriously explore the designerly approach's affordances. To see *design as a discipline*, but not design as a science, as Nigel Cross suggested (Cross 2001).

In parallel to design's struggle to find its identity as a discipline, Cybernetics also tried to find its place in academia. Based on fundamentally constructivist approaches to knowledge, both cybernetics (second-order cybernetics in particular) and design have been considered countercultures to prevailing paradigms in science. However, with the introduction of second-order cybernetics, this changed. As Dubberly and Pangaro (2015) wrote, '*suddenly, serious researchers were talking*

seriously about subjectivity - about language, conversation and ethics - and their relation to systems and design.'.

The emphasis on knowledge through practice and making has been prevalent in both design and cybernetics. Andrew Pickering (2009) describes how early cybernetics often had a *performative* component, where cybernetic researchers embodied their arguments in machines and experiments which attracted public interest. *The Tortoise* was built by Grey Walter, as a light-seeking robot which simulated the goal-function of a living animal. (Exhibition Robots) Gordon Pask designed the *Musicolour machine* and the *Colloquy of Mobiles* as two interactive installations exploring interaction and conversations between men, machines and their environments. Stafford Beer allegedly experimented with simple biological computers, which he grew in his garage and researched in his spare time (Pickering 2009). To me, these experiments are clear examples of design approaches, where the researchers were constructing knowledge *through* design (Frayling 1993), embodying their cybernetic theories in vivo and using them as evidence for their theses. However, these experiments were likely also driven by 'delight' which Glanville often refers to, an intrinsic aesthetic pleasure in the act of designing, which leads to novel ways of thinking and making.

Contemporary design practices and design thinking are now making their way into the higher echelons of organisations. Strategic design and design thinking have emerged as tools for corporate managers. For that reason, it is worth mentioning an early idea of cybernetic design of organisations. In the '60s, the British cybernetician Stafford Beer introduced a cybernetic perspective to operations research (OR) and management studies. Beer's *viable systems* approach framed companies and organisations as goal-seeking entities focusing on achieving an autopoietic state, trying to anticipate and adjust to disturbances in the political and business environment (Beer 1984). He was famously appointed to apply his theories to the Chilean economy, a project which unfortunately was upended with the murder of his client - President Allende. Beer's ideas could arguably be seen as a form of *strategic design*. He drew parallels between living systems and organisations and designed them to survive in the operating business environment. Beer's approach to organisational diagnostics is not the only framework offered by operations research consultants. In the 2000s, Paul Pangaro worked with applied cybernetics and Pask's conversation theory as a consultant to organisations such as DuPont (Pangaro 1989). Daniel Lockton founded the agency *Requisite Variety* working with clients such as Jaguar, Dyson and IDEO (http://requisitevariety.co.uk/).

In 1987, the connection between design and cybernetics became more evident, and Donald Schön published *Educating the reflective practitioner*, where he built upon Pask's theories of conversation to formulate an argument for how practitioners' knowledge is created (Schön 1987). He made an example of how practitioners have conversations with themselves when sketching and doodling; creating a circular, evolving learning cycle between mind, pen and paper. Schön wrote that practitioners might, when reflecting on their practice, reflect on tacit norms which underlie

judgements, feelings which inspired their actions, the way they have framed the problem or his/her role within the context. The analogy to second-order cybernetics is evident: Schön does describe not only the first-order design act but also the reflective second-order aspects of the act: feelings, judgements, and the observer's role in the act of practising one's profession. He also describes how the circular interaction between the practitioner and the materials they work with generate new knowledge, while 'wandering', exploring, trying something, testing something else over and over.

"…then the practitioner may surface and criticize his initial understanding of the phenomenon, construct a new description of it, and test the new description by an on-the-spot experiment" (Schön 1987, p 63)

The practitioner's reflective circle: making - observing - reflecting - making again is cybernetic, in the sense that the practitioner is an intelligent agent, a second-order cybernetic system, who acts in the world, senses what happens and then adjusts their activity until the goal is reached. The 'goal' for an intelligent system, however, is sometimes a moving target. Although the activity is circular to its nature, it is occasionally *goal-seeking* and sometimes *goal-oriented*.

3.1.4.2 Contemporary connections between design and cybernetics (1975-present)

The first wave of cybernetics ended around 1975 (Kline 2015 in Umpleby 2018). Since 1975 there has been a distinct turn towards second-order cybernetics. There are several influential strands of design cybernetics, which I will dive a bit deeper into. In the 36th (9/10) double-issue of Kybernetes, edited by Glanville, he recognized in the guest editorial section that himself, Krippendorf and Dubberly/Pangaro were the only people who were educated in and taught and practised both design and cybernetics (Glanville 2007a). Given their influence in contemporary design cybernetic thought, I have chosen to reflect on their writings and how it has influenced my practice.

Glanville's approach to design cybernetics

Ranulph Glanville was an Anglo-Irish architect and cybernetician who led the design cybernetic movement through a critical decade and was the president of the American Society of Cybernetics from 2009 until his passing in 2014. Glanville positioned and vigorously defended design as the practice of cybernetics and cybernetics as the theoretical arm of design.

Müller and Riegler (2017) share three aspects which they believed characterized Glanville's work. They state that it 1) focused on high-level abstract frameworks that produce the possibility for others to build cybernetic work on, 2) promoted the circular act of designing in the contexts of production and reflection and 3) that Glanville was much of an observer himself in the texts he wrote.

I will highlight another aspect of Glanville's work which I believe has been vital for connecting the two domains: promoting the romantic values of design; *purposelessness*, *wandering* and *delight*, and integrating these designerly values into the science-led taxonomy of cybernetics.

Glanville strengthened the axiological aspects of second-order cybernetics, by emphasizing the seriousness of the ethical and aesthetic dimensions of arts and design. For Ranulph Glanville, delight was an important feature (not a bug!) in design, the 'x-factor' in the act of design which engineering often fails to account for. In A (cybernetic) Musing: Design and Cybernetics, Glanville refers to Vitruvius's De Architectura. Vitruvius wrote that architecture is constituted of three parts; utilitas, venustas and firmitas. The first two, utilitas (commodity) and firmitas (firmess) are relatively easy to work with in design: constructing things which have a certain function and which are fit-for-purpose (Glanville 2009). Venustas, however, was later translated by Sir Henry Wotton as delight. Delight, however, is perhaps more slippery and difficult to quantify, measure and test for. Glanville writes that 'the exclusion of delight is particularly apparent in Engineering Design, where it is often seen as superfluous - a trivial distraction.' However, Glanville also states that 'Design is about doing more than simply satisfying the necessary (being well-built and fit-for-purpose). This can be contrasted to Le Corbusier's modernist approach, where delight was a by-product rather than an essential variable (1986). Glanville also recognized the role of non-utilitarian exploration in design and introduced the idea of anti-cybernetics for describing purposeless activity such as doodling with a pen and wandering without a plan in the woods. He argued that the purposeless activity could lead to new, unexpected discoveries, as a novelty source and variety. 'If doodling has a purpose, it may be to find (rather than assume) purpose.', he writes. While delight does not have a natural place in first-order cybernetic systems, it is an integral part of second-order cybernetics, which Glanville helped us recognize.

Krippendorf's semantic turn

In addition to Glanville's broad contributions to design cybernetics, I will account briefly for the 'semantic turn' that Krippendorf argues for in design, which can help us better understand the connection between design, cybernetics, rhetoric and persuasion. Krippendorf argues that language and semantics play a central role for cyberneticians and designers in a constructivist world. He builds on Ashby's theories of cybernetics, 'the study of all possible systems informed by what cannot be built or evolve in nature.'. By putting 'designers and observers on equal footing', Krippendorf connects cybernetics to design. He writes that 'systems are always under continuous reconstruction by its constituents', networks of observers who are simultaneously proposing and constructing reality in discourses. He states that 'To design artefacts for use by others requires second-order understanding.', i.e., a designer needs an understanding of other people's understanding of an artefact and what it allows them to do. As I perceive his view, the continuous construction of the world takes place in conversation, meaning that the languages we use to construct it should be taken seriously. Paul Pangaro also connects language to second-order cybernetics, describing first-order cybernetics systems as 'goal-directed systems, organic or constructed' and second-order cybernetics as 'linguistic, goal-directed systems organic or constructed'. That definition is useful in this research for positioning

persuasive systems, which are also goal-oriented, as an analogy for second-order cybernetic systems (Pangaro 2014).

Another part of Krippendorf's writing that has inspired my research the most is a peripheral argument in his reasoning about human-centred design. He writes:

'What designers pass on to other stakeholders in design are proposals. Proposals occur in language. Whether these proposals utilize drawings, models, video presentations, and more or less detailed suggestions, the products of designers are essentially communicative and their sole purpose is transmission to those who matter. If designers work within a network of stakeholders, which can make or break a design, their proposals need to enrol them into the project of a design (Krippendorf 2019).

That resonated with me because design proposals are such simple, important, but largely forgotten constructs that profoundly impact people's lives. On a macro level, the world is built on proposals: political proposals, business plans, petitions and blueprints. Without a design proposal, a building would never have been made. The Chinese Belt and Road initiative has been described as the world's largest design proposal (Bratton 2016). It is a massive proposal, which needs to enrol thousands, even millions of stakeholders to become a reality. Thousands of minds and hands shape it; it is dynamic and shaped by external and internal influences and circumstances.

On a micro level, people's lives are often steered by proposals we make; proposals for employers to hire us, proposals for academic institutions to take us on - even marriage proposals are proposals which we put out into the world to enrol particular people in.

Furthermore, Krippendorf's theory suggests that there exist 'successful' proposals, meaning that there is a persuasive dimension connected to design proposals. A successful design proposal is thus a persuasive proposal which allows the designer to enrol a desired group of stakeholders in their design project. Design proposals which fail to be adequately communicated to the world will not be realized. Connecting this to the 4P framework - with possible, plausible, probable and preferable futures originally developed by Hancock et al. (1994) and popularized by Voros (2017) the power to realize a preferred future lies in the designer's ability to design persuasive design proposals.

That brings us into the domains of politics and power - a designer's power to determine the future can be considered their ability to enrol stakeholders in their design proposals. For persuasive systems, the persuasive properties are by definition explicit, for other systems, there may still be persuasive properties embedded in the system's structure, although they may be implicit. Although a designed system may seem unintentional and non-persuasive, it may still communicate language, impacting second-order systems.

Dubberly and Pangaro's models

Given the abstract nature of cybernetics, Cyberneticians' enduring mission has been to develop communicable metaphors for the plethora of concepts in first- and second-order cybernetics. Gordon Pask even referred to cybernetics as 'the science or the art of defensible metaphors. (Pask 1966). An example of successful transdisciplinary collaboration that has contributed to making cybernetics accessible to designers and not just defended but also designed new metaphors for cybernetic concepts, is that between the designer Hugh Dubberly and the cybernetician Paul Pangaro. Over nearly four decades the duo has generated extensive *communicable knowledge* in the form of models, articles and practical projects, situated in the nexus between design and cybernetics. They were also among the first who explicitly taught courses in design and cybernetics: between 2002-2007, Dubberly and Pangaro taught a course in Design and Cybernetics at Stanford University, focusing on 'similarities between the framework of cybernetics and the processes of design'. The course's offering to students was: '*Students will learn not only the history and principles of cybernetics but also expand their notion of design, extend their repertoire of design methods, and gain a valuable perspective from which to critique design activities and outcomes.'* (Stanford University 2006).

The course was designed as a traditional university course, where the students learned the history of the subject, learned about system tools and applied them to a project of their design. Examples of assignments included *model a system in cybernetic terms* and *model a second-order system*. Cybernetics was conceived by scientists, biologists, physicians, engineers and mathematicians, and although their abstractions held up to stringent scientific standards, they were often complex and inaccessible to a broader audience. Visualising simple metaphors, such as the thermostat, or a conversation between two people has helped me tremendously when trying to navigate the complexities of cybernetics. When modelling, however, there is a latent risk for *reductionism*. Sometimes, the map does not represent the territory, which one needs to be aware of when creating a model, or scrutinising an existing model. Dubberly raises this issue in *Models of models*, where he emphasises the importance of revisiting models and updating them and updating the models of models continuously (Dubberly 2009b). According to Benyon and Imaz (1999), models are essential for communicating, exploring, testing or recording design ideas and decisions both within design teams and external stakeholders. Models hide some details so that the more critical features can stand out. For persuasive systems and service designers working with digital platforms, having one or more useful models for describing the systems are essential. Better models create shared understanding for the system at hand and make it easier to work with them across disciplines. Paul Pangaro has also contributed to design cybernetic scholarship by extensively decoding Gordon Pask's work, making it understandable and accessible, and translating and applying Pask's conversation frameworks to contemporary contexts (Pangaro 2018).

Becoming a design cybernetician

As Glanville noted when he edited the special double-issue of Kybernetes on Design and Cybernetics, few researchers have explicitly taught design and cybernetics (Glanville 2007a). There have been several approaches, ranging from more conventional programs and courses taught at universities, to innovative and arguably more esoteric approaches. Krippendorf, Pangaro/Dubberly and Glanville, and Baron and Herr, and Hohl have all taught courses in design and cybernetics at established universities and used concepts from cybernetics for designing educational experiences. For example, Baron and Herr (2019) provided a thorough account of how they have integrated conversation theory in their teaching in China and South Africa. Other examples include that of Richards (2020) who have developed novel formats in which acting cybernetically is the focus. These approaches have all contributed significantly to the understanding of how cybernetics can be taught and disseminated. However, there is more work to be done before cybernetics is a cornerstone in education, to guide human action in the world. I reviewed a series of articles which concern how people came to discover cybernetics. There is a treasure trove of stories themed 'How I found Cybernetics', collected on the American Society for Cybernetics' website, collected from an email list on Yahoo Groups in 2008 American Society for Cybernetics 2008). In the anthology *For the love of Cybernetics*, edited by Jocelyn Chapman, nine prominent cyberneticians describe how and why they discovered cybernetics and what it has meant for their practice (Chapman 2019). How did these researchers get into Cybernetics in the first place? From the stories, there are two broad trends:

1) Because of an interest in the theoretical universe which Cybernetics offers.
2) After meeting a charismatic cybernetician who inspired one to explore further.

For example, Paul Pangaro describes how he was 'seduced by the personae of Gordon Pask', and Pedro Martin's described how meeting the charismatic Gordon Pask shaped his research 'you can see how influent Gordon [...] was/were not only in my research path but also in my personal vision of the world.'. Charismatic cybernetic researchers contributed greatly to popularising cybernetic research.

3.2. What can a design cybernetic approach offer service design?

To address some of the challenges specified in chapter 2, I here make explicit the connection to the field of design cybernetics. The purpose is to explain why a design cybernetic approach could be useful for, and contribute to, the understanding of services as persuasive platforms.

It is important to emphasise that cybernetic ideas have, to some extent, already been applied in service design contexts. Beer's application of VSM to Chile's government in Project Cybersyn can

be seen as a form of service design for the public sector. Pask's Musicolour machine has been described as a 'theatrical object', but it was often delivered as part of an experience, an entertainment service, in theatres (Pickering 2010, p. 319). These projects took place before service design had matured as a discipline, and before the Internet was established.

Dynamic models for emergent persuasive service systems

As described in chapters 1 and 2, services as persuasive systems are emergent systems, where stakeholders are enrolled and active throughout the services lifetime. Over the lifetime of an app or a web service, numerous designers, managers and engineers come and go, adding complexity to tracking and tracing responsibility for design decisions and the goals and mechanisms of the service system. The 'unspeakable horrors of legacy code' are well known among programmers in large organisations (Pasco 2019).

What makes design cybernetics unique is its ability to capture second-order cybernetic dynamics of design activity. The designing system is an integral part of the system that is being designed. While first-order cybernetics can be used to describe persuasive service systems as purposeful, goal-oriented systems, second-order cybernetics can be used to describe the function, goals and intents of the designing system, which either determines the functionality and goals of linear, first-order systems or negotiates goals with other second-order systems. The design cybernetic perspective acknowledges the existence of first- and second-order cybernetic systems, to create a *holistic* understanding of multi-level goal-oriented systems. However, certain persuasive service systems can arguably be described as second-order adaptive and learning systems.

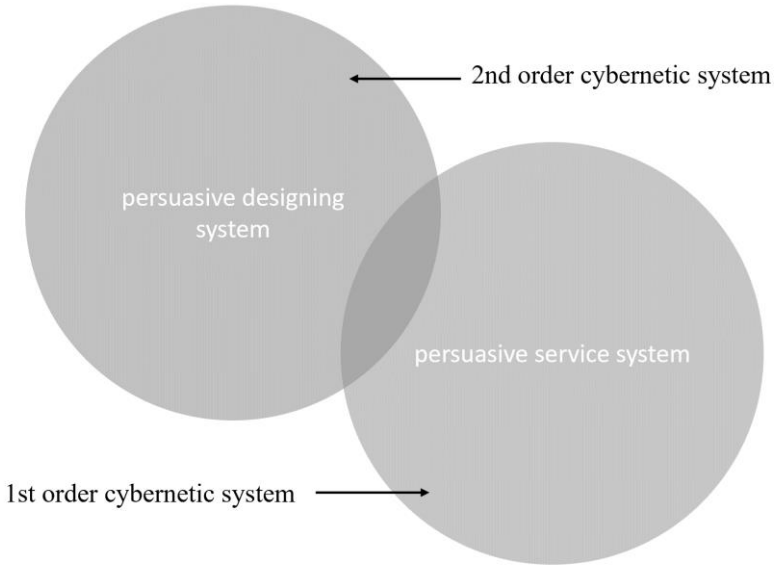


Figure 36: Multi-level goal-oriented system.

A conversational approach

Second, the focus on *conversations* as a basic unit for epistemic analysis distinguishes design cybernetics from other approaches. Conversations between cybernetic systems are at the heart of design cybernetics and also of design practice. By constructing models for persuasive systems rooted

in design cybernetics, we may arrive at dynamic models to understand how persuasive systems emerge and how their goals and functionality change over time with conversations. Design cybernetics is also *systems agnostic*, meaning that the behaviours of the systems involved in a service are the units of analysis, rather than the actors themselves. These behavioural 'shapes' can thus be applied across disciplines. In section 3.2.1, I will describe some of these 'shapes', cybernetic concepts which describe system behaviours, and relate them to the subject of study: services as persuasive systems.

A more ethical way of designing services as persuasive systems

As described in previous sections, framing and justifying design decisions is central in the second-order cybernetic design approach. That means that the designer's role as an observer and participant becomes important since it is impossible to observe a system without participating. That calls for an *intrinsic* approach to design ethics, *making the designer ultimately responsible for her design decision*s. Second-order cybernetics and ethics were conceptually connected by Heinz Von Foerster, whose ethical imperative was to 'act always so as to increase the number of choices' (von Foerster 2003). He also emphasised that ethical considerations should be implicit in our acting. He highlights two ethical features of cybernetics: taking complete personal responsibility and engaging in conversation and dialogue with others (Sweeting 2015).

Dubberly and Pangaro (2015) further suggest that designers are working with a second-order epistemology and thereby need to take responsibility for design processes, conversational formats, and articulating their position concerning the design activity and stakeholders, and the rationale for engaging in the design project. In second-order cybernetics, as in design, conversations are ethical processes where values are made explicit, shared and compared between agents, who may or may not adjust their values as consequences of the conversations. As Glanville suggested, conversation implies *listening*, a prerequisite for being influenced (Glanville 2007). Ben Sweeting (2015) adds that conversations have even more qualities which are considered ethical. He lists generosity, honesty, learning, mutuality, open-mindedness, respect, responsibility, selflessness, sharing and trusting as areas which conversations imply.

Because of the nature of the challenges with designing services based on persuasive systems that I accounted for in chapter 2, this perspective became an essential building block for my research. It implies that it is highly relevant to explore the connection between practical service design processes, both in early design stages, where design propositions are still being formed and have not yet stabilised and in later stages where the services are evolved but where ethical qualities are lacking. By acting cybernetically when designing services, the outcomes may become more ethical.

What are the limitations of using design cybernetics in service design?

There are several limitations with using design cybernetics in service design.

The first line of criticism concerns cybernetics' roots in rationalism and control and the general unwillingness among design researchers to 'scientise' design. Cybernetics is still tightly connected to its first-order cybernetic heritage of engineered control systems. Its mechanized approach to control is in stark contrast to the reflective, explorative, and experimental design approaches. Second-order cybernetics offers a more relevant approach to design. However, the fear of controlling and dampening design researcher's free spirits seems to remain. There is also a challenge connected to the epistemological anti-objectivity of design cybernetics, and its roots in radical constructivism. Herr further asks how 'design can be a suitable method for rigorous investigation if it is opportunistic and dynamic in nature?' (Herr 2019, p. 164). That means that a design cybernetic approach may be unacceptable in positivist camps as well.

Second, Cybernetics has been criticised for being too theoretical to engage a new generation of scholars in its ideas. It has even been declared dead (Kelly 1994), which may be a bit of an overreaction. However, the *marketability* of a discipline needs to be taken seriously. Early cybernetics research had a performative aspect which engaged and excited other researchers from across disciplines. However, the reflexive turn towards second-order cybernetics shifted the field deeper into theoretical domains, away from physical performances. This development has been recognized by Richards (2020), who suggests that *'What […] is needed are performances of cybernetics beyond the papers and books.'*. Richards also indicates that the marriage between cybernetics and design may help achieve that and make cybernetics relevant again.

3.2.1 Cybernetic concepts which are useful in service design

In the former section, I reviewed the historical connection between cybernetics and design and connected design cybernetics to the challenges identified in chapter 2. That led to the following knowledge gaps, which the current section will answer.

Design challenges (identified in section 2.4.4.)	**Hypothesis**
A lack of systemic design approaches necessary to address wicked ethical problems in persuasive service systems.	H1: Design Cybernetics can offer a holistic framework for understanding and designing persuasive service systems.
More complex systems make it challenging to locate and design persuasive intent.	H2: Design cybernetics can facilitate the understanding of goal in higher-order systems, where many emerging issues related to governance and ethics is located.
New approaches are needed to translate ethical guidelines to practice.	H3: Design Cybernetics offers an endogenous ethical approach that can improve governance and ethics in persuasive service systems.

Table 10: Design challenges and hypotheses.

To recapitulate, the purpose of this section was to answer:

How can design cybernetics contribute to the design of persuasive service systems, and where in the design process can it add the most value?

In the following section, I will review key concepts in design cybernetics and relate them to the above-mentioned knowledge gaps. The structure of each concept's review is 1) background and explanation of the concept, 2) how the concept has been used in design and 3) how the concept could be used in service design of persuasive service systems. The selection builds on a list of frameworks compiled by Dubberly and Pangaro (2007), with a few modifications and additions.

This exercise resulted in a list of 'shapes', visual expressions of the concepts (see Project #4, poster) which I continuously updated and iterated throughout the PhD, which is found in chapter 5.

3.2.1.1 Goal, purpose, intent

In section 2.1.4, I accounted for some views on intent and purpose in persuasive system design. I concluded that there is a lack of models for understanding the purpose and nature of 'the designer' of persuasive service systems. Here, I will account for some cybernetic perspectives on intent. Cybernetics describe goal-oriented, purposeful systems, be it mechanical, biological, social, natural or

cultural. Although the term was allegedly first coined by von Wolff (1732, p.46), the teleological ideas in cybernetic scholarship have their roots in Greek philosophy and ontological arguments about man's nature and his relationship with the world. Teleology is not uncontroversial and a key sticking point in the discourse of science versus faith - human goal-orientation and free will versus a 'grand design'. The philosophical concept of teleology distinguishes between human-made goals (extrinsic) and deterministic goal-orientation (intrinsic) which exists irrespective of human opinion or will. This has implications both for designers and the systems they design. Critics of teleology say that purpose emerges from previous events and that it cannot and should not be considered as valid in scientific arguments.

Design is sometimes considered *purposeful,* and a designer is usually designing *something* for *others*, a goal-oriented process. In those cases, design could be regarded as a cybernetic process, where the designer 'sees the goal in the distance' and then acts intentionally to get there (Pangaro in Henriksen, Mishra and Warr 2017). The circular loop of observing - reflecting - acting/making - observing again, is central in design and action research. However, a designer also spends quite a lot of time s*earching for goal*s - effectively framing worthy problems to solve. That effectively means that goals are altered continuously; however, they can be more or less stable over time.

Goal-seeking / purposelessness

If the goal is stable or not is of less importance, it is the 'steering' part, the reflection-in-action, which is characteristic for cybernetics (Pangaro 2014). Glanville also wrote about how to deal with *purposelessness*: systems which search for a goal function. Glanville described these 'wanderings' as anti-cybernetic. Random exploration and wandering are central to design activity. So how should we think about goal formation and the dynamics of fluid targets? A designer designing something is essentially a second-order system, designing goals or structures for first-order systems OR second-order systems. That would mean that purposelessness is not essentially an issue because it belongs to the world of second-order cybernetics. The 'wandering' that Glanville describes is just a feature of an oscillating system sensing its environment to eventually arrive at a stable state (for some time, at least).

Perhaps a theoretical connection to these 'wanderings' can be found in Von Foerster's description of *eigenforms* - stable representations of reality, which has been reviewed (and made understandable) by Glanville (Glanville 2007). There are no fixed goals in a radically constructivist world, only constructed goals, meaning that they are always negotiated in the discourse, creating the system they are part of. There can be more or less stable goals, but all goals are essentially fluid. The design expression of an eigenform, in my view, is the design squiggle (figure 37). The design squiggle depicts the random process designers go through before their ideas eventually stabilise. There is no independent reality in a radically constructivist worldview, only more or less stable descriptions, probable models and representations of reality. In this perspective, an idea is simply a concept which has not yet been brought into the world, which has not yet stabilized. The semantics matter, if an agent (someone who acts in the world) cannot imagine or describe a concept, communicate it and enrol others in your design project, the 'thing' or concept will never be realized.

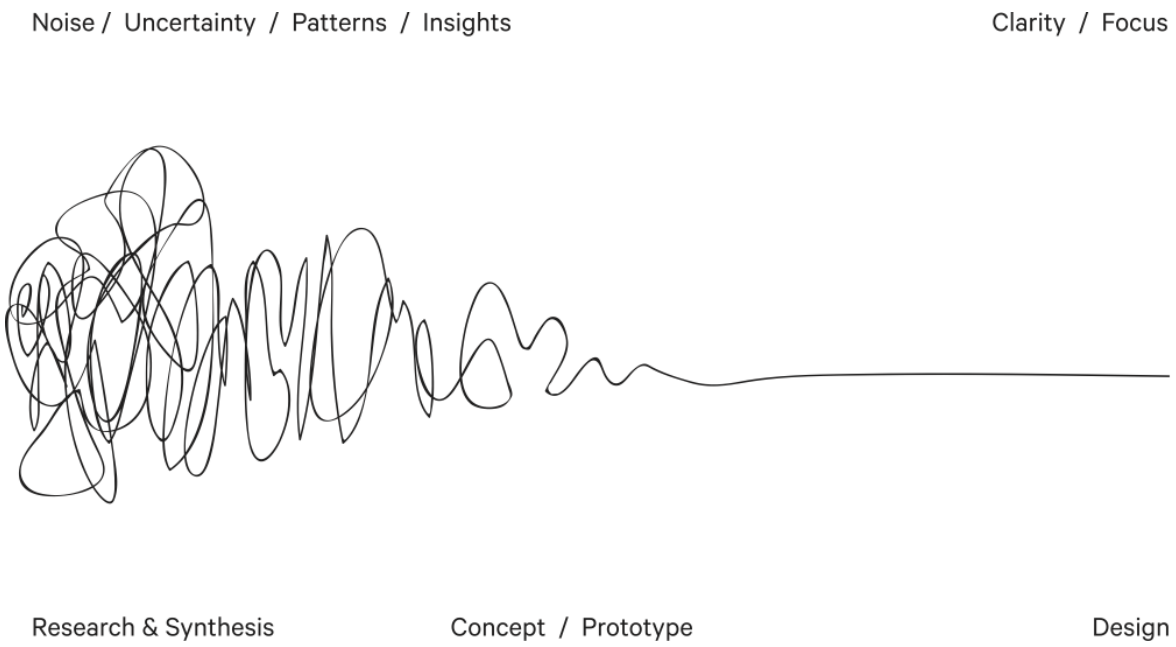


Figure 37: The Process of Design Squiggle by Damien Newman. Reprint from thedesignsquiggle.com. CC BY-ND 3.0 US license.

How is the concept of goal-orientation useful in design of persuasive service systems?

Depending on the level of abstraction used, there are several occasions when service designers deal with goal searching, goal-setting or management of set goals. An insight from the review is that it makes sense to differentiate between *intrinsic* goals, which can be seen as the goals and motivations of the designer to engage in the act of service design, an *extrinsic* goal, which could, for example, be the goals for the users or the purposes of external stakeholders. The following ideas were considered applicable to a design context:

1) To understand a designer's or designing system's goals and intent. In an interview with Paul Pangaro (Henriksen, Mishra and Warr 2017), Pangaro emphasises the importance of knowing oneself when engaging with new, attention-seeking technologies: *"What are your beliefs? How do you operate in the world? What do you want? What kind of world do you want?"*, states Pangaro. Design cybernetics emphasises the responsibility of the designer, meaning that understanding their values, beliefs, intents and wants is crucial to understand the ethical qualities of the design proposals they work on. Victor Papanek also emphasised the 'social and moral responsibilities of the designer' in Design for the Real World (Papanek 1972, p. 65). Second-order cybernetics includes designers as active and influential agents in design projects - a perspective that is not talked enough about in service design. In cybernetic theory, the designer has significant responsibility for the designs they bring into the world, meaning that design cybernetics may give an additional vocabulary and toolbox for working with ethical questions in

service design. However, placing the responsibility of design squarely on the designer is problematic, because their actions and design possibilities are always constrained by other governing systems, such as the dynamics of the organisations they work for, or the cultural systems they operate in.

2) It is also imperative to understand *who* the designer is, at different points in time, over a service's lifecycle. In teams, there may be several team members who contribute to a design over time, and understanding their intents and goal-functions could help us better understand how to align their goals and align their work with those of the services they create. That complicates Pangaro's view, as several designers' intents and goals could engage with a persuasive service system over time.

3) To understand other stakeholder's goals and intentions. Service design projects always involve other people. In the first steps of a service design process, there is often a brief created that outlines the service's goals and purpose, sometimes referred to as a service concept (Goldstein et al. 2002). Part of service design's responsibilities (and frustration) is that you have to interpret signals to understand the client's real goal and purpose with a feature or service component. If second-order cybernetics allows service designers to interpret and understand other stakeholders' underlying interests, they can develop better value propositions and design proposals. Stafford Beer used the term POSIWID (the purpose of a system is what it does) to illustrate that there is often a discrepancy between a system's actual goals and its 'official' explicit goals. That is an especially valuable insight for understanding particular ethical challenges of persuasive systems used in pervasive industry platforms, such as those discussed by Borgefalk and Leon (2019).

4) To understand the goals of a service system. As accounted for in the section about persuasive systems, it has been debated whether services can have embedded intent or not. By describing the service systems as goal-oriented systems, (cybernetic systems) it is possible to infer their endogenous goals or purposes. It is also possible to apply second-order cybernetics to add insights about the system's ethical qualities.

5) To understand the linkages between and the processes leading up to the above. Second-order cybernetics could be useful to understand how goals are formed and shaped in conversations between stakeholders in a service design project. How are the intrinsic goals of the designer linked to the extrinsic goals of the service's stakeholders? How do goals emerge and how can service systems be managed and their goals influenced while they are there? For example, the concepts of Key Performance Indicators (KPIs) and Operational Key Results (OKRs) are

examples of measurements of a service's performance. These metrics, and others, are representations/models for the desired goal functions of the systems. 'Desired' in this case for whom? That also ties back into the governance of services based on persuasive systems, namely how you manage and govern persuasive service systems in complex, dynamic environments.

3.2.1.2 Conversations

Conversation is perhaps the most central concept in design cybernetics, which intimately connects cybernetics and design domains. In this section, I recognize that it is impossible to cover everything said or written on the topic. I review some systemic perspectives on conversation in design, which has influenced my research.

Although there have been similar ideas circulating earlier, the principal authorship of conversation theory has been ascribed to Gordon Pask. The perceived difference between conversation and communication (for example as per Claude Shannon's model) is that communication does not per se lead to changed behaviours or attitudes, while conversations lead to a change in behaviour, understanding, concepts, intents or attitudes for either party (Pangaro 2017). *'We retain the experience of the conversation in that our mental processes have been changed as a result of the conversation and we carry those changes with us.',* Pangaro writes. The Musicolour machine designed and built by Gordon Pask is a vivid example of one of the first conversations between a persuasive system and a human being. The behaviour of both the pianist and the lights controlled by the machine depended on the other's action. The machine worked in concert with the human to evolve the music's variety, thus arriving at novel and unique compositions. In the Musicolour machine, the interface between human and computer was not textual but based on sound and light. The conversation between man and machine could be described as *generative. Pask even went as far as to propose that the computer could be a design partner, feeding information to the human-in-the-loop and* formulating theories of objects and together evolving novel representations of these objects.

With a narrow definition of the system, the human and machine could be put on equal footing. Still, taking a step back, it is clear that the device, the persuasive system, in this case, is programmed by, and thereby governed by the human. Apart from creating variety in music, the machine has no other intents in the world. Yet, one could say that the machine *intends* to create variety in music—the intent, in this case, endogenous and generated by its designer, Gordon Pask.

Conversations in a cybernetic sense, does not only refer to two people chatting with each other (it could be though), but to an emergent model of mutual learning emerging through interactions between 1) two second-order cybernetic systems, 2) within a single second-order cybernetic system (*conversation with the self*).

Gordon Pask's earliest models of conversations are brilliant but very abstract and largely inaccessible to most designers. Pangaro has also done significant work deciphering Pask's

conversation theory and developed diagrams, posts, and videos to explain conversations' dynamics. The CLEAT model for conversation (illustrated by Dubberly Design Office) has five main parts:

1) **Context**, the actor who initiates the conversation chooses a context/medium for the conversation to take place in.
2) **Language**, the actor sends off a message in a language that may be verbal, visual, gestural, haptic or a combination thereof. The recipient must not share the language, but it is a prerequisite for conversation that he or she can sense it. However, a shared language makes it easier for the parties to agree on the meaning of messages.
3) **Exchange**, meaning that if the recipient of the message (participant B) wants to continue conversing with (A), they can respond and so, the conversation continues until either party chooses to leave (stop responding).
4) **Agreement**, an agreement may follow, a shared understanding, which could either result in 1) augmented knowledge, 2) agreement on collaboration for new goals in future or 3) an agreement on action
5) **Action/transactions are** not necessary, but they may come out of the conversation.

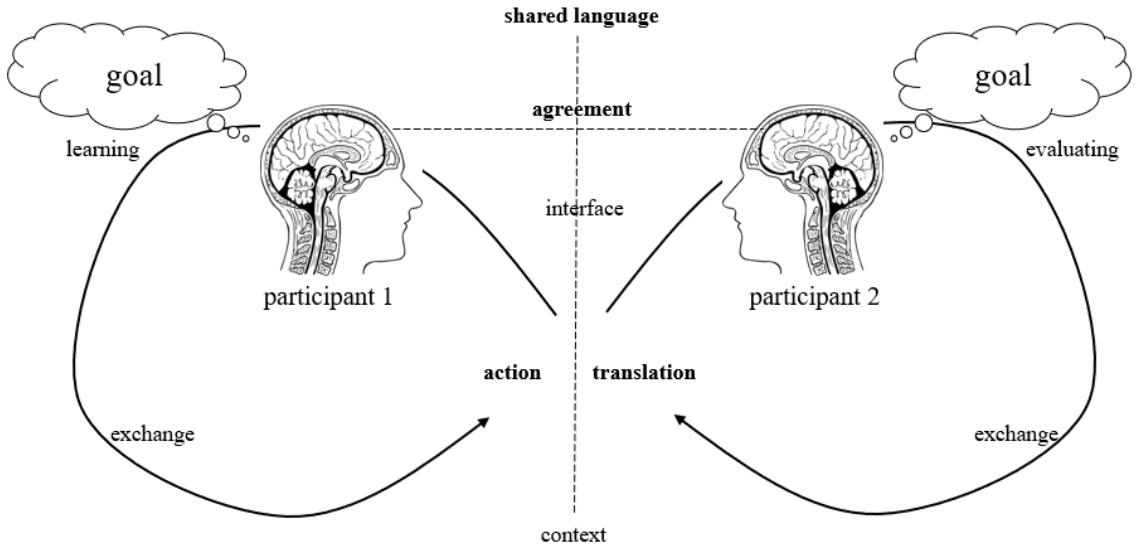


Figure 38: A Model of Conversation. Adapted from Pangaro (2015). http://pangaro.com/designconversation/2015/10/a-model-of-conversation/)

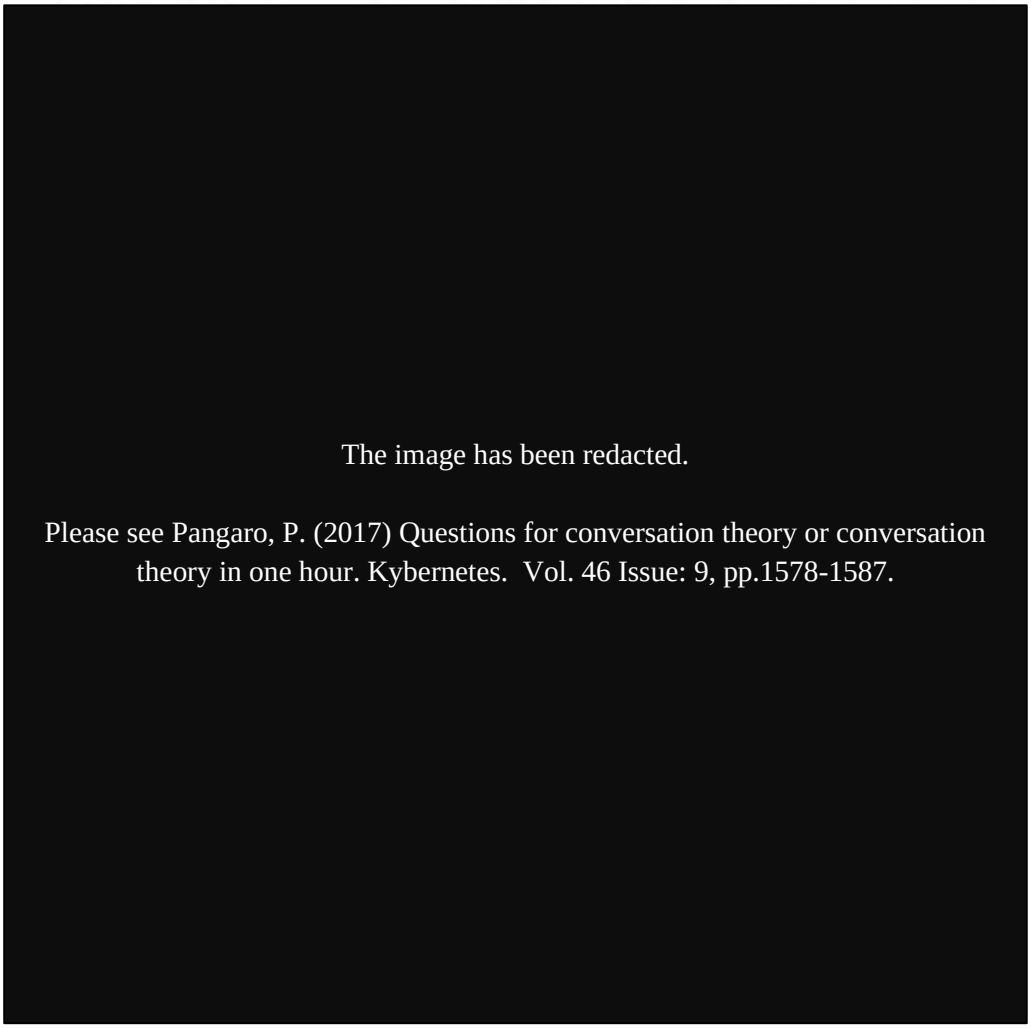


Figure 39: A Model of Conversation. (Pask (1976), as depicted in Pangaro (2017))

Dubberly and Pangaro (2009b) writes about the limitations of conversation and describes two scenarios where conversation can fail. The first scenario is when the conversational infrastructure does not allow for effective conversation. That may be caused by noise, or because the interfaces fail to provide the necessary conversational support. The second limitation they point out is the participants in the conversation: Which type of participants contribute to upgrading the other participants' thought structures? That may be dependent on conversational style and the knowledge/content the participant brings to the conversation.

In Ranulph Glanville's writing on design and cybernetics, he expanded on the idea that conversation, as a constructivist activity is central both to design and second-order cybernetics. The conversations can either be with the self and others or with materials (Glanville 2007). He suggested that *listening*, both to one's 'inner voice' and others, is an empathetic and ethical act, which conversations enable. He describes how two people's subjective views of the world can meet in a conversation, which upgrades both actors' thinking and increases their conceptual variety. That also rings true for Pask's *Musicolour* machine, though the sparring partner is a machine and not a human, which is perhaps even more current, given that we 'spar' more with machines these days.

Donald Schön also expanded on the idea of conversations to describe acts of design as circular, reflective practice. He used the metaphor of the designer holding a pen against a paper, allowing for a 'wandering', an exploratory act leading to novelty and unexpected turns. That can be understood as a conversation with the self, a second-order system exploring opportunities, where the wandering, the creative act, gradually increases variety for the system. Furthermore, Schön describes the act of designing as a dialogue between designers and their stakeholders, materials, environments, and with the evolving design itself (Schön 1983). In contrast to Pask's conversation theory, which was strictly grounded in science, Schön's theory came from the social sciences, thus providing complementary perspectives on the same act.

What kinds of conversations are there?

In a 2010 article, Jones (2010) asks the rhetorical question 'Can conversations perform acts of design?'. The article criticises and contrasts Dubberly et al.'s Paskian perspective by adding useful historic viewpoints about alternative views on conversations. Jones is a proponent of Winograd and Flores Language/Action Perspective (LAP) model for conversations. The LAP model proposes an *illocutionary force*, connecting the designer's intent with using a certain language, to the desired action to follow, 'Saying it so, making it so' (Mitchell 2020). For example, the sentence 'the door is open' may carry an illocutionary force, meaning that the door should be shut. If one instead says 'shut the door!' it is more forceful. Jones further describes three 'epistemological orientations': *rational*, *pragmatic* and *phenomenological*.

The *rational* approach is the one which most people relate to conversations in design, an instrumental and purposive approach where conversation is a set of sophisticated patterns employed to facilitate the relationship between designers, stakeholders and products/services or materials.

The *pragmatic* perspective positions design as an inherent communication practice and proposes that design activities 'enact the creation of a linguistic system of meanings applicable to a problem in context'.

The *phenomenological* perspective suggests that reality is created in language, and therefore, design is performed in language, and all meanings arise in language.

This approach is coherent with Krippendorf's semantic approach to design, where reality and designs are constructed in language and conversations. This perspective suggests that design itself is a conversation, that products and services are networks of conversations and that design acts are performed in language (Jones 2010). That supports the argument for why language is a key component of the design cybernetic process, especially pertaining to systems' persuasiveness.

To understand what conversations can be used for in service design of a persuasive system, I account for Winograd's (1986) description of four types of purposeful conversations. Conversations for *orientation* implies that two parties 'create a shared background as a basis for future

interpretations of conversations'. Conversation for clarification, describes how conversations increases clarity. Conversation for *possibility* means that the two parties co-construct. Conversation for *action* means that the parties agree on a course of action from the interaction. It is interesting to explore further how these four perspectives can be integrated with persuasive systems.

The following were deemed relevant implications for designers of services as persuasive systems:

1) **To inform a conversational approach to the governance of persuasive systems**. Governing persuasive systems effectively means influencing the way they behave and their 'attitudes' and intentions. The conversational concepts from design cybernetics can offer a new toolbox to describe and evolve these systems ethically. If you cannot converse with a system, you cannot govern it. As Dubberly et al. (2009b). wrote, *"Design grounded in argumentation requires conversation so that participants may understand, agree, and collaborate on effective action."*

2) **To understand how intents/goals/purposes are formed and reformed**. Conversation theory can be useful to describe stocks and flows of intent, both in first- and second-order systems. Pangaro also suggests that the conversational view on design allows for conversations about the negotiation of goals, collaboration and cooperation for action. (Pangaro 2000) This knowledge is useful when addressing the politics of persuasive systems' complex governance problems in pervasive industry platforms.

3) **To describe learning situations in services.** Conversation theory has been applied in interface and interaction design settings where the *conversational media* is in focus, for example, in voice assistants. Conversation theory is used frequently across design disciplines, especially in *learning design and instructional design*, which makes sense given that the conversational process is essentially a learning process.

4) **To describe human-computer interaction and interfaces.** Conversation design has a natural home in interaction design, both in human-to-human and human-computer interaction. As Pangaro points out, the conversational approach may be advantageous when analysing human-computer interaction, which is traditionally seen as a second-order system (the human) interacting with a first-order system (the computer). New digital services, especially those built on AI/ML techniques could instead be seen as second-order, goal-oriented systems. That would indeed be helpful when trying to understand concepts such as intent and goals for persuasive systems.

3.2.3.3 Variety

As developed by W. Ross Ashby (Ashby 1957), the cybernetic concept of variety refers to the number of states which a system has to respond to the environment it is situated in. In a sense, it is a measure of *agency*. A system with enough variety to keep stable, pursue its goal-function, and respond to changes in the environment is said to have *requisite variety*. A system that does not have enough variety to respond to changes/disturbances in the environment will fail to achieve its goal function. Success, in this case, refers to a system's ability to navigate towards its goals. The concept of variety is tightly connected with *governors*, which I will return to later. Variety implies that the more complex a system is (the higher its variety), the greater variety is needed for another system to govern it.

Related to the concept of variety is the *homeostat*, described as a device capable of adapting to its environment i.e., it can learn, adapt, and keep requisite variety when facing disturbances in the environment. The device was pioneering in that it embodied adaptive control.

The concept of variety and requisite variety can be instrumental in design, but like Pask's writings, Ashby's original texts are relatively complex and inaccessible to a non-specialist audience. Dubberly and Pangaro created illustrations to communicate the concept in a less complicated fashion (see figure 40). That demonstrates how a cybernetic concept can make the journey from complexity to simplicity.

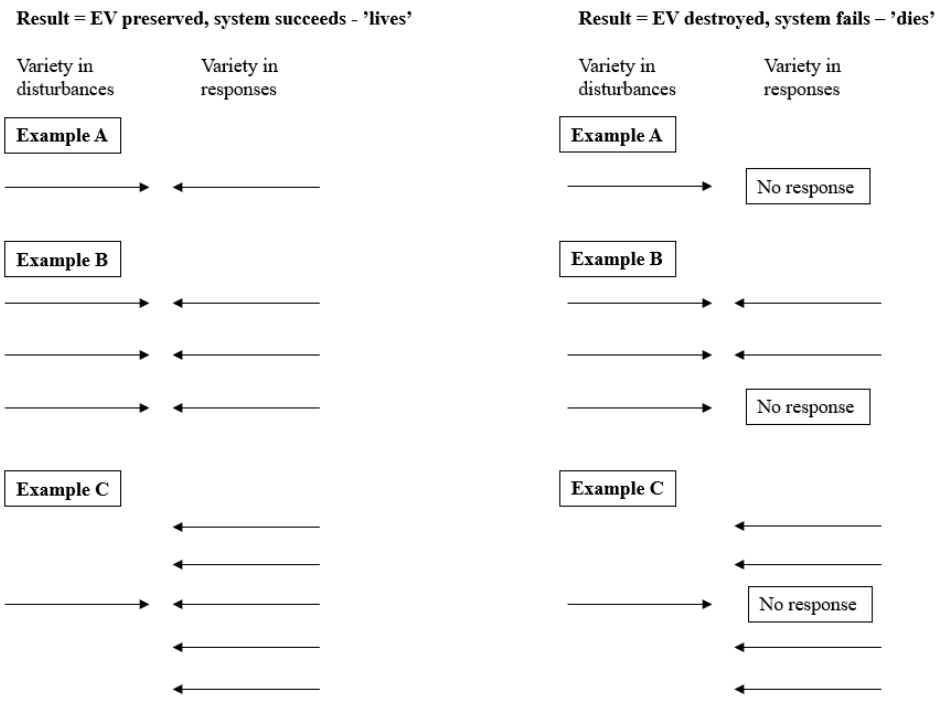


Figure 40: Illustrations of variety / requisite variety. Adapted from Dubberly and Pangaro (2009).

How is variety/requisite variety useful in service design of persuasive systems?

Variety is a versatile concept that can be applied to different meta-levels, both in the service design process (second-order design) and in the actual service being designed (first-order). In a service design context, there are many situations which can be described using variety/requisite variety:

1) **To describe the architecture of services based on persuasive systems**. Whenever there is a functional, aesthetic, physical, or perceived goal of purpose for a product, service, policy, artefact, service or experience, variety can be used to describe the structural composition of the system. That could for example be:

    - The actual features of a service.
    - To understand if the service meets the customer's requirements.
    - To understand if the service follows all applicable laws.
    - To understand if the service is politically and socially viable.
    - To understand if the service can gather the resources necessary to be realized.

2) **To assemble the right service design teams.** Dubberly and Pangaro (2009) also describe how the concept can be applied to understand a designer or design team's skill set. The mean that all designing groups, whether they are product teams or whole companies, have variety in that they bring a set of competencies to the design projects they take on. A team's 'fitness' for a task can be described based on their perceived variety for specific tasks.

3) **To create services to match wicked problems.** In the context of design theory, Ashley Hall (2016) describes how cultural influences on design are becoming streamlined across geographies, causing a reduction in creative variety. He uses the example of smartphones, which all look more or less the same, regardless of brand, despite increased access to the world's creative talents and ideas. Hall argues that more creative variety ultimately leads to higher global resilience in the face of an uncertain future. Hall uses the cybernetic concept of variety to make sense of a design and meta-design landscape connected to complex and wicked challenges such as climate change, and states "...*how can we assess the future amount of requisite variety needed in such a system, especially as future impacts may be disruptive and not forecastable on an on-going basis from historical models*." He highlights the value of a cybernetic and constructivist perspective when trying to predict and govern the future, complementing science-led predictive models.

4) **To describe aspects of persuasive systems.** Variety can be used to describe if a service has requisite variety to meet the designer or user's persuasive intent. It can also be used to understand if a system has enough variety in terms of modalities, messages, credibility, et cetera, to influence a person.

3.2.3.4 Autopoiesis

Autopoiesis was first devised by Humberto Maturana and Francisco Varela, two Chilean biologists who studied how cells reproduced and developed a general theory from their behaviour. (Maturana and Varela 1980) An autopoietic system is capable of replicating and in doing so, realizing itself. This property is a foundation of living systems, where the molecules are arranged according to an inherent structure, or blueprint, of each part of the larger, evolving, structure. This can be contrasted to an *allopoietic* system, such as a car factory, where several components are assembled to a final form, *different* from its components. (Maturana and Varela 1980) An autopoietic system is operationally closed, but open to disturbances from the environment - it just has an 'inner map' for how to evolve which it sticks to. While Maturana and Varela originally developed the idea of autopoiesis to describe biological systems, the concept has been transferred to numerous other disciplines, including social sciences management sciences, engineering, art and design. I have chosen to review the areas I deem most relevant to service design.

Emergence

While autopoiesis describes systems, which are self-organised and self-producing, certain systems also have emergent properties, '*in the evolutionary sense of new higher level behaviors, structures, and patterns that develop from lower level simpler entities*' (Griffiths 2017). Many modern information systems, in particular digital systems, are *emergent*, meaning that they are '*rarely defined a priori and in toto; rather, they grow over time and key features evolve through interactions with users and the environment.*' (Dubberly 2018). For service designers, who are often working with systems and product-service ecologies, complete plans are not desirable, but rather that the designs set structures and patterns for engagement and interaction, which can evolve over time and for changing the rules. That means that they need to have conversations about both first- and second-order systems and jump seamlessly between the two modes when designing.

Organising communities

Dubberly and Pangaro (2009) suggest that the concept of autopoiesis is a '*promising framework for discussing organizations and communities—how they form and how they maintain themselves*.' Most organisations experience disturbances from the environment all the time, and not all have the requisite

variety necessary to be successful. A recent example of how autopoiesis has been applied in a socio-technical service system and been included in the organisational structure of an emerging system is the DAO (Decentralized Autonomous Organisation), where a fixed set of internal rules allows the organisation to collect money, hire labour to do work and deliver output - it is autonomous in the sense that it manages and realizes itself. The DAO is an artificial construct, but it raises interesting new questions of how services can be structured. There are also exciting hybrid design projects emerging in this space, such as the *Plantoid*, a mechanical plant that is powered by bitcoins, which it uses to reproduce and spread in the world (De Filippi 2016). This perspective is extra relevant, given the rise of life-like technologies, where biology and technology are merging. The Xenobots developed by Tufts University represents a new breed of technology which calls for new frameworks for understanding (Ball 2020).

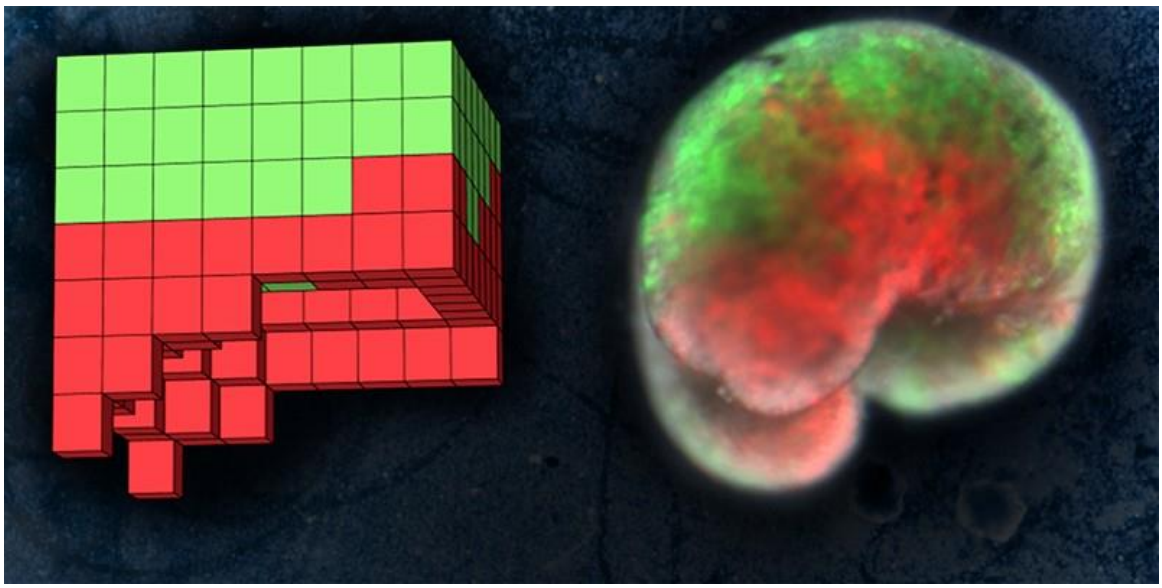


Figure 41: Xenobots. (Ball 2020) CC BY 4.0 license.

Autopoietic social systems

There is an interesting sociocybernetic line of thinking, that considers social systems as autopoietic and self-realising. According to Luhmann (1986), social systems reproduce themselves via elements of communication and meaning. The systems can be differentiated on three sub-groups: *societies*, *organisations* and *interactions*. If a social system stops reproducing itself, it 'dies' (Seidl 2004). Luhmann also describe psychic systems (reproducing systems of belief) and living systems as complementary to social systems. Similar idea of social systems wanting to live and 'survive' can also be found in memetics, where 'memes' are cultural replicators operating on similar logic to genes (Dawkins 1989, p.192).

How is autopoiesis useful in service design of persuasive systems?

As digital systems have become part of society's infrastructure, the idea of autopoietic systems may be useful in several ways, when considering persuasive systems:

1) **Autopoietic organisational- and service architecture.** The first domain where autopoietic ideas can be applied in service design is in the architecture of services. Maturana and Varela were reluctant to regard organisations as living systems, Stafford Beer was not. Inspired by their theories, he developed the Viable Systems Theory based on the idea that organisations should be seen as living systems which should evolve and 'survive', sustainably, in the face of a continually changing environment.

2) **Autopoietic model for the service design process.** It has also been suggested that the design process itself can be understood as an autopoietic process. Iba (2010) Proposes an 'Autopoietic System for Creativity', as a theoretical framework which explains creativity as a self-referential process of evolution. Aguayo (2019) suggests that autopoiesis is useful in digital learning design. He argues that by incorporating autopoietic elements such as adaptability and responsiveness to the environment into the design of digital learning tools, these can better respond to socio-cultural changes and better meet students' requirements over time.

3) **Autopoietic descriptions of social systems.** There may be an opportunity to apply autopoietic social system theory to analyse how persuasive systems emerge, grow and die over time. Both on a first-order level (how persuasive service systems are designed) and a second-order level (how beliefs and values related to designing emerge).

3.2.3.5 Black boxes

The black box concept describes systems based on their inputs and outputs, but where their inner workings are unknown. Einstein and Infeld (1947) wrote in Introduction to Relativity that

'...[man] may form some picture of a mechanism which could be responsible for all the things he observes, but he may never be quite sure his picture is the only one which could explain his observations. He will never be able to compare his picture with the real mechanism and he cannot even imagine the possibility of meaning of such a comparison.' (Einstein and Infeld 1947, p. 33)

Einstein compared the world to the inner workings of a watch. By studying the systems from the outside, it is possible to develop hypotheses about the watch's working, thus 'whitening' it. A *grey box* refers to a system where the inner workings are partially known, and a *white box* or a *transparent box* describes systems where the workings are completely known. In cybernetics, William R. Ashby did a thorough review of black boxes (Ashby 1956) and in 1963 system's theorist Mario Bunge published *A General Black Box Theory* where he described black boxes as '*abstract and applicable to any problem involving the transactions of a system (physical, biological, social, etc.) with its milieu [...] unconcerned with either the structure of the box or the nature of the stimuli and respons*es.' (Bunge 1963).

Design practitioner Koyama (2018) writes about the black box culture of digital services, where hidden algorithms and big data collection are the modus operandi. Koyama describes how 'service design activism' could be one way of democratizing digital service innovation practice and uses the black box analogy to describe the hidden processes that allegedly are the source of many

digital services issues. (see intro chapter for more details.). That is echoed by Danny Hillis, who writes in Enlightenment or Entanglement that we can only see bits and pieces of the digital 'jungle', through the interfaces we use to access the services: keyholes to peek into the black boxes (Hillis 2019).

Whereas black box theory could help understand first-order systems, Lockton (2015) describes, although not explicitly using the term, how the theory can be applied to second-order systems. His perspective is useful for us when trying to understand persuasive systems. He writes that understanding complexity itself is not always necessary when faced with wicked problems, but understanding what agency that is possible and how change can be enacted. He describes design for behaviour change as '*design which enables people to change the behaviour of the systems of which they — we — are part*'. He describes usefully five levels of understanding which sums up to a theory he calls Designing Agency:

1) Understand the world. Using design as a tool to do science or social science creatively. In my view, this corresponds to understanding the first-order mechanisms that are constraining design spaces.

2) Understand people's understandings of the world. That corresponds to Von Foerster's second-order imperative 'understanding understanding', how different observers perceive situations and concepts as they make sense of the world (Von Foerster 2003). In a design context, we can both make explicit and interrogate our own understanding of a problem and the understanding of other stakeholders involved in design projects. Conversations can be used to generate empathy and the ability to adopt the perspective of others.

3) Help people understand the world. In this stage, the designer acts to influence other people's understanding of the world. Lockton writes that this can be done through educational activities, new kinds of interfaces or designed experiences, to change or reframe their understanding of a situation or problem, to enable and support growth. In the domain of persuasive systems and design for behaviour change, this can be regarded as controversial. Lockton emphasises that it is not about 'correcting incorrect mental models', but rather about emphatically sharing information that helps them refine their models and understanding of the world.

4) Help people understand their agency in the world. Lockton does not have a formed opinion about how this stage can be done; however, he hints that Kocaballi's Agency Sensitive Design (Kocaballi 2010) could be a way forward. I interpret this stage as matching people's skills, competencies, motivations and action potential with opportunities to use them, to solve problems that matter to them.

5) Help people use that agency in the world. The final part of Lockton's approach is the part where people are encouraged to act to change the systems they, themselves, act towards realizing their own desired futures.

How are black boxes useful in service design of persuasive systems?
In the context of designing persuasive systems, the following aspects of black box theory were considered relevant:

1) **To frame complexity.** As described in chapter 1 and 2, increasing complexity characterises services as persuasive systems. The concept of black boxes and related scholarship can be useful for modelling first-order system complexity and frame second-order axiologic meta-levels of complexity, such as ethical consequences or changes in value judgments.

2) **To understand and make explicit what is known and unknown regarding a persuasive system.** From a first-order perspective: the concept of black boxes can be used to ameliorate understanding of the 'hidden' properties of persuasive service systems. More transparent services mean that it is easier for external actors to make a model of how the system works, and it follows that it is then also easier to govern or regulate said systems. It could prove beneficial if this perspective is integrated from the beginning as a feature, not a bug, in novel digital services, ensuring transparency from the start.

3) **For understanding how much one knows about a system.** From a second-order perspective: Lockton's framework is useful on a conceptual level, to understand our understanding of a persuasive system. In doing so, we work with second-order design, framing the human context and system in which design takes place, with its mental constraints. When does a service become a black box?

3.2.3.6 Governors

The word 'cyber' and 'govern' has the same roots in 'guberne', meaning 'to steer'. Systems steering other systems have been described differently in science, social sciences, humanities and the arts. In engineering, steering and control are generally desired features - creating stable, predictable systems. In mechanical systems, governors are sometimes called regulators. The concept of governors is attributed to James C. Maxwell, who used the term to discuss control functions of mechanical systems. Maxwell outlined several general concepts for dynamic regulators/governors which would inspire later cybernetic scholarship, such as the range in which the regulator could operate efficiently

(where it has requisite variety) and how it dynamically adapts to disturbances from the environment (Maxwell 1868). Ashby introduced the theory of the *good regulator*, which states that 'every good regulator of a system must be a model of that system'. That means that an effective regulator needs to have an isomorphic model of the system it regulates to be maximally efficient in regulating it.

Weick (1979) describes three ways in which variety can be used to design control measures for systems. The first way is to *create a one-to-one relationship between the controlling variable and the variable being controlled*. Using a customer service help desk as an example, this would correspond to having staff available to speak with every user, every time there is an enquiry, being available 24/7 everywhere, in all media (including physically), all the time. In this particular case, from a financial perspective, meeting complexity with an equal amount of complexity-approach, however, is not very viable. A second approach would be to *reduce variety*, to a manageable level of complexity. For the helpdesk, this could mean providing fixed channels for communication, fixed opening hours and providing support in a single language only. That would channel the disturbances from the environment into manageable variety, but the system would not meet all inquiries.
The third option is to *complicate the controller*, i.e. to continuously try to innovate and adjust how the help centre can support the user. That could involve introducing chatbots that are active 24/7, FAQ's with answers to common questions and so on. It could also mean that the centre adapts the modality of communication based on the user's preferences.

Weick's theory can help discern whether design cybernetics can provide a valuable perspective when designing the governance of persuasive systems as used in services. Governance, the steering or regulation of systems, is central to cybernetics and second-order cybernetics. Consider the following situations (Umpleby 2013):

- The Iris controlling the light reaching the retina
- Hunger and eating
- Thirst and drinking
- A person driving a car
- An executive managing a firm
- A government agency regulating an industry
- The voters of a country choosing representatives

In all these disparate cases, one system is effectively controlling another system. The relationship between the systems is circular, meaning that the two systems are inseparable - one could not exist without the other. These are but a few examples of how systems surrounding us at work or home, in physical and virtual spaces, are controlled, in the cybernetic sense. There are systems that 'steer' our

behaviours and attitudes, physiological processes et cetera, and systems that we steer, intentionally and unintentionally. These systems can be physical, social, cultural, biological or mechanical.

As described in the previous section, conversation theory can be used to understand how systems interact and evolve their intents, values or behaviours. If a system is capable of having a conversation, rather than just communicating, it

How are governors useful in service design of persuasive systems?
The following implications for designers were extracted:

1) **To devise instruments for regulating persuasive systems based on new and untested technologies.** Every time a new technology is introduced, there is a debate about governing and regulating services based on the technology. In cybernetic scholarship, governors should not be seen as mechanical and soulless. Instead, they should provide inspiration and ideas for how to 'steer' service design projects in desired directions. That implies that there needs to be a discussion about who should steer, where to, why and how.

2) **To bring a new perspective of governance to service design.** Design cybernetics offers a new language for service design, bringing new possibilities for new governance methods. Design cybernetics offers a systems language for describing these features, and this research aims to identify more precisely how and where this language is useful in service design.

3.2.3.7 Biocost / energy

Many services are free to use, but the personal effort and time spent can also be considered a cost, we can refer to this as the Biocost. Our preference for using one service over another can be based upon the relative biocost, not just the value of the outcome – for instance, the choice of search engines, social media or e-commerce platforms.

Geoghean and Pangaro (2009) discuss the concept of *biocost*, to describe the total effort that a living agent spends in performing an action. It was further developed by Dubberly, Maupin and Pangaro (2009a), where the authors recognize that all actions take energy and time to carry out and by making this effort explicit, this could be a useful measurement when designing services and products. Dubberly et al. list *time*, *energy*, *attention* and *stress* as a few different types of biocost expenditures. The antithesis of biocost is *biogain*, denoting factors that lead to gains in these domains.

Component	Type of expenditure	How experienced	How compared
Time	opportunity	Duration	More or fewer hours:minutes: seconds
Energy	physical	Work	More or fewer calories
Attention	mental	Focus/concentration/ degree of familiarity	How many/what type of multitasking possible
Stress	emotional	Fear/worry/anxiety/uncertainty	Higher or lower risk higher or lower enthusiasm/motivation

Table 11: Biocost types. What is the cost of achieving a goal? Adapted from Dubberly and Pangaro (2010).

In a system's context, biocost can be traced back to Ashby's concept of essential variables, which he described as those '*which are closely linked to survival and which are closely linked dynamically such that marked changes in any one lead sooner or later to marked changes in the others*' (Ashby 1952). Survival here means achieving the system's goals, in the face of a changing environment. Geoghean and Pangaro (2009) nuances the term essential variables with *social essential variables*, which are linked to a system's survival (ie reaching viability) in a social landscape.

Since the biocost account is not infinite, it is theoretically possible to calculate how much biocost a person has to spend and what they get from spending it in different ways. Questions of biocost also reveal payoffs between various alternatives with different biocost. Interestingly, Dubberly et al. argue that *reducing biocost creates value and is ethical*, because it increases possibilities (variety of choices). Therefore, the concept of biocost may be extra relevant given the recent focus on the 'attention economy' where attention is seen as a limited resource.

Relating the theory to this research, the concept of biocost is a potent concept for service design of persuasive systems both form a first- and second-order perspective.

In the context of designing persuasive systems, the concept of biocost can be useful in several ways:

1) **For improved organizational design.** Dubberly and Pangaro (2009) argue that corporations and other organizational structures help groups achieve biocost reductions, effectively making effective organizations ethical. If human beings collaborate in laborious tasks, there is less labour per unit, which means that time is freed up to work on other tasks. By analysing the biocost structure of organizations and identifying biocost-reducers, innovation can be built around insights.

2) **For understanding behavioural costs and gains in service design.** Understanding what a biocost budget looks like for a product or service may help service designers to reduce (or increase) barriers of use, thereby designing user behaviours. However, this also raises interesting questions about whether reducing biocost is always ethical, if it stimulates addictive behaviour. For example, slot machines lower the barrier for people to play but increase the total time spent on the device.

3.3 Conclusions from the literature review

3.3.1 What can Design Cybernetics offer service design?

In this chapter, I have described a range of areas in which cybernetics and second-order cybernetic concepts can be useful in service design of persuasive service systems. In chapter 2, I described the design context in which the research is situated. I discussed the relationship between service design and design methods and gave an overview of the research landscape for persuasive systems design. I identified the limitations of existing design approaches and summarised these. Chapter 3 introduces cybernetics and second-order cybernetics as a potential language to address some of the design challenges identified in chapter 2. I discussed different cybernetic and second-order cybernetic concepts and explained their relevance for service design. I will conclude this chapter by discussing what design cybernetics can offer service design and how the literature review led me up to the research questions. Next, I will consider the implications of these insights by identifying opportunities for new knowledge and formulating research questions. In the following chapter (chapter 4), I will describe my methodology and methods for answering the research questions.

From the above review, it is clear that there are substantial overlaps between cybernetics and design.

1) Design cybernetics can offer a *general research philosophy and approach*, which may be useful in the design of services as persuasive systems. Design cybernetics offers a *reflective layer* which allows for dialogue about purpose, ethics, the designer's role in designing and introspection on the process of design. That constitutes a middle way between technology-led and design-led models of persuasive systems. Lissack writes that this expands the research space for service design, adding a layer of opportunity on top of existing research (Lissack 2017).

2) A designer's power to determine the future can be considered their ability to enrol stakeholders in their design proposals. For persuasive systems, the persuasive properties are by definition explicit, for other systems, there may still be persuasive properties embedded in the system's structure, although they may be implicit.

3) From the review, I also argue that there is a need for more *ethical* approaches to service design in persuasive system design. Design cybernetics may offer a philosophical foundation to service design, which may emphasise ways of integrating ethics in service design practice.

4) I also conclude that there are several *individual concepts* from cybernetics, such as requisite variety, governors, conversations, and autopoiesis, which could be useful in service design theory and practice to address ethics and governance issues. There is ample opportunity to extend the cybernetic vocabulary to service design, to tackle downstream challenges in contemporary services, for ethical reasons and also because extending the language of cybernetics to service design may be a source of inspiration for novel service design approaches, models and tools.

What are implications for the design of persuasive service systems?

Service systems designed to influence people's behaviours in different ways, such as social media apps, advertising services, games and so on, can be described as persuasive service systems. They are defined based on their goals and purpose, rather than their structure. Although other models which describe persuasive systems may include their intent (such as the PSD model) the cybernetic approach is more direct. The main implications of persuasive service systems for service designers are that they ought, as a matter of routine, observe the designers; more explicitly include second-order meta-analyses of persuasive systems in their design process. That is especially important in the early stages of the design process when the persuasive service's model and goals have not yet stabilized. Once stabilised, the models and goals become more rigid and more difficult to change, because of the inertia created when more stakeholders become involved. More involved stakeholders mean that a higher biocost is necessary to change the system. It also means that designers should pay more attention to themselves, their motivations, the projects they choose to engage in and give life to. In doing so, they properly recognize their status and power as responsible agents and actors in the world.

On a strategic level, second-order cybernetics offers a constructivist view of persuasive systems, and as such, persuasion primarily becomes an exercise in semantics, rhetoric and storytelling. Humberto Maturana who wrote extensively on cybernetics and biology emphasises the emotional weave that underpins human existence: "*...what we think forms part of the network of conversations that constitutes our living, we become according to our emotioning interlaced with doings in the flow of our languaging.*" He implies that desired futures are constructed in language and propelled in the world via cybernetic conversations.

Implications for persuasive service system design

Merging the insights from the above sections, I arrived at a working model that captures some important dimensions of persuasive service systems, which will be used to define the design space which this thesis operates in. As discussed, persuasive service systems are:

1) Goal-oriented, complex adaptive systems
2) Striving towards altering a user's relation to that goal
3) By shaping the system's constraints to that end
4) And matching the goal specificity with a specificity of the measurement of outcome

Using a simplified model for persuasive service system design, I suggest a model for defining the relationship between the different 'levels' in persuasive service system design (Figure 42).

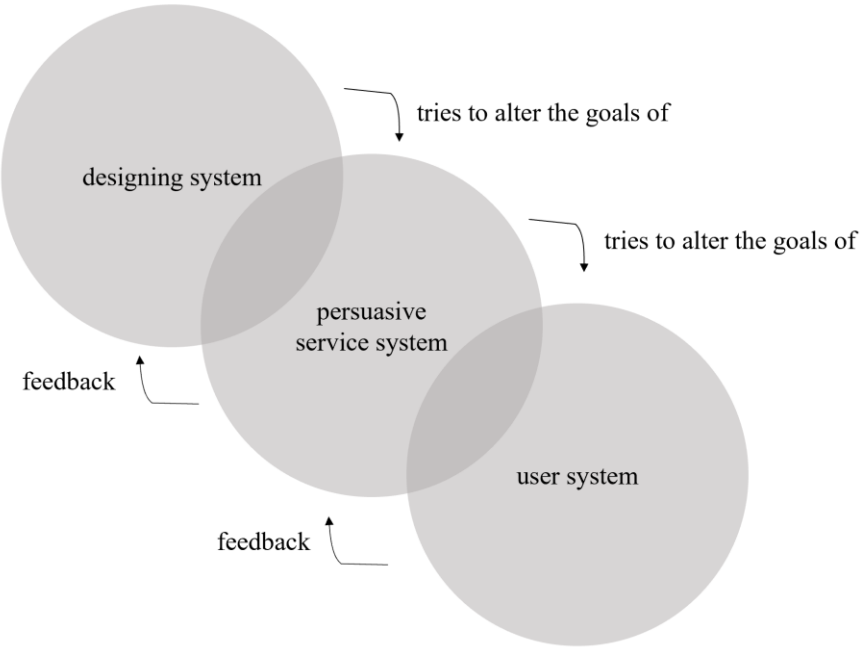


Figure 42: Simplified model for a second-order persuasive service system.

The *designing system* envisions, constructs, designs, builds, manages, maintains, and upkeeps the persuasive service system. It could consist of a single designer; however, it is more common that services are designed by teams of people and supported by technology. If we consider designers not as individuals, but *systems* it gives intentionality a different dimension, they are *goal-oriented systems*, rather than intentional humans. The *persuasive service systems* that are the subject of study are also defined as a system designed to influence its user's goals, which is in line with William's definition of persuasive systems above. These are socio-technical systems which deliver 'the service'. Finally, *user systems*, in this case, can be single users or groups of users depending on the system's boundaries.

As an example, Netflix' recommendation engine can be described like this:

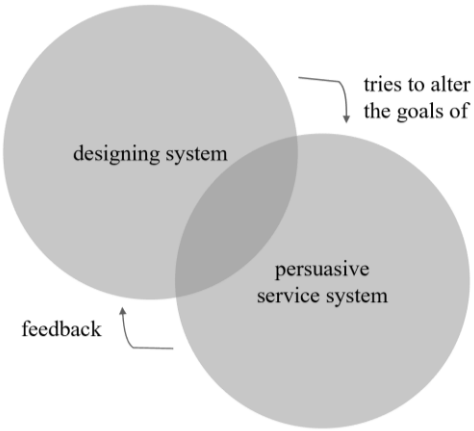
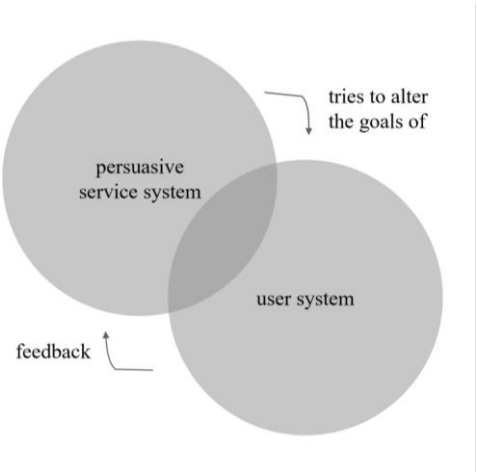
Systemic level	**Who or what?**	**Goal**
Designing system	Netflix' owners, managers, design team, content team and coders.	Modify the system so that it can influence user's behaviours or attitudes.
Persuasive service system	The software and hardware through which the Netflix recommendation engine is delivered.	Modify the user's behaviours or attitudes.
User system	The users of Netflix.	Use the service to be entertained.

Table 12: Description of Netflix using the simplified model for a persuasive service system.

I acknowledge that this is a simplified and reduced model of persuasive service systems and that reality is often more complicated. It is also difficult to define clear boundaries between the systems, since they are connected and interdependent. However, I found this definition and systemic model useful for this research to describe persuasive service systems on a high level.

In table 12, I describe two distinct causal *feedback loops* which concern persuasive service systems: that between the designing system and the persuasive service system (Design loop), and that between the persuasive service system and the user system (Service System loop) (Figures 43, 44). I denote these feedback loops 'conversations' to highlight their circular, dialectical relationship. These two systems describe a first-order cybernetic system (which is being observed) and a second-order cybernetic system (which observes and includes itself in the observation).

Together, these two circular feedback loops make up a hierarchy of *nested* cybernetic feedback loops, which are persuasive, meaning that they aim to influence the lower-level system's goals (see figure 42).

Conversational level	Analysis of
Design Conversation  *Figure 43: A design conversation.*	'The cybernetics of observing systems' Design level of analysis concerning the approach to design. - How does the designing system operate? - What principles guide design decisions? - How does the designing system design? - What motivates the designers? - What influences the designers?
Persuasive Service System Conversation  *Figure 44: A persuasive service system conversation.*	'The cybernetics of observed systems' Persuasive service system level, where questions concerning technology design live. - What features should be built? - What is the architecture of the system? - What tactical design choices are made? - How should the system be built?

3.3.2 The gaps in knowledge

To recapitulate, the research questions of this thesis were:

R1: How can a design cybernetic approach contribute to the understanding of services as persuasive systems?

R2: How can different concepts from design cybernetics be applied in a persuasive service system design project, to create more understandable and valuable service propositions??

In chapter 2, I outlined some contemporary challenges of persuasive service systems and arrived at three knowledge gaps:

1) A lack of systemic design approaches versatile enough to address wicked ethical problems in persuasive service systems.
2) More complex systems make it challenging to locate and value persuasive intent.
3) New approaches are needed to translate ethical guidelines to practice.

After having reviewed design cybernetics in chapter 3, I formulated *three hypotheses* of how the approach could add value to the design of persuasive service systems. Here, I attempt to answer these questions, with a short statement about *how* value can be added. That provides partial answers to research question 1 and 2. More detail of how specific concepts from design cybernetics can be useful in persuasive service system design is described in Table 13, as per below.

H1. Design cybernetics can offer a holistic framework for understanding and designing persuasive service systems.

> **DC can be used as a conceptual framework (a language) to describe persuasive service systems.** Per definition, persuasive system research concerns systems with persuasive goals. These systems are becoming more common in services. The cybernetic vocabulary could enrich conversations about persuasive systems, in areas where challenges remain, such as describing ethical aspects, how their goals and purposes are formed and how they can be governed. These challenges belong in the second-order cybernetic domain.
>
> **DC can be used to illustrate the emerging human-computer design relationship.** Making explicit that both people and computer systems can be systems designing or being designed. In cybernetics, systems, whether they are made of flesh, silicone or words and concepts, are

treated equally. That is useful when understanding the emerging relationship between people and computers, as computing products become more complex.

H2. Design cybernetics can facilitate the understanding of higher-order systems goals, where many wicked problems related to governance and ethics are located.

For meta-designing the reflective second-order layers of services. Persuasive systems research stems from an engineering tradition: studies human-computer interaction and information systems. Second-order cybernetics adds an important reflective layer to persuasive systems research, bringing the observer/designer into the analysis. A language for persuasive system meta-design, would enrich the engineering-heavy discourse in the persuasive technology community with further interdisciplinary perspectives and allow a more nuanced conversation about values.

Provide a new approach to the governance of persuasive service systems. Governing persuasive systems has become a societal challenge on a massive scale. Governments and companies are struggling with regulating and controlling systems that influence people's behaviours or attitudes at scale. Design cybernetics offers a vocabulary for a meta-design of persuasive systems that helps us put words on wherein these challenges lie and provide inspiration to tangible approaches for governing these systems. That may prove especially desirable in the light of exponentially more advanced technological development.

As Krippendorf writes, designers make proposals, and whatever we call them, or in which language they are expressed, all services start with a proposal made by someone, somewhere. A second-order understanding of these proposals is valuable for identifying and assessing risks early to avoid downstream issues proactively. When a structure is set, the goals are far more challenging to influence. It is also essential to continue to develop our understanding of the designer's role in society and which powers they possess to influence the future.

H3. Design Cybernetics offers an ethical approach that can improve governance and ethics in persuasive service systems.

Provide a new approach to embed ethics in service design practice. Design cybernetics brings two main ethical imperatives to service design practice: that designers are ultimately responsible for their designs, and the theory that conversations involve interactions with the world that leads to an upgraded understanding thereof, which has certain ethical qualities.

That may prove useful in the design of persuasive systems, where ethical design methods are needed. Berdichevsky et al. (1999) provided the ethical guidelines, for example and do not directly translate to practice, which the ethical imperative of design cybernetics does.

To describe relationships between organisations and the persuasive systems they develop and deploy. Bringing the observer into the equation and second-order perspectives such as governance and management means that persuasive systems cannot be seen as isolated systems. The emphasis on capturing contexts for these systems is thus essential.

The literature review focused on design cybernetics and governance of services as persuasive systems. It provided a brief historical overview and outlined important nuances in design cybernetic philosophy. It also described some current issues in persuasive technology research.

It suggests that there is an opportunity to make an interdisciplinary contribution in the nexus of the domains of persuasive systems, design cybernetics and service design, by exploring how design cybernetics as a design philosophy can be applied in service design projects, for creating persuasive service systems. New knowledge in this domain would provide evidence for the value of design cybernetics as a design approach and contribute to new, urgently needed knowledge about persuasive service systems and how they could be understood and governed.

Domain	Usefulness in service design
Overall philosophy	1. As a conceptual framework to describe purposeful, persuasive service systems. 2. For meta-design of the reflective second-order layers of services. 3. To illustrate the emerging human-computer relationship. 4. To embody ethics in service design practice. 5. New theories of governance of persuasive systems. 6. To study relationships between organisations and the persuasive systems they develop.
Goals/purpose/intent	1. To understand the designing system's goals/intent. 2. To understand other stakeholder's goals and intent. 3. To understand the goals of service systems 4. To understand the linkages between and the processes leading up to the above.
Conversations	1. To inform a conversational approach to the governance of persuasive systems. 2. To understand how goals and intents are formed and reformed. 3. To describe learning situations in services. 4. To describe human-computer interactions and interfaces.
Variety/requisite variety	1. To describe the architecture of services based on persuasive systems. 2. To assemble the 'right' design teams. 3. To create services to improve wicked problems 4. To describe aspects of persuasive systems. 5. To create system resilience
Autopoiesis	1. As a service architecture for persuasive systems. 2. As a model for the service design process. 3. Autopoietic descriptions of social systems.
Black boxes	1. To frame complexity 2. To understand and make explicit what is known and unknown regarding a persuasive system. 3. For understanding an understanding of a system.
Governors	1. To devise instruments for regulating persuasive system. 2. To bring a new perspective of governance of service design.
Biocost	1. For improved organisational design. 2. For understanding behavioural costs and gains in service design.

Table 13: Summary of how cybernetic terminology and concepts are useful in service design.

4. Methodology

In the first chapter, I presented evidence of three areas in which services as persuasive systems are problematic and concluded that these interconnected problem areas need to be addressed. In the second and third chapters, I outlined the theoretical base I draw from in this dissertation. I defined the positioning of the research in the nexus of persuasive systems research and design cybernetics and described the relationship to service design.

This chapter will motivate and describe the overall research philosophy, design philosophy, research methodology, and *methods* used and present arguments to why this approach is appropriate for generating new knowledge and answering the research questions.

The research approach is summarized in the following table, with a research process adapted from Crotty (1998):

Ontology	Performative ontology - Truth is socially constructed and performed by individuals or groups of cognitive agents.
Epistemology	Pragmatic-constructivist
Theoretical perspective	Design cybernetic conversations - Research for design - Research through design
Methodology	Design-based research using reflective practice and action research in the context of service design. → epistemic service design
Methods	Reflective practice Action research
Tools	Prototypes Qualitative interviews Observation Research diary Service design projects

Table 14: Summary of methodology.

Ontology and epistemology: A pragmatic-constructivist claim to knowledge

By now, you may have noticed that this PhD thesis is written from a first-person perspective. This is to acknowledge that I, as a researcher and observer, am inseparable from my research, as per constructivist second-order cybernetic logic. Constructivist approaches lean on the theory that reality is constructed from individual and collective human subjective experiences and that it is not possible to arrive at objective truths about the world we live in, only more or less probable models and

representations (Patton 2015 p.121-122). Cybernetic logic also assumes an inherent teleology in living beings, which means that I also frame myself as a goal-oriented actor, when pursuing my research.

The research's epistemological foundation follows a constructivist logic, common in the tradition of design research, and central in design cybernetics (von Glaserfelt 2002, Glanville 2009, 2014). Constructivist epistemology can be traced back to ancient Greek philosophy: Heraclitus wrote that *everything is in flux and* Protagoras proclamation that *man is the measure of all things* (Graham 2019, Bonazzi 2020). However, the academic term was first introduced by Jean Piaget, who studied human cognitive development (Staver 1986). Constructivism promotes the idea that there is not one, but *multiple realities, which are socially constructed among its observers*, that reality is constructed from individual and collective human subjective experiences and that it is not possible to arrive at objective truths about the world we live in, only more or less probable models and representations. This can be contrasted with positivist approaches which suggest that there is a world independent of human subjectivity, which we can discover by a systematic and empirical inquiry into its nature and by eliminating subjectivity to an as far extent as possible from the research process (Hacking 1999, Quinn Patton 2015). In contrast to 'dead', non-cognitive objects, humans as cognitive, living beings are actively reflecting on reality and in doing so, constructing models of the world and terminology to describe it. Quinn Patton (2015) writes that 'Constructionists study the multiple realities constructed by different groups of people and the implications of those constructions for their lives and interactions with others.' highlighting that the way people frame the world directly influences what they do and how they live. As this research concerns extending the vocabulary of design cybernetics into the domains of service design, it is implied that the framing alone may influence people's perceptions of the world, leading to different practices. The design research approach and in particular research *through* design, is sometimes described as *pragmatic*, where the best methods are considered those which solves problems. Pragmatism is a different branch of philosophical inquiry into epistemology, suggesting that what can be known, is an instrumental matter of what can be sensed and measured. Pragmatism's focus on problem-solving has resonated with design theoreticians and inspired both action research and reflective practice (Adelman 1993). William Gaver, for example, states that 'epistemological accountability is not integral to design' and argues that design research could be evaluated on 'aesthetic accountability', which in his view does not refer to a judgement of beauty, but of whether a design 'works' or not (Gaver 2016).

Since constructivism is the epistemological opposite of positivism, it has been criticised for being relativistic meaning that what is 'true' for one social group may be considered 'unttrue' for another social group (Baghramian 2020). In addition to being criticised for relativism, pragmatism has also been criticised for focusing on what is *good* and useful, rather than what is *true*.

Justification for choosing this approach

As described in chapters 2 and 3, persuasive systems and cybernetics systems are defined as *purposeful* systems, meaning that they actively influence the future through their actions in the world. One could argue that people's actions are deterministic and inevitable. However, since this thesis's subject of study is human-made constructs, I find the ontological and epistemological grounding in a constructed reality more useful. That said, I do not exclude completely the idea of a reality existing outside of the world us humans have constructed, but the focus of this thesis is not to examine the fabrics of reality, but to generate new knowledge about how we *could* work with artificial, persuasive systems in the form of services, which suggests a practical, pragmatic approach.

Furthermore, some of the challenges related to persuasive systems discussed in chapter 2, can be considered wicked problems, according to Rittel and Webber's definition. This implies that there are multiple realities, multiple different futures that could be realised, depending on people's actions and choices today. In research areas where little theory is available, and problems are wicked to their nature, an exploratory, emergent design approach is usually appropriate (Rittel and Webber 1973). Therefore, I argue that the chosen pragmatic-constructivist perspective is appropriate because the dissertation is also a designed artefact in itself and should 'work' for its audience. Although the impact will likely be limited in the grand scheme of things, this thesis will influence how people relate to these technologies going forward. In doing so, it (and I) makes an argument for a certain future.

The nature of the inquiry touches upon theoretical and practical domains concerning services, persuasive systems, and cybernetics. Over the course of my research, I have found it both necessary and enjoyable to continuously shift perspectives between these two domains. The research process can be mapped to Dubberly and Evenson's analysis-synthesis bridge. I have created abstractions (using design cybernetics) to model the challenges and problems with, to arrive at concepts of preferable solutions which are then prototyped and brought to the world (Dubberly, Evenson and Robinson 2008).

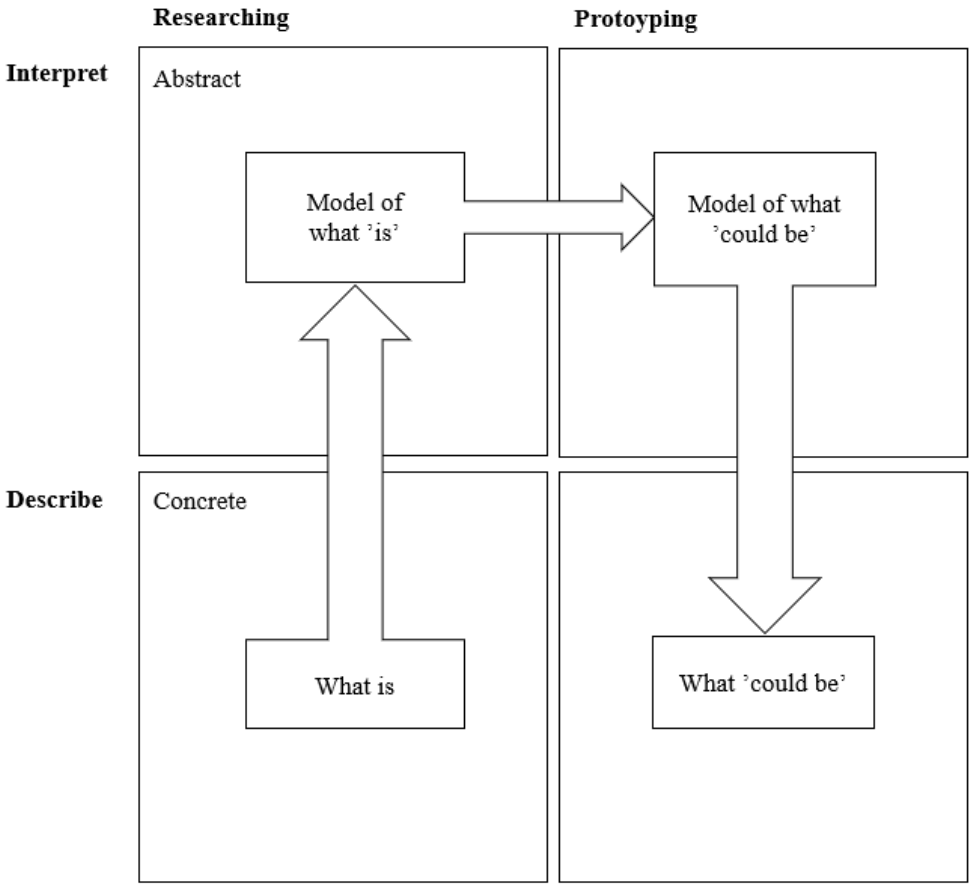


Figure 45: The Analysis-Synthesis Bridge. Adapted from Dubberly, Evenson and Robinson (2008).

4.1 Design Cybernetic Research Approach and Philosophy

Design cybernetics assume that there is an epistemological connection between design and second-order cybernetics. A growing number of distinguished scholars recognises that there is a clear link between the two research traditions. Second-order cybernetics provides a theoretical language for design and design provides a practical arm of second-order cybernetics (Glanville 2009, Krippendorf 2019, Dubberly and Pangaro 2019, Sweeting 2015, Herr 2019). As described in chapter 1, the issues related to services as persuasive systems can also be considered *wicked* problems, as per Rittel and Webber's definition. Design epistemology and methods are especially useful for addressing wicked problems. The *iterative, circular process of design* is ideal for bringing clarity to unstructured problems, both in formulating the challenges and exploring and testing novel solutions. In this thesis, I have used design research methods, but described and analysed my practice using second-order cybernetic concepts.

Design research

In contrast to positivist sciences, design research does not primarily aim to generate objective and verifiable knowledge about the existing world, but to explore, evaluate and bring to the world new concepts and innovations that do not yet exist. In *The Sciences of the Artificial,* Herbert Simon established the foundations of design epistemology, and he described the designer as 'changing existing situations into preferred ones', meaning that the designer, in essence, is an agent of change concerned with the production of the new (Simon 1988). The knowledge claims made by design research thus follows a different logic than those of the sciences. It is more concerned with what *could* and what *ought to* be, rather than what already exists. In the context of this research, the purpose is to generate new knowledge of how to use concepts from design cybernetics in a persuasive system service design project. The literature review suggested that new theoretical frameworks, methods and tools may be needed to achieve this, why I have embraced the future-oriented, exploratory research mode which design research offers. The research's exploratory nature is a strong argument for selecting a constructivist approach since positivist approaches are worse at forward-looking, generative, explorative and meaning-seeking inquiries.

Circularity is a key concept which connects design and cybernetics. The reflective processes embedded in the research can be described as 'reflection-on-action' and 'reflection-in-action', two different modes of reflective practice, where new knowledge is created *through* the act of design (Schön 1983, Frayling 1993). The circular relation, think-act-observe-reflect has its roots in Kurt Lewin's action research methods, aimed to support practitioners. Lewin was influenced by pragmatism, and I particular the philosophies of Charles Peirce and James Dewey, who argued that new knowledge is developed through acting and observing action (Adelman 1993). In 1983, Donald Schön published his theory of reflective practice, which emphasised that direct connection between action and reflection leads to improved knowledge for the practitioner. Schön was also influenced by the pragmatic philosophy of Peirce and Dewey (Schön 1992).

In this research, I am a service design practitioner, and through different forms of reflective practice, I am evolving my knowledge. I *document* my reflections as I design, *share* those reflections in this research, and also *reflect and evaluate* the design decisions taken ongoingly. New knowledge has been created in an *iterative* process, which is *cyclical* and goes back and forth between the problem formulation and possible solutions. Some see this process as a spiral (such as the 'spiral' commonly depicted in action research), but as Glanville argues, '*given that there is change in what is made and criticised, some may think of what is produced as following a spiral. The traces of its history is indeed a spiral: but the form remains a circle.'* (Glanville 2016). I agree with Glanville and do not prefer to see the process as a series of steps, but rather an *ongoing construction of knowledge in the intersection of theory and practice*. The two modes of working inform and build on each other. My methodology subscribes to the idea of design activity as *conversations*, a cybernetic concept that

can be mapped to reflective practice, which was described in greater detail in chapter 3. I further agree with Glanville (2014), who stated that '*The circular activity in which we talk and listen is a 'conversation'*.

Thesis based but practice-located

This thesis-based PhD research seeks to apply design cybernetic ideas to better understand and work with services-as-persuasive systems. I did not have a clear view of the result when the investigation commenced, why the research has thus been a simultaneous process for *problem framing* and *problem-solving*. Although this is not a PhD by practice, typical for design research, the study is *practice-located* in the sense that new knowledge is partially derived from a series of practical design projects. As a researcher, I sometimes participated as an observer and sometimes I was actively involved in these service design projects, placing parts of this research in the domain of action research, which could be regarded as research *through* design, as per Christopher Frayling's definition (Frayling 1993). Through active problem solving and design projects, new, contextual knowledge is created, to generate generalizable conclusions. Archer (1995) writes that '*there are circumstances when the best or only way to shed light on a proposition, a principle or material, a process or a function is to attempt to construct something, or to enact something, calculated to explore, embody or test it.*' and I concur with this statement. Cross further emphasises that '*Design as a discipline [..] can mean a science of design based on the reflective practice of design: design as a discipline but not design as a science'*, suggesting that design research can and should be studied on its own terms, with its distinct methods rooted in design practice (Cross 2001). The mode of research is perhaps best described by Findeli (1998), who proposes *project-grounded research* as a hybrid research methodology between grounded theory and action research. '*Only in the field of a project, we believe, will the student be able to refine the construction of the original problématique and to reformulate the main research questions adequately*.' writes Findeli. The goal of the project-grounded design research is to generate new knowledge for answering the research questions regarding the governance of services as persuasive systems.

Throughout the PhD, I have worked across a spectrum of roles; from that of a *passive observer* to an *active observer* (an actor), in the role as a reflective practitioner. 'Every observation is autobiographical', writes Glanville, alluding to Von Foerster's notion that 'everything that is said, is said by an observer', recognizing the observer's inevitable entanglement with that which is being observed (Glanville 2008, von Foerster 2003b). The research process's desired outcome is new knowledge which managers, designers and other practitioners who design, regulate, use or interact with services delivered in part by digital platforms, can use to improve the way they design. That means that continuous interaction with this group has been important for the development of the research.

How to generate knowledge through a design cybernetic process

Creating new knowledge in a constructivist context means that the researcher needs to make a believable and trustworthy *representation* of the world and an extension to the current model, perceived as *new* by the academic community. To achieve that, the researcher needs to have enough conversations with the State of the Art and State of Practice, to *understand* what could constitute novelty, *propose a solution* and collect *evidence* for the solution. In doing so, he *increases his intellectual variety,* and his arguments for new knowledge becomes more *persuasive*. In parallel with developing his own knowledge, he also elevates others' knowledge about his research when engaging in different forms of conversations. For further evaluative criteria of what constitutes trustworthy research in this context, I refer to Cross (2007, p. 14) criteria as discussed in section 4.3.1.

My personal design process is in focus for the research. Scholte (2020) suggested that 'each individual must develop a theory of themselves as an observer. We must develop and equip these researchers with tools for the kind of second-order observation necessary for this task.' I concur with that statement and suggest that developing second-order observation sensitivity is not only a 'nice to have' but a 'need to have' for service design researchers.

To address the complex challenges presented in chapter 1 and 2, I used a *qualitative approach*, to arrive at an in-depth and contextually sensitive understanding of the challenges at hand. I have used *reflective practise* and *action research methods* to formulate and validate a research agenda and collected evidence from reflective practice, which I refined by engaging in explorative service design projects. Learning from professional managers, designers and academics, I collected rich data which informed the research and through continuous reflection on the process, I eventually arrived at stable conclusions.

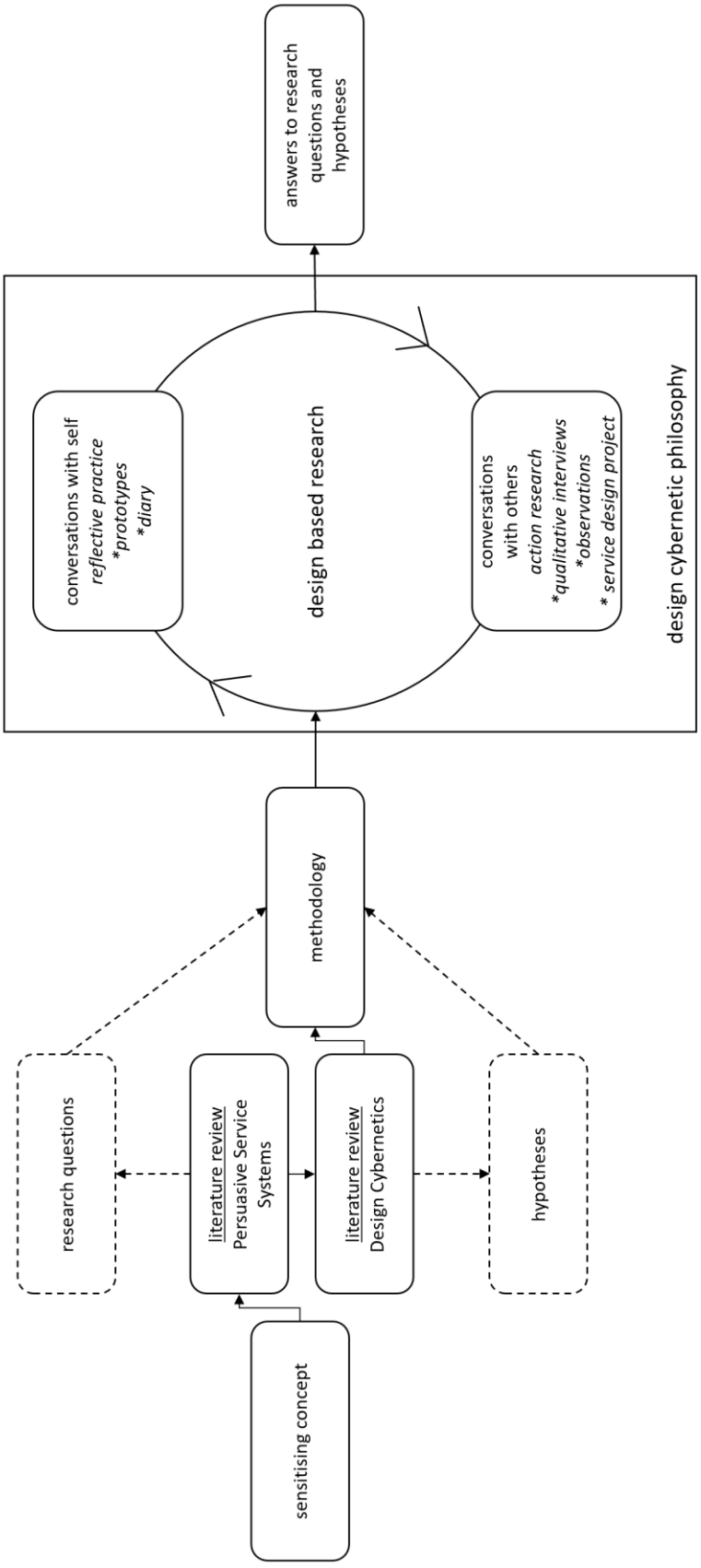


Figure 46: Methodology diagram

4.1.3 The Research Process

On the previous page, I provided a *methodology diagram* (figure 46). Although the process may look linear from the picture, it was *circular* in practice, and I did go back and forth between the different sections (it has been 'flattened' for improved readability). In my case, the exploration began with a 'sensitising concept' as a starting point, my 'itch that needed scratching', a term borrowed from grounded theory. It denotes a 'starting point of exploration' which the researcher uses to guide the research (Charmaz 2014), and it is described in chapter 1. The sensitizing concept led me to explore the challenges of persuasive technologies more in detail, which is accounted for in chapter 2. After an extensive literature review, a review of existing design models for persuasive systems (chapter 2) and an ongoing analysis of the fragments in the research diary, I had a better understanding of the challenges and earlier approaches. I formulated two research questions and identified areas in which technological challenges called for improvements. Next, I did another extensive literature review in chapter 3, covering design cybernetic history and concepts and arrived at three hypotheses of how design cybernetics could be useful for service design of persuasive service systems. Next, I formulated a methodology (chapter 4) to address the research questions, informed by the hypotheses developed in the literature review. I had identified several clear gaps in knowledge, which I had also partially validated through publishing a positioning paper (Borgefalk and de Leon 2019). Next, I set out to fill the gap, by engaging in reflective practice, expressed as an epistemic service design project, and engaged with others, through participating as an observer in two live service design projects. (chapters 5 and 6) A design cybernetic philosophy thoroughly inspired the research approach. Throughout the practice, I gradually moved from a passive to an active observer, as my confidence and knowledge grew. In chapter 7, I discuss the outcomes of the research and what it means. The thesis is concluded in chapter 8, with a summary, final reflections, and recommendations for future research.

4.2 Methods: Conversations

Throughout the PhD, I engaged in a series of *conversations*, inspired by *conversation theory* originally attributed to Gordon Pask and subsequently developed by Dubberly, Pangaro, Glanville and others. (see chapter 3.2.3.2) Glanville stated that 'conversation is the bridge between Cybernetics and design'. The circular, epistemic and iterative process of conversations resembles that of a design process. Different stakeholders' requirements and goals are exchanged in an interactive process that may lead to orientation, new information, possibilities or actions, as per Winograd's definitions. (Winograd 1986) Conversations differ from communication (for example as per Claude Shannon's model). They lead to updated (new) knowledge, behaviours or attitudes for both parties participating in the conversation, while communication can just be messaging. Conversations also allow innovation

in the sense that it lets the mind learn from other systems and in doing so, generate new concepts and perspectives. It also means *educating*, i.e., influencing, the behaviours and attitudes of other systems.

A spectrum of engagement

As described in design cybernetic literature, as discussed in chapter 3, the observer or researcher should be included in the analysis of any second-order cybernetic system. In the context of action research, there is an ongoing discussion of the extent to which the researcher should engage with the subject of study and the challenges with intervening, to avoid harm (Kelly 2019). To address this challenge, I chose a gradual approach to intervening as a researcher, starting as a more passive observer, then moving to a level of higher engagement in the following project. In this way, I perceived that there was less risk that my interventions, which were still at the experimental stage, would do any harm to the host organisation. In the worst case, my presence would make them worse off than if I had not been there at all; however, intervening in the wrong way would not be desirable. As my framework, methods, and tools developed, I got more confident in talking about it and applying them, which led me to take a more active role when engaging with the study subjects. It was my impression that the more conversations I had, the better a conversational partner I became.

Other external conversations

In addition to the conversations I had with the project partners, I searched for other forums to have qualified conversations. By participating in academic conferences, symposia, lectures, tutorials, and later on, by teaching, lecturing, and tutoring other students, I got the opportunity to have numerous conversations with other scholars, which helped me refine my framework and models and tools. Through these conversations, I not only upgraded my personal thinking, but following the second-order cybernetic theories, also upgraded the thinking of others. I developed my ability to deliver communicable knowledge. Primarily through teaching and tutoring, I could listen in to the academic community's needs and upgrade my understanding of what would be helpful to them, not only in substance but also in form. For example, the COVID-crisis forced me to shift form of practice, from classroom-based to online learning, meaning that I had to develop teaching material suitable for the new medium. Besides engaging in the academic setting, I engaged extensively with managers and design practitioners working for companies and NGOs. In doing so, I upgraded my understanding of how the framework, methods, and tools could be applied outside of an academic setting, further validating the framework's need and usefulness. Although the dissertation's scope is limited and more interactions with practitioners would be desirable, these dialogues contributed to improving the research's overall quality. In one of the case studies, I also got an opportunity to explore a project where a company (Planethon) interacted with academia (the students) in a live service design project, which provided rich insights in how and where I could intervene in the process to support it.

Overview of methods used in the study

Objective	Methods	Activities
Understand existing knowledge and stress test research questions	Reflecting on literature Presenting in professional and academic forums Writing positioning papers	Review of existing literature and practice. Exhibited and interacted with people at the Work In progress-show at RCA in 2018. Presenting positioning paper at Persuasive 19' Presenting at Doctoral Consortium at Persuasive 19' Article in Journal of Service Design Participation in Microsoft's PhD Summer AI School in Cambridge Participated in (and won) Future of Money Design Award.
Increase personal knowledge Test out research formats Collect data	**Conversations with the self** Epistemic service design as reflective practice Design prototyping Researcher's diary and fragment collection	**Design Cybernetic Garden** - Design prototypes - Notes and diary entries **Conversational Stones** - Service design prototypes - Diary entries - Service design prototypes
Turn personal knowledge into communicable knowledge Try out new knowledge in a real-world setting Reflect on communicability of new knowledge	**Conversations with others** Service design projects Observations Interviews Workshops	**Case study: Friends** Data: - Observations - Semi-structured interviews - Discussion with workshop participants **Case study: Planethon** Data: - Observations - Semi-structured interviews - Service design prototypes Tutoring other students

Table 15: Summary of methods used in the research.

4.2.1 Conversations with the self

A central research method has been an extensive reflective practice, which I denote *conversations with the self*. Conversations with the self, as an approach to operationalising Pask's conversation theory, has for example been discussed by Ranulph Glanville, who stated that 'conversation is the bridge between Cybernetics and design' (Glanville 2014). Different stakeholders' requirements and goals are exchanged in an interactive process that may lead to an exchange of knowledge (learning), new knowledge, action or transactions. However, a conversation with the self is per definition not a conversation with others, but an 'inner dialogue' where the researcher reflects *on* action or *in* action. I recognized that knowledge was also created between the session, which Currano, Steinert and Leifer (2011) refer to as 'reflection-out-of-action', describing the ideas one gets 'while jogging, or while in the shower', between sessions of practice. It has been suggested that conversations with the self can be used as a process for generating new knowledge, in the sense that when the mind wanders, it generates new concepts and perspectives which can be evaluated. Fischer (2015) emphasises that performance (practice) should go before description and that actually *practising* cybernetics is crucial.

However, for this research, I realized that there was an important distinction that I wanted to explore further: my practice's primary goal was not to create communicable knowledge at this stage but to generate new *personal* knowledge. That meant that I could toss out the slides and canvases and explore new methods in a playful, risk-free and judgment-free environment.

So, to upgrade my personal thinking, I performed research by *designing an epistemic service* throughout the PhD (2018-2002). The service design exploration took its starting point to search for solutions to the challenges I described in chapters 1 and 2. However, at the very beginning of the PhD, I did not have detailed knowledge about the issues at hand. To support the epistemic service design process, I kept a *research diary*, *sketch books* with loose thoughts and concepts and a *media diary* mostly capturing clippings from various media. I experimented with clay, electronics, drawings and 3D modelling. To further support my thinking, I created a series of *service artefacts and speculative touchpoint*, where I was inspired by the fragments I had collected and the projects I engaged in. I allowed myself to *wander* - to be led by delight and lust for creation rather than the need to deliver anything to anyone. Through the research process, and my previous professional career, I have dreaded spending time in front of the computer and longed for creating physical things. Although I do not have any evidence to back up this assertion, I am confident that other designers feel the same way. Although modelling and prototyping is a part of service design, which allows for making, I find it challenging to articulate insights using prototypes and artefacts only. The artefact I created effectively became fragments themselves, which provoked reflections and new thinking, as I tried to ascribe meaning to them.

4.2.2.1 Epistemic service design

A selection of the results from the epistemic service design process is documented in chapter 5. The purpose of the epistemic service design process was initially not to arrive at a working service. Instead it began as a way for me to structure my thinking and experiment with new concepts and questions. Throughout the research, I realized the value of this practice and went on more and more bold and free explorations. These *wanderings* were important to the process because they allowed me to form theoretical concepts and grasp concepts concerning persuasive systems in the cyber-physical borderline. I call the service design method *epistemic* because the primary purpose of the service design activity was to generate new, communicable knowledge, not arrive at any particular goal, or design a service for someone. I experienced a sense of *freedom* in the *purposelessness* of the design exploration. It allowed me to reflect deeply on the underlying theoretical and sometimes practical matters related to services as persuasive systems and design cybernetics. I regularly revisited the epistemic service, to play around with different solutions, sometimes to generate ideas and sometimes to synthesise ideas which I picked up elsewhere.

Epistemic services versus epistemic objects

As Dubberly et al. points out, there has been a shift in design from hand-craft to service-craft, pointing to that service-craft is more about designing behaviours, rather than things. As previously described in chapter 2, '*Service-craft includes the design, management, and ongoing development of service systems, the connected touch-points of service delivery*.' writes Dubberly and Pangaro (2007). That means that service designers work with *different materials* than product designers. Epistemic services incorporate the distinct features of services such as intangibility, inseparability, perishability and heterogeneity, meaning that they can be expressed differently than epistemic objects. Services designed as part of the research allows the researcher to evolve his knowledge by engaging with it. '*The lack, uncertainty or indeterminacy of epistemic objects generates questions which turn into avenues for further exploration. Pursuing these avenues causes the epistemic object to evolve, satisfying some equations whilst opening up new ones*.' writes Ewenstein and Whyte (2009)

In the existing literature, *boundary objects, epistemic objects* and *technical objects* have been described as artefacts with which people engage to generate new knowledge. Ewenstein (2009) describes the difference between these three types of objects and points to their writing. *Boundary objects* can be interpreted differently, but they are stable and concrete representations, allowing people to discuss and coordinate across communities of practice. *Epistemic objects - objects of knowledge* - are continually evolving, as they emerge, they answer questions and enable knowledge work. On the other hand, *technical objects* are fixed and stable objects that can be used as unproblematic and straightforward tools to communicate a concept. Working with epistemic, emerging service as a central part of my practice has been challenging because of a lack of guidelines

for how to handle epistemic services. Although I have been guided by literature on epistemic objects, there are different sets of challenges which I will account for in the analysis section.

4.2.1.2 Diary

As scaffolding for the primary research activity, I have collected empirical data in the form of *fragments of data: texts, sketches, quotes, photos, screenshots, books and pamphlets* which have been analysed using methods borrowed from *grounded theory*, however, the methods have not been applied rigorously, and they have been adapted to suit a generative purpose primarily, to stimulate deeper thinking and the generation of new ideas. I was deeply inspired by a workshop held at the RCA where I was introduced to Dillon's (2017) research who wrote about the process of creating text-based on literary or physical *fragments* from the past. The author gave the example of ancient texts from Greek scholars that often survived to the present day in the form of fragments of text, which later has been interpreted and combined to whole texts and narratives by modern-day researchers. The fragments are 'made to speak' by the researcher who composes, crafts, persuasive, compelling narratives from the fragments. Depending on how the fragments are composed, the meaning may differ, allowing for an argument about how the fragments should 'rub up against each other', with which pattern the fragments should be combined. The struggle between the fragments allows for multiple perspectives, which allows the text and the researcher 'to say many contradictory things at once' (Dillon 2017). When working interdisciplinary and in a second-order context, I believe that there is a value in not saying things certainly, but rather to create texts or artefacts that can provoke reflections and can instead be internalized and interpreted by others. Certainty will almost certainly be overturned, whereas philosophical, ambiguous ideas can continue to provoke for a long time ahead. To place the method in the contemporary context of this research, the purpose of the *fragments*, which can be considered *unstructured data* from various sources, has been to *articulate* and build *material evidence* for the *exploratory process* and create a *body of evidence (a corpus) for my personal reflective process*, which can be examined.

To continuously collect impressions which related to my research, I kept a *diary of fragmented evidence*. Shumack (2010) writes that keeping a *research diary* allows the researcher to capture and make his personal design process explicit. The methodology 'offers a means to engage with experiential knowledge and knowing through multiple readings of situations'. Shumack offers a case study of her research journaling, where she reflects on her journal entries - allowing for a reflexive second-order learning loop. Throughout the research, I filled thousands of journal pages with notes, reflections, doodles and loose ideas. I have not included the full diary in the thesis, but the diary notes were vital to my creative process, why I felt it necessary to mention them.

4.2.2 Conversations with others

One of the main modes of *reflective practice* in this research consisted of me (the researcher) engaging with external actors. The purpose of engaging with others was to navigate my personal knowledge about the environment, understand what is already known, and identify whom the research would be useful for. This means that the reflective practice incorporated elements of action research.

Action research (AR) as a design research approach has been developed over nearly seventy years. The researcher participates as an active agent in a change project and thereby creates new knowledge. MIT professor Kurt Lewin coined the term action research in 1944, in a social psychology context, where he described an iterative mode of doing research (described in Adelman 1993). He outlined a circle of planning, acting, observing, reflecting, where situation-specific knowledge is generated iteratively. (Lewin's theories have come to influence action research and the entire field of design research. It is a reflective process which focuses on creating new knowledge by problem-solving, which is also reflected in second-order cybernetics and design cybernetics - learning systems which evolve their knowledge using the same circular mechanism. It is essential at this point to emphasise that a noticeable feature of action research is that I, as an investigator, am passively and actively influencing the subject of study in the action research process, whether I want to or not. As an investigator, as Archer (1995) wrote, '*it is impossible to conduct the investigation on an interference-free and value-free and nonjudgmental basis*'. Observing and reflecting on the researcher's actions, and having a sensitivity for ethical issues is thus central for action research.

The service design methods used have mainly taken place in *workshops* and *interviews* (*conversations)*, which come together in a coherent *service design process*.

4.2.2.1 Projects

Throughout the research, I engaged in two service design projects, with two different organisations: Friends, an anti-bullying organisation, and Planethon, a planet-centric business development consultancy (described in section 4.2.2.1.1-4.2.2.1.2). These two projects are accounted for in greater detail in chapter 6.2-6.3, and they provide partial answers to research question 2 that concerned how design cybernetic concepts can be applied in service design projects. It can be considered research *through* design and *for* design. In the first project, a brief was generated by the hosting organisation, in the second project, I was part of devising the brief, for three student teams to work on. The case studies are descriptive rather than explanatory. They are included to demonstrate how designing cybernetic concepts that I had processes in my personal reflective practice could be used in the real world. The insights derived from the projects informed the framework, tools and methods and led to several interesting insights related to the research method. An analysis of the interplay between the conversations with the self and others, and the projects' role, is found in chapter 7.

Selection of project partners

The selection of project partners was made based on my needs to generate rich data for answering the research questions, identifying subjects of study who were okay with the experimental nature of the inquiry and who also were available for the duration of the project period. The sampling method can be considered *purposeful* (purposeful sampling), defined by Quinn Patton (2015) as 'selecting information-rich cases to study, cases that by their nature and substance will illuminate the inquiry question being investigated'. The selection of partners was also opportunity-driven to some extent because the organisations allowed me to access, observe, and manage service design projects together with them. This approach can also be likened with Lincoln and Guba's concept of *naturalistic inquiry*, common in qualitative research, where the researcher studies phenomena in real-world contexts (Lincoln and Guba 1985). The primary purpose of engaging with external actors was to observe my personal design approach and how I could use design cybernetic concepts in the process. The research method and observations are inherently subjective and should be viewed in that light. The data generated from the projects were mainly qualitative and documented formally (interviews, workshops, desk research) and informally in personal reflections (research diary, fragments, clippings).

4.2.2.1.1 Friends

Friends is an anti-bullying organisation focusing on preventive antibullying work. They primarily address the target group 'adults who care about children' rather than directly engaging with children. Their offering includes educational programs which they provide to schools, as-in-person programs or online programs.

Having completed the first round of reflective practice, I engaged in an exploratory persuasive systems service design project, to test how cybernetic concepts could be applied to a real-world service design project to respond to research question 2. The Friends case study was initially planned to be carried out over six months. Due to reorganisation at the host organisation and subsequently, the COVID-19 crisis, the project was stretched out over 12 months, albeit with lower intensity. I spent approximately 200 hours with the organisation throughout the project in their offices and in the field. By embedding myself in the organisation, I could get rich insights in the challenges the organization was facing and learn about the workings of the 'designing system', the organisation which produced and delivered anti-bullying solutions as services.

To collect evidence, I did initial desk research about cyberbullying and about Friends. I carried out semi-structured interviews and organised workshops (see section 4.2.2.2. for more details), where design cybernetic concepts were integrated. To further expand my knowledge, I was invited to join the World Anti-Bullying Forum in Dublin, where I could get a broader picture of what solutions were available and engage with the global anti-bullying academic community.

The project's outcome was design prototypes of a meta-service that aimed to improve Friend's conversational capabilities. Their approval of the proposed concept provided partial validation of the value of the cybernetic design approach.

4.2.2.1.2 Planethon

To further explore how cybernetic concepts could be applied in a persuasive service system design project, I switched roles from an active observer to a more passive educator, to get a new perspective on the issue. Although I did not directly design myself, I designed the setting in which a design project took place, thus acting as a 'governor' for other designers.

A project was formulated together with Planethon, a planet-centric business and design consultancy. The project was carried out over four months in fall 2019 and subsequent interviews carried on into 2020. I developed a project brief jointly with Planethon, which subsequently was presented to service design students at the RCA, and worked on as part of their Master's program. I explored how cybernetic knowledge could inform the service design process and how different design processes' meta-layers interacted.

4.2.2.2. Interviews and workshops

To record and analyse conversations, I carried out a series of formal interviews per project. The purpose of the interviews was to increase the trustworthiness of the research, by creating an auditable trail (Lincoln and Guba 1985) and get insight in the thinking of the 'audience' for the thesis, to gain knowledge about their current level of knowledge about design cybernetics, their practices, their challenges, needs and working processes. The interviews were semi-structured and allowed the respondents to answer questions openly so that the discussions got more of a conversational format. I did consider having more informal conversational interviews. However, I was pretty nervous when carrying out the formal interviews, why the questions provided me with a safe structure to facilitate the discussion from. The interviewees were recruited in the projects and to ensure their informed consent to participation, all interviewees were provided with a participant information sheet and consent form, which they signed. In a few rare instances, it was not possible to get the interviewees signatures in writing, why I in those cases received their expressed consent via email.

To improve my interview technique, I wrote a short diary post with a few bullet points that summarized the interview and a 'reflection on method' - evaluating my perceived performance after each interview. That created a reflective feedback-loop that allowed me to improve my interviewing technique throughout the PhD journey. I chose not to transcribe the full interviews, but selected quotes included in the text. In a few cases, the quotes were edited for better readability.

Workshops

To further engage others in my research, I designed workshop formats based on conversation theory, where the idea was to gather a larger group of people around the concepts. I carried out two workshops, one as part of the Friends project and one towards the end of the PhD journey, which involved 17 student participants from RCA. The first workshop was held in person at Friend's offices, and the results are accounted for in chapter 6.2. The second one was held online, due to the COVID-19 crisis. For the workshops, I wrote extensive notes that constituted rich data, which I could then feed directly into the case a reflection on the method.

4.3 Validity and reliability of the research

4.3.1 How the methodology helps to answer the research questions

The thesis's central proposition is that there are benefits of extending the vocabulary of design cybernetics to the domains of service design, particularly for the design of persuasive service systems. Albeit there are many different approaches to design and many approaches for the design of persuasive systems already, extending the design vocabulary means opening up new design spaces. Krippendorf (2006, p. 11) has written extensively about language's role for design. He asserted that '*...it is not impossible to create and start using new metaphors, new vocabularies, and new ways of conceptualizing the world and encouraging new practices.*'. The research methods were selected to support my exploration into the conceptual world of design cybernetics. The journey has expanded my personal design space and ultimately generated answer to the research questions.

4.3.2 Evaluating the research

To evaluate the research, I have used the common framework of Nigel Cross (2007). While there are several frameworks for assessing the trustworthiness of qualitative research (ex. Lincoln and Guba), Cross provides a more specific framework for evaluating design research in particular.

Nigel Cross writes that good design research should be *purposive*, *inquisitive*, *informed*, *methodical* and *communicable* (Cross 2007, p. 124). *Purposive* means that the research problem should be worth solving, i.e. non-trivial. I have spent quite some time in the problem space, identifying a problem worth solving and then validated that the problems I identified actually matter to the community of academics and practitioners. That has mainly been done by presenting my ideas in journal papers and at academic conferences and having had in-depth conversations with tutors and advisors. *Inquisitive* means that it should seek new knowledge. Through presenting the problem formulation at academic conferences, I have verified the problems and, in the process, also got a better understanding of what state-of-the-art is in the field. *Informed* means that the reviewed knowledge should cover the state of knowledge (SoK), state of practice (SoP) and state of the art

(SoA). The problem formulation and conceptual review in chapter 2 and chapter 3 cover these dimensions. *Methodical* means that the research is planned and disciplined, which it is to some extent. The projects were planned out according to current regulation; the work was documented and recorded. However, design research also benefits from 'wanderings', seemingly aimless acts of creation, which is neither planned nor disciplined, but rather spontaneous and serendipitous - necessities in the exploration of novelty (Glanville). Finally, *communicable* means that the research generates knowledge which others can access, scrutinise and evaluate. I have thus far used every opportunity to test my ideas, approaches and methods with other researchers, tutors, and the broader communities in conferences. Each interaction with other people or organisations - even with academic literature I read or even popular fiction- helps me 'correct the course' to identify new knowledge.

Further limitation

The research should primarily be seen as *design research,* and it is not computer science research, hardcore old-school cybernetics research or social science research. Whoever expects methods common in these fields will likely be disappointed. However, this does not mean that the investigation is not interesting, relevant or useful for researchers and practitioners in those fields. It just means that the research has been executed in the tradition of design research.

Reflective practice can be criticized as a method for being self-centred and limited in scope. Furthermore, the method has been criticised for a lack of clarity on self-reflection and its external value (Royal College of Art 2020). In design cybernetic tradition, I am explaining the research from my perspective as an observer in the system I am studying, why the choice of methods is warranted. I chose to use reflective practice and action research methods to *explore* the research questions, not necessarily answering them. To address these risks, I have tried to be *clear* and *structure* my self-reflections consistently across the projects. I documented my conversations with the self and others thoroughly and described the research journey as I experienced it, trying not to leave out important details.

A second limitation is that the Western-centrism of the research. It does unfortunately not capture scholarship which has not been translated to the English language. There is a Russian tradition of cybernetics. However, I speak neither Chinese nor Russian, which makes it infeasible to research those languages. However, several prominent scholars in design cybernetics are active at Chinese Universities, the editors of the 2019 book on Design Cybernetics: Navigating the New, Thomas Fischer and Christiane Herr, for example, are located at Xi'an Jiaotong-Liverpool University in Suzhou. Richards (2020) writes that Stuart Umpleby has worked to integrate Russian and Western cybernetic scholarship and the American Society of Cybernetics 2020 conference was planned to be organised in Moscow. However, as far as I can tell, despite significant contributions to cybernetic and second-order cybernetic scholarship, neither the Chinese nor the Russian Cybernetic traditions have significantly impacted the Design Cybernetic body of scholarship just yet. That does not mean that

there isn't any; it just means that those ideas have not been recognized widely.

A third identified limitation is the scope of the dissertation. A selection of literature from persuasive technology and cybernetics has been chosen for review. However, there are numerous papers which I have had to leave out, either because they were not relevant for the arguments of the thesis, or because they did not contribute to a better understanding for the research questions at hand.

A fourth identified limitation is related to my role as a researcher and observer. I am a middle-aged, Caucasian, slightly balding Swedish man, studying at the Royal College of Art. I grew up in a middle-class home in Sweden, a technology-abundant society with early-access to computers, the Internet and broadband. Although I have tried to be aware of the risks of researcher bias, the research is inevitably coloured by my background and privileged position. I have tried to reflect on this position continuously, and it became clear in the projects I engaged in that it would have been impossible for me to be just a fly on the wall. I personally subscribe to a constructivist epistemology and assert that it is impossible to study the world without changing it. My description of the world, my perceptions are phenomenologically mine. I can share my perspective with others, but it will always be coloured by the lens through which I perceive the world. The study and results should thus be viewed in this light.

There is a Swedish proverb by Esias Tegnér, which I keep above my computer screen that reads 'det dunkelt sagda är det dunkelt tänkta' (Tegner 1820) which can be translated as 'the words dimly spoken, are the ones dimly thought'. Language can confuse or clarify, and my ambition has been to write as clearly as possible.

4.4 Research ethics

Research ethics is essential, and this research has been executed following the ethical guidelines set out by the Royal College of Art. I have sought and received consent from all organisations and individuals who participated in the research. A set of consent forms were developed for the research program, which was continuously approved by the ethics committee at the RCA, whenever updated or changed (see appendix 2). All interviewees and workshop participants signed these forms

For the projects, I developed agreements between RCA, myself and the organisations with which I interacted, that regulated intellectual property generated, and set out the terms for the engagement. Also, key interviewees I recorded signed individual consent forms to ensure that they were properly informed about the project and their participation. All other physical documentation, such as consent forms can be provided and examined on request. To protect the identity of the interviewees, they have not been included in the printed thesis. Data collection has been carried out in line with RCA's policy on data collection and storage and following GDPR regulations of the EU.

4.4.1 Ethics related to the design of persuasive systems

As stated in chapter 1 and 2, there is a thin line between persuasion and manipulation. These issues are central to persuasive systems research, and I have given a thorough account for these in the literature review. Ethical issues about the use of persuasive systems are described closer in chapter 2. Since my research concerned persuasive systems of the second-order, I specifically address this in these sections.

4.4.2 Conflicts of interest

No conflicts of interest were identified in the project, which could question the integrity of the research. The research has been fully funded by Dr Tech. Marcus Wallenberg Foundation for Education in International Industrial Entrepreneurship, giving me academic freedom and independence.

5. Conversations with the self

In chapter 4, I introduced the concept of *conversations with the self* as a method. This chapter *documents* the conversation with the self in the form of two design explorations, the process I have used to generate new, personal, knowledge. It is an account of my *epistemic, design cybernetic reflective practice* which has been expressed as an exploratory service design project that emerged over the PhD. A reason why I decided to engage in this kind of research is that I wanted to explore and document an epistemic, knowledge-seeking process, from a first-person observer's perspective. The autobiographical observations describe how my personal knowledge evolved and took form; it represents my personal approach to *cybernetic design* and shaping the epistemic service, which makes up my research. In the next chapter, I describe how the knowledge was turned into communicable knowledge and how the learnings from the reflective practice informed my 'first-order' service design practice. This exercise can be seen as an exploration of how to upgrade a second-order cybernetic system (the designer's goals and intents). The reflective practice has served a *generative* purpose, allowing me to explore and play with concepts and ideas related to the research questions. In that process, substantial contributions to the generation of new knowledge were made. In the below section, I account for how each of the projects contributed to answering the research questions.

The design proposals that I have created as part of my reflective practice constitute *material evidence* for the conversations with the self. Where possible, I have described the thought process which led up to the design proposals and used quotes and images from the research diary as supportive evidence. The result of the conversations with the self, constitutes early steps towards a *new approach to* working cybernetically in service design, which I denote *epistemic service design*. Epistemic, in this context, means that the primary purpose of the exploration is to generate new personal knowledge. It is expressed as an exploratory service design project that aimed to support my personal learning process, allowing me to play and experiment with theoretical and practical concepts in a safe, irresponsible and non-public context. These wanderings are common in other design disciplines. Still, due to the nature of service design, it is often difficult to explore new services in an experimental environment, a safe space for exploration.

5.1. Overview of the conversations

In this section, I will account for the following conversations with the self. Each conversation comes with a description of the process, tangible output (if any) and reflections, contribution to personal new knowledge.

	Project	**Function**	**Material evidence**
5.2	A Garden (visual language) for design cybernetic concepts	Understanding design cybernetics	Poster. Map of design cybernetic concepts
5.3	Conversational Stones	Understanding the rhetoric of system Making my research communicable	Artefacts: Networked stones

Table 16: Overview of conversations with the self.

5.2 A Design Cybernetic Garden

This exploration is a partial answer to the second research question, presenting an idea of which concepts there are in design cybernetics. It is essentially addressing the first part of the research question concerning 'different concepts from design cybernetics'.

R2: How can different concepts from design cybernetics be applied in a service as persuasive system design project, to create more understandable and valuable service propositions??

Justification of including project

When exploring existing literature on design cybernetics (chapter 3) it soon became apparent that few holistic collections of design cybernetic concepts are available. There were several collections of cybernetic concepts and second-order cybernetic concepts, but none specifically for applying design cybernetics in a service design context (Glanville 2002, Dubberly and Pangaro 2010). To answer the research questions, I needed a reduced and simple, but easily digestible overview of design cybernetic concepts. As discussed in chapter 3 and 4, design cybernetics has shared roots in design tradition and cybernetics (second-order cybernetics mainly). However, the languages used in the two disciplines stem from two different traditions. Since Herbert Simon's days, design research has tried to shift away

from the influences of science and justify its intellectual independence. Cybernetics is inherently interdisciplinary, but has emerged from an engineering tradition, where its original uses were control systems (first-order cybernetics mainly). The turn towards second-order cybernetics though has brought cybernetics and design closer together. However, cybernetics has been criticized for being inaccessible and 'too theoretical'. To further advance the mission to merge the two approaches, I decided to examine common concepts of second-order cybernetics used in a design context, which led up to the interdisciplinary review in chapter 3.

As described in chapter 3, design cybernetics offers a *pattern language*, 'shapes' for system's behaviours which could be useful in service design of persuasive service systems. Ashby (1956) highlighted that cybernetics offered '*a single vocabulary and a single set of concepts suitable for representing the most diverse types of systems'*. When reviewing the literature, it became apparent that there were many readily available shapes and patterns in the existing scholarship of design cybernetics and systems theories. However, these were accounted for by many different individuals at different points in time. I perceived a need to create a simplified library and visual language for cybernetic ideas to be truly useful in persuasive system service design. The original sketches and articles, such as Gordon Pask's work on conversation theory described in chapter 3, are highly abstract and thereby less accessible to non-specialists (Pask 1976). Subsequent models developed by Dubberly and Pangaro moved the visual language forward, making cybernetic ideas accessible to a broader audience by packaging them in diagrams, illustrations and symbols (Dubberly et al. 2009a). However, I missed a map of the territory, a simple overview of concepts that are relevant in design and cybernetics, that I could refer back to when learning about the domain.

Digital gardens

I used the garden metaphor to describe my work because I wanted to build the collection of concepts as a digital and physical place that I could tend to and nurture both during and after my PhD. I plan to grow wilder and more prominent over time. The 'garden' analogy has its roots in Hypertext Gardens (Bernstein 1998), which he used to describe curated corners of the Internet, created by enthusiasts to organise chaos by linking webpages together so that they would become easier to navigate. Eventually, the term digital gardens rose to prominence as Mike Caufield delivered the keynote *The Garden and the Stream: a Technopastoral,* which was later published as an essay (Caufield 2015). Appleton (2020) defines a pattern language with the following features for digital gardens:

1) They have a non-chronological structure
2) They are deeply interlinked
3) They are continuously evolving, work in progress
4) They are experimental, playful and personalised
5) They have a diversity of contents and mediums

Appleton's personal website (figure 30) is an example of a digital garden, a curated place online. She denotes thoughts in different stages 'seedlings', 'budding' and 'evergreen' depending on their development stage. Each article says 'last tended to' rather than the date they were published to highlight the posts' evolving nature.

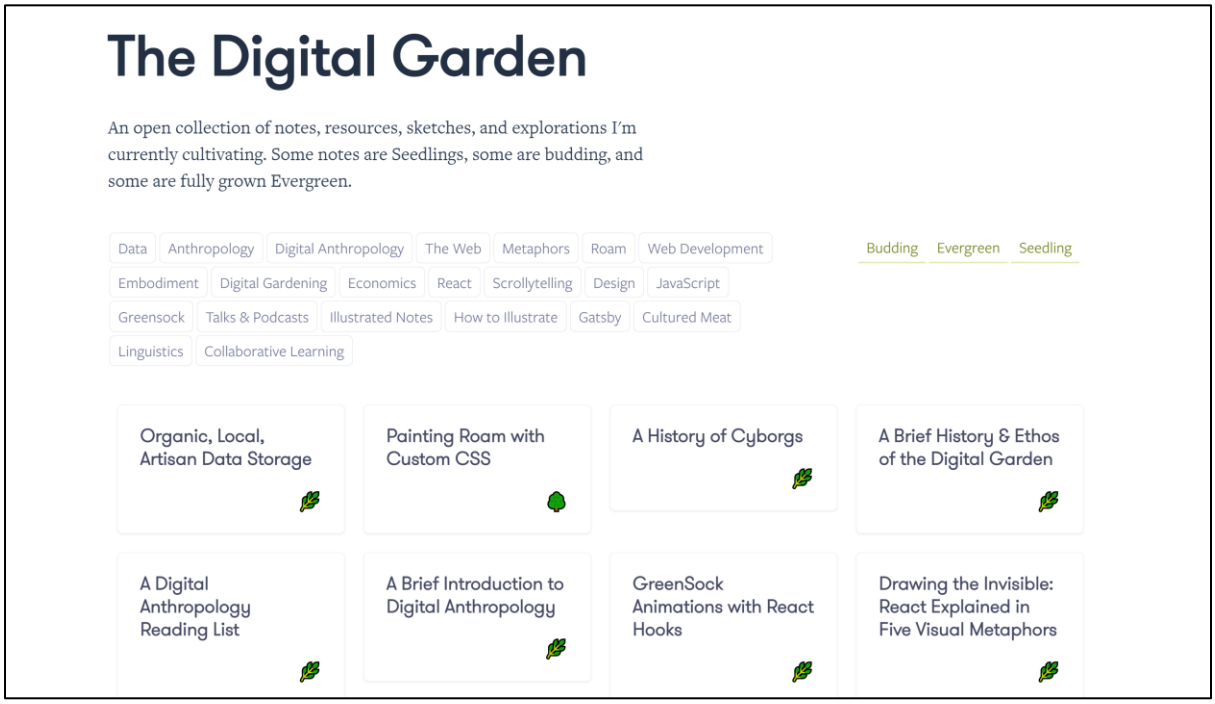


Figure 47: Maggie Appleton, Digital Garden. Screenshot from https://maggieappleton.com/garden-history.

5.2.1 Design process

Based on the literature review in chapter 3, I distilled *19 concepts* which I deemed relevant from cybernetics and second-order cybernetics. The concepts are a mashup of first- and second-order cybernetic concepts, with 'shapes' that can be meaningful for designers of services as persuasive systems. The cybernetic concepts can, of course, be applied to systems of both first- and second-order, or higher orders, because second-order cybernetics, as we recall, is essentially cybernetics applied to itself. The selection criteria were

1) that they were acknowledged concepts in cybernetic literature and

2) that they could potentially be useful in service design of persuasive systems

However, I did not want to apply these criteria too stringently, because I wanted to keep an open mind exploring them. After I went through my action research process with internal and external conversations, patterns emerged, and I could better understand how certain concepts were related between the two disciplines. As I touched briefly upon in the literature review, there are different 'languages' for cybernetics. There are also numerous metaphors (such as the thermostat metaphor),

describing and making tangible cybernetic and second-order cybernetic concepts. However, some of these descriptions are rooted in the Sciences, and thereby inaccessible to a non-specialist audience. A challenge in creating this map was that the cybernetic territory is inherently messy (just like design), and there are many nuances to each concept. I see this as a strength, why the concepts presented should be seen as a point of exploration and inquiry into a behaviour, rather than fixed, static concepts. These are *my* interpretations of the concepts, and although some concepts may be intuitive to many, others may interpret them differently.

A strength of a dynamic conceptual world is that it is up to the individual designer/observer to create their own interpretation of the concept to fit the context they want to apply. A few concepts, such as the mathematical concept of *eigenforms, are not native to design, and needed to be translated in*to a service design setting. From my perception of Von Foerster and Glanville's descriptions of eigenforms, these resemble the design squiggle, the behavioural form of stabilisation (see 3.2.2.1). Other concepts, such as *biocost* or *autopoiesis* are relatively unknown to the general public, but have already gained ground in Architecture and Design. For example, Patrick Schumacher of Zaha Hadid architects has published *The Autopoiesis of Architecture*, translating the cybernetic concept to the architectural context (Schumacher 2010).

Similarly, several of these concepts promise to become more useful if service designers engaged with them in similar ways. Concepts such as intelligent and non-intelligent agents correspond to many similar concepts across science, social science and design. Certain concepts, such as feedback and black boxes, are already used extensively in systems theory and particular domains of design.

In table 17, I share my personal collection of design cybernetic concepts, based on my subjective interpretation of the design cybernetic universe.

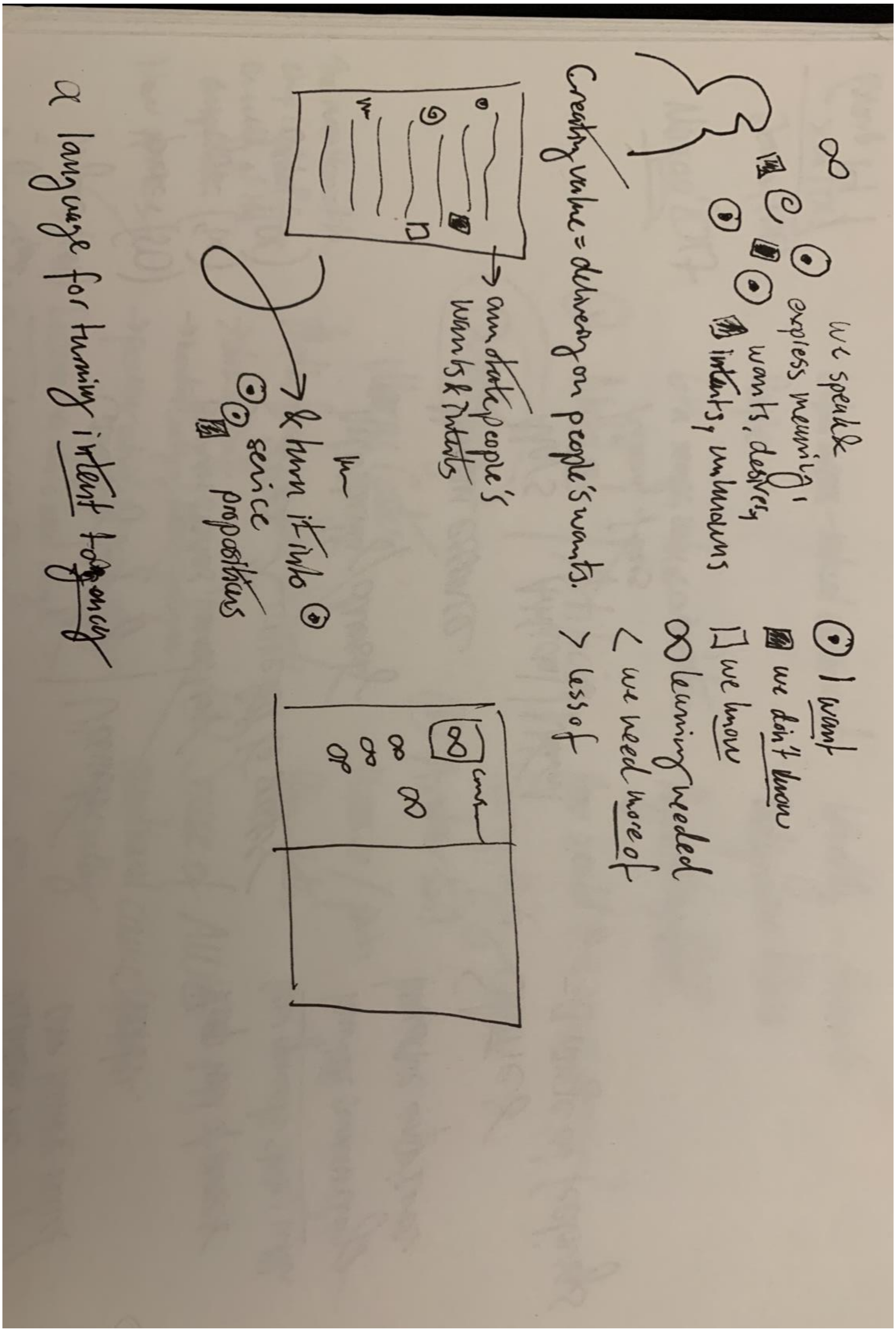


Figure 48: Early sketches, trying to figure out how to use design cybernetics in service design.

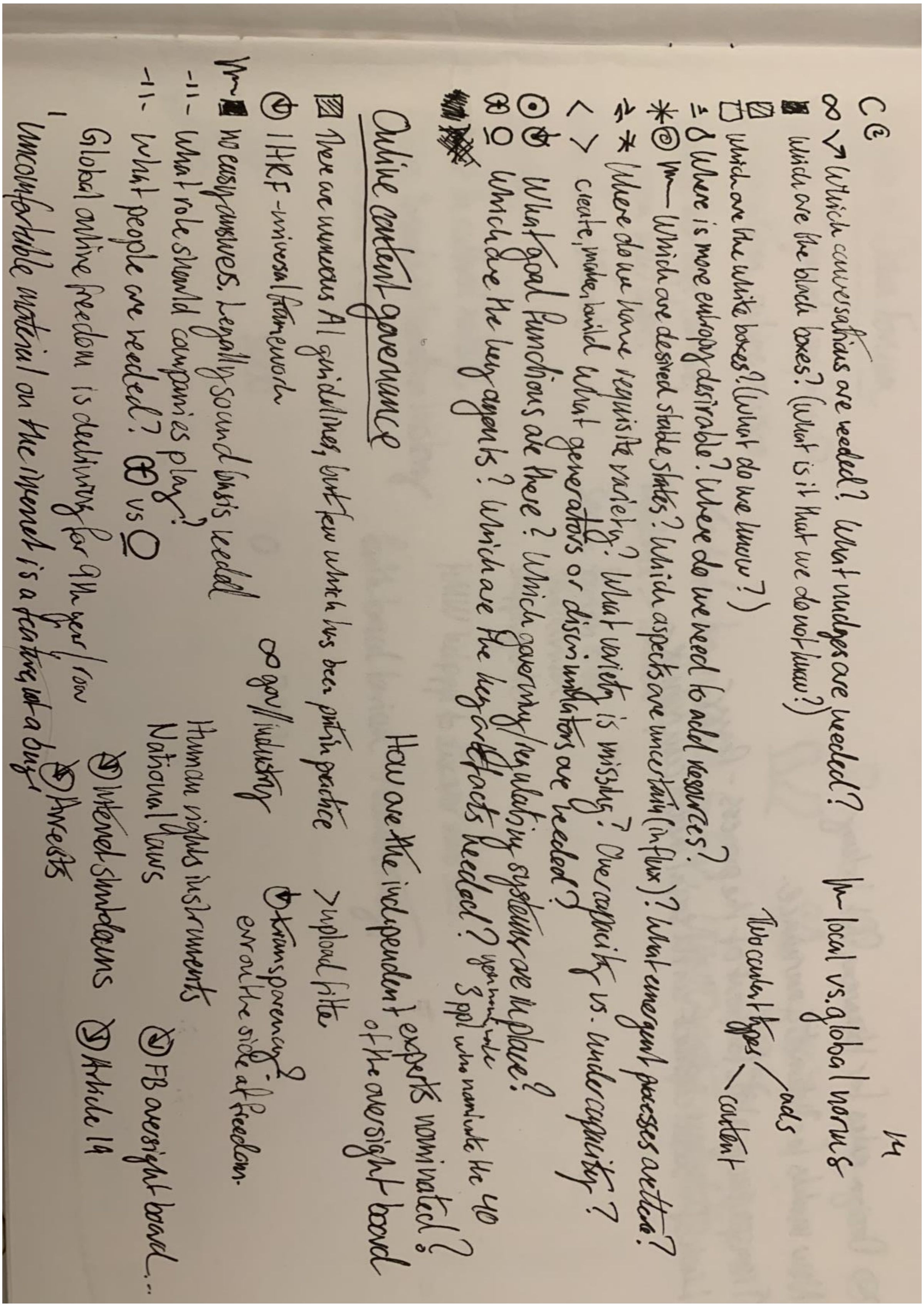


Figure 49: Exploration of design cybernetic terminology.

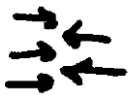
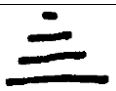
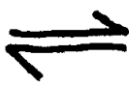
		 
Feedback loops describe increasing or decreasing processes and flows.	**Black boxes** are systems where the inner workings are unknown and non-transparent for an observer	**Reflexivity** is intentionally acting on another object, agent or system to provoke a reaction.
		 	 
Variety describes a system's means to counter changes in its environment.	**Eigenforms** are processes or systems that oscillate initially to arrive at a stable state, form or value eventually.	**Generators** are diverging processes that increase the flow in a system. Removing barriers or stimulating creative expression.
		 	 
Requisite variety means that a system has the means to counter a change in the environment.	**Emergence** describes evolving systems with emergent properties.	**Discriminators** (attenuators) are converging processes which reduce a flow in a system—adding constraints.
		 	 
Goals describe the goal or purpose of a system, it's direction.	**Conversations** are exchanges between two systems where existing knowledge is transferred or new knowledge is created	**Intelligent agents** are agents which act – learn-act and modify their behaviour based on previous experiences. Complex adaptive systems.
		 	 
Autopoiesis describes the process of realising a self-referencing system.	**Regulators** or **governors** are second-order systems which influence (controls) the goals first-order systems.	**Design proposals (designs)** are first-order systems which act without learning.
		 	 
Biocost is a concept which describes the total human effort involved in executing an activity.	**Entropy** is the total amount of 'energy' that a system accommodates.	A **Homeostat** is a device capable of adapting to its environment (which has requisite variety).
		 	
Performances are conversations about design proposals.	**A leverage point** is a place in a system where one can intervene to create change.	

Table 17: Design Cybernetic Garden: symbols and markings

Influences on my approach

During my brief time in the Swedish Air Force, I learned about the importance of clear communication between units, to quickly create mutual understanding across people, teams and units with different backgrounds and cultures. The benefits of models are described closer in the literature review, and I had those insights in mind when designing.

When designing the visual language, I was inspired by the visual language that NATO uses as map symbols, which can be placed on any map or used to explain situations on the battlefield even without an underlying map. These symbols are universally accepted across NATO countries, a standard which harmonizes and facilitates communication. The visual language is simple, distinct and easy to draw, even with a marker. An essential purpose of models, I learned, later on, was that shared models support discussion and that they provide a basis for shared understanding, agreement, and group action, in addition to building trust and enabling collaboration (Dubberly 2009).

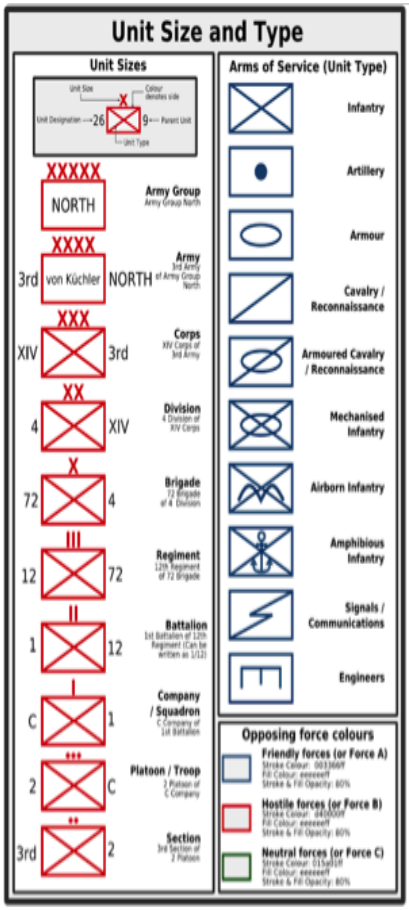


Figure 50: NATO symbols. CC BY 2.0 license.
Retrieved from https://commons.wikimedia.org/wiki/File:Template_of_Military_Symbols.png

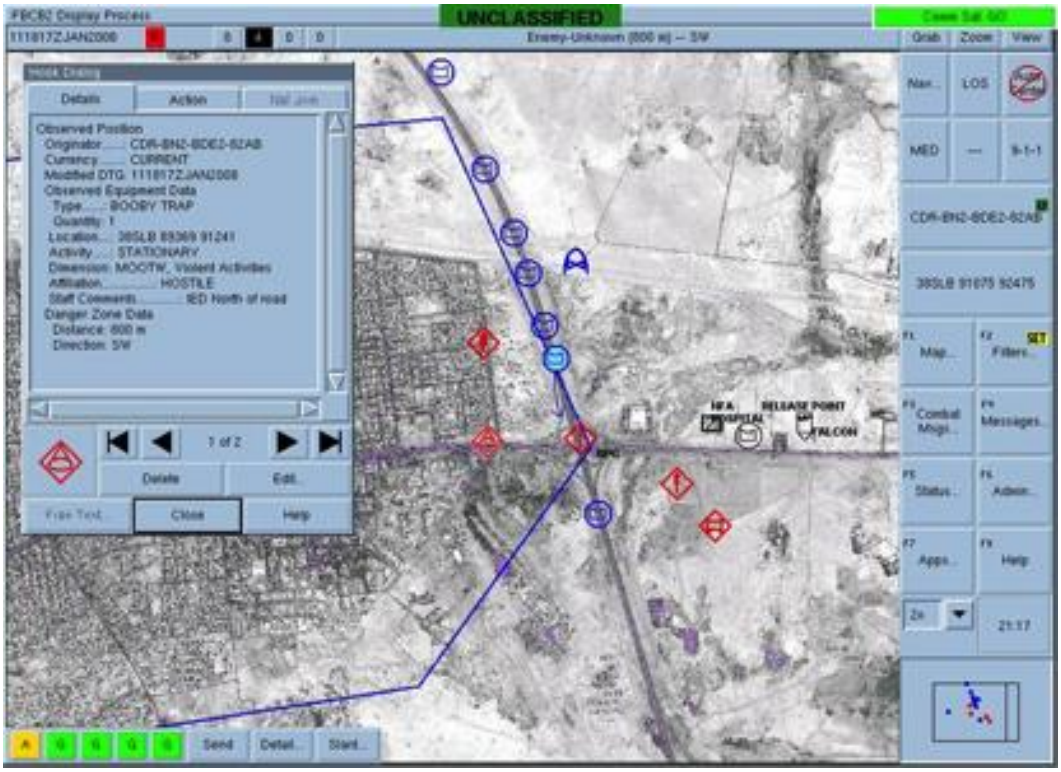


Figure 51: NATO symbols as used on a map. U.S. Air Force photo illustration/Ret. Master Sgt. Bernie Kabis. Retrieved from https://www.laughlin.af.mil/News/Article-Display/Article/355883/friend-or-foe-blue-force-tracker-to-clear-fog-of-war-for-next-afghan-prts/

Inspired by the map symbol markings, I explored creating a font and made a keypad prototype so that I could seamlessly type the characters digitally. Some symbols were difficult to write by hand, so I chose simpler versions where available. It was important to me that the signs were quickly recognized and simple to draw by hand. The following illustration shows how the design exploration unfolded across different physical and digital media.

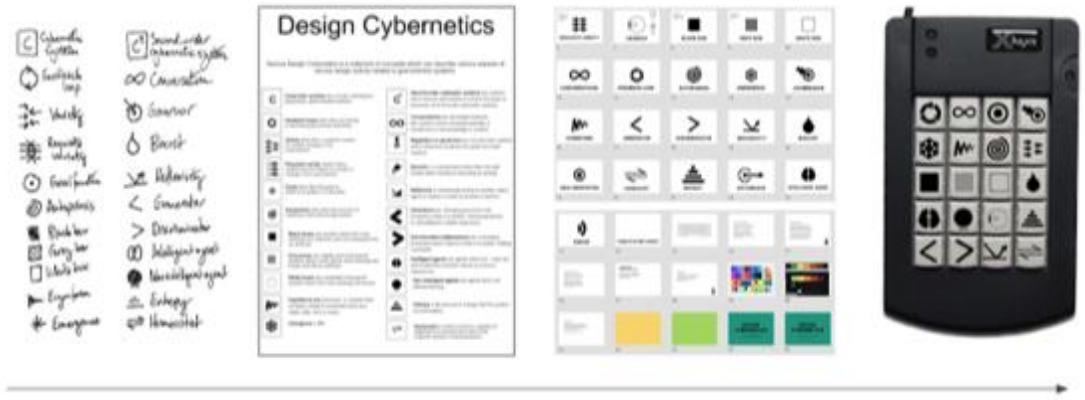


Figure 52: Design exploration into design cybernetic terminology.

Some of these artefacts were realized in full (poster, language), other, I abandoned half-way (cards, keypad) when realizing that I was going down the wrong path. To me, it was the creative process, rather than the actual output, which was important.

5.2.2. Applications and usefulness

In the previous chapter, I identified an opportunity to introduce design cybernetic language into service design processes, to explore how they could bring value to designers. However, I realised that for designers to refer to design cybernetic concepts, there needs to be a guide that provides a simple overview. As described in chapter 3, there were some collections available, but none specifically designed for a service design context. This project was a first attempt towards realizing that ambition. The visual language was useful in my personal practice in several ways. It allowed me to shift between digital and physical media and to think deeply about what the concepts mean in different contexts. By reflecting-in-action, I gained a deeper understanding of cybernetic, second-order cybernetics and design cybernetics, and a sense of how and where it had been applied in practice over the years.

Initially, I experimented with *design cards* to capture the concepts. The usefulness of design cards is well documented and has been used successfully by Daniel Lockton and others. I studied a paper by Robin Roy, who did a review of 155 card-based design tools for designers and designing, which led me on to explore that approach further (Roy 2019). However, design cards did not give me the overview I was looking for. Instead, I created a *poster* with the concepts, which I used to remind me about the concepts when reading academic texts, the research diary or going through the clipping's diary. The poster was a useful tool for me; however, it may have been less valuable to someone else, who had not been part of creating it.

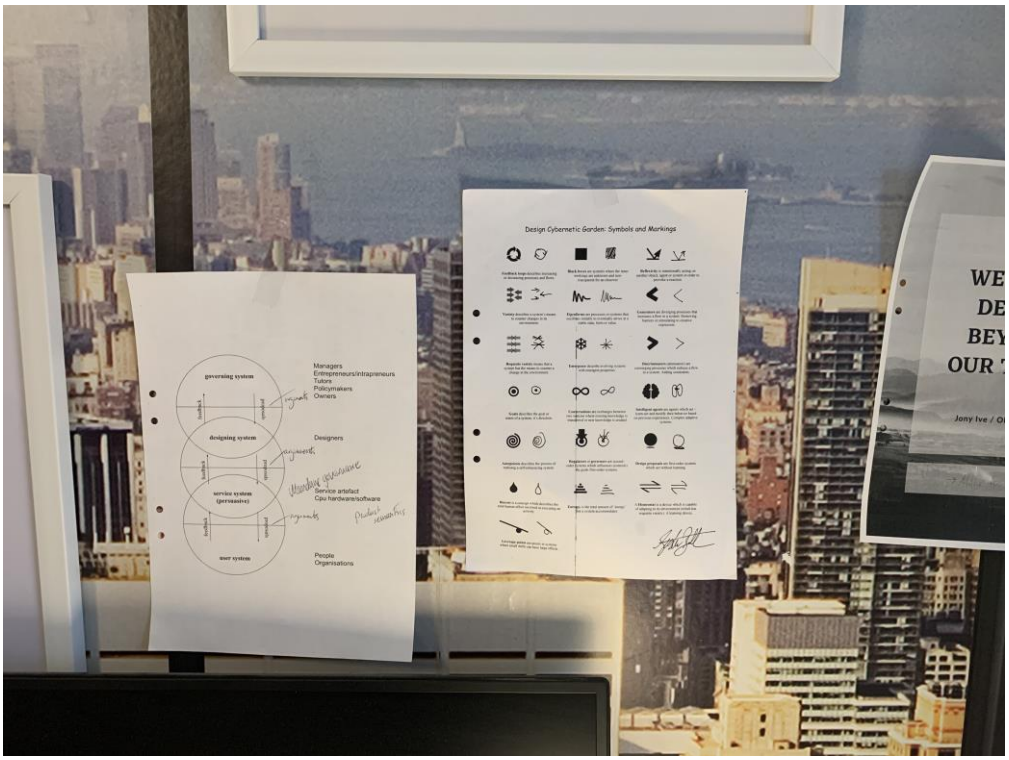


Figure 53: Poster of the design cybernetic garden

While writing, I could quickly glance at the poster and remind myself of the shape and meaning of a design cybernetic behaviour. The fact that I made the poster myself however, may have contributed to its usefulness, it may have been different if I had not taken the time to process each concept.

Thus, the first useful application was that the symbolic language worked as a heuristic tool - a *cognitive shortcut*, allowing me to access a concept and adopt that particular perspective quickly. The poster also reminded me regularly of the concepts, which I perceived facilitated my learning. As we know from Gibson and Norman's work on affordances and signifiers (see section 2.1.3), heuristics are potent tools for directing human behaviours or attitudes in desired directions. In a way, the concept became a non-interactive persuasive artefact.

The second useful application was *generative* - to *structure conversations, interviews and workshops*. The visual language allowed me to *build and iterate other tools quickly*, and use symbols from the poster in generating new tools. For example, I develop a Worksheet (appendix 1) in preparation for a workshop, where the Design Cybernetic Garden's main concepts were incorporated. The DCM worksheet is *modular*, in the sense that it can include just a single concept or several different concepts depending on the researcher's taste and the problem at hand. I used the DCM worksheet in workshops and at student tutoring sessions. I found it very useful to identify people's struggles and provide tailored advice based on their situation. The worksheet is an early-stage product though and further work from my end will be needed for it to be transferable and useful to others.

The third useful application is that I have used the concepts in my *teaching*. Since Paul Pangaro taught CS 377A: Introduction to Cybernetics and the Design of Systems at Stanford University in 2006, few courses that focus specifically on design and cybernetics (Stanford University 2006). Baron and Herr have used cybernetic concepts as bases for their teaching and described in great detail how they have worked with conversations to stimulate their student's learning in different cultural contexts (Baron and Herr 2019).

There were also some attempts which were less successful. I tried to use the toolkit to annotate a conference talk, to explore if it was possible to extract service concept ideas (Figure 54). It did provoke reflections and made me listen deeper to the talk, however, the usefulness of the symbolic language for this end did not add much extra value to me.

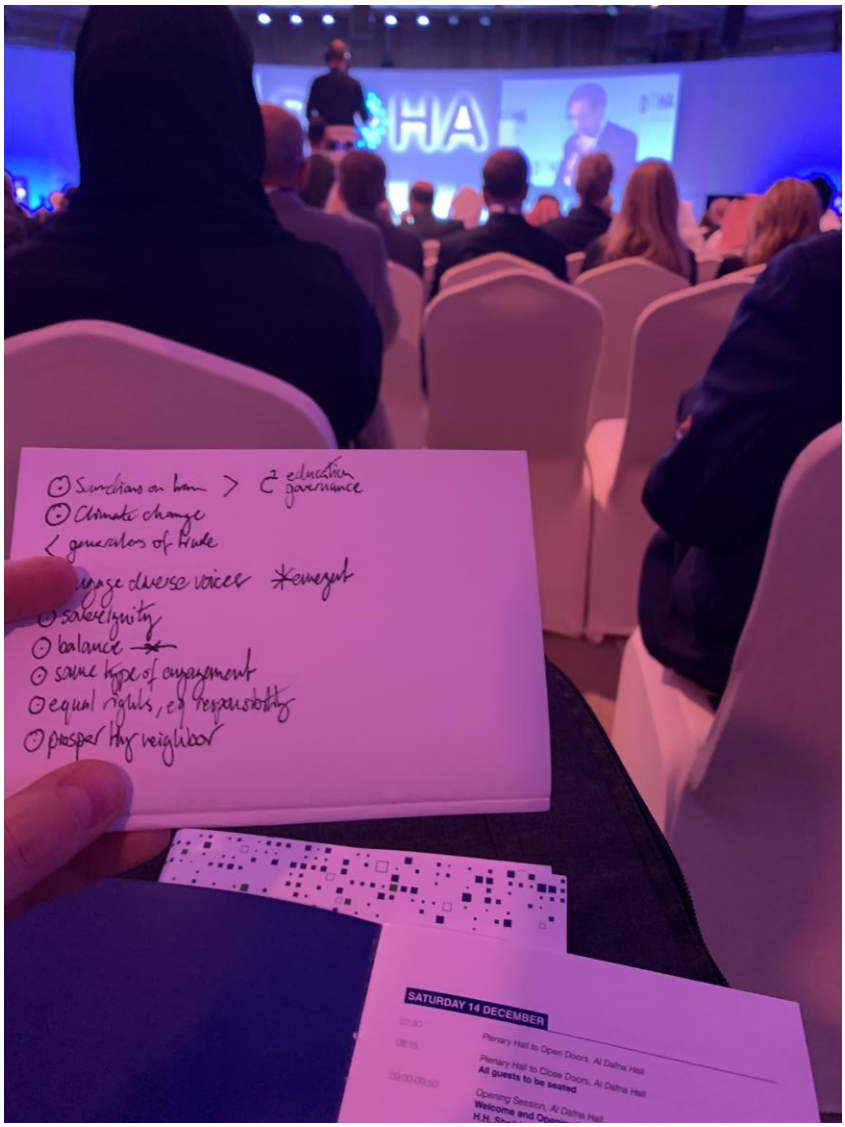


Figure 54: Attempting to annotate a conference speech using design cybernetic language.

5.2.3 Limitations

This was the first iteration of my personal reflective practice, which was also my first exploration into the domains of design cybernetics. There are certain limitations to the concepts that need to be considered. The first and perhaps most obvious is that numerous decisions went into selecting concepts, and the way they were presented and depicted. The garden constitutes a *subjective selection of concepts. A*lthough I have tried to go to lengths to make sure that I got as many useful and relevant concepts as possible, it is even likely that it does not capture all useful concepts of design cybernetics. However, it is a start, and the project contributed to upgrading my personal knowledge.

A way to address this could be to develop a structure which is open for adding new concepts or adding many different interpretations of concepts. I revisited that idea in a later iteration. Although I have had many conversations with texts and people, it is impossible to separate this product from my personal subjective research and design approach.

A second challenge has been *getting the concepts right*. Cybernetic concepts are sometimes very abstract, and there are occasionally multiple different definitions available. It is possible that my reduced models have missed out on crucial aspects of concepts, simply because I did not understand them well enough, or that I reduced the concepts too much so that their original meaning got lost. As the model evolves, it can add essential *nuances,* a natural development of the Concept Garden going forward. In future, I would love to develop a full taxonomy/phylum -a design cybernetic family tree.

5.2.4 Future development

Designing the Garden was highly rewarding. As I have become more familiar with the many concepts of Design Cybernetics, I also see great opportunity in packaging this knowledge to disseminate it to other designers, as a starting point for their exploration into the world of design cybernetics. A new question and natural next step in the development is understanding how these concepts can be *delivered as a service,* to become even more communicable. At a minimum, ambition is to publish a website with a personal, open-source, curated repository that allows anyone to add, discuss or download the content's Garden. The benefits of an open platform offering 'design cybernetics as a service' would allow. Once I have published my thesis, I see an opportunity to publish an online repository where these concepts can be delivered as a free service to anyone interested.

5.3. Conversational Stones

Figure 55: Conversational stones.

The Conversational Stones started as personal reflective objects, however, throughout the PhD, they grew into *epistemic objects* that became a cornerstone of the epistemic service and a key deliverable in the projects. Epistemic objects have been defined as '*Characterized by lack and incompleteness; partially expressed in multiple instantiations; continuously evolving*', which can be contrasted with boundary objects, which are defined as '*one object that is differently interpreted and provides a holding ground for ideas for communication, translation and standardization of meaning.*'. (Ewenstein 2009). It can be discussed what the objects should be denoted. However, I would place them in the category of epistemic objects since they express an incompleteness, and their meaning is continuously evolving, rather than being stable. The conversational stones helped me explore my understanding of the cyber-physicality of persuasive systems and work simultaneously in first- and second-order design practice. In my view, they *embody conversations*, one of the central tenets of design cybernetics which is also crucial for understanding persuasive systems. In the following section, I will expand on what that means.

Sensitising concepts

The term sensitizing concept is borrowed from grounded theory, and it describes a starting point for exploration that 'gives the researcher initial but tentative ideas to pursue and questions to raise about their topics.' (Charmaz 2014, p. 30). From the literature review of challenges of persuasive service systems, I had several questions regarding people's intent: where it was located, how it was formed, how it was disseminated and if it can be embedded in material objects. I thought of some of the oldest artefacts known to man: clay tablets. I wondered what embedded intent would look like ten thousand years from now and what that meant for digital, persuasive systems. How could they persuade after their creators were long gone and what would that mean for service design? Mission and vision statements and service concepts can be considered expressions of service's goal functions in service design. However, these constructs are fluid, and the goals of services are still not easily defined. They are also dynamic and change over time.

Referring to the Rhetoric of Things (Buchanan 1985) as described in the literature review, I reflected that there might be some form of material persuasion going on here. I chose to explore clay to examine the possibilities of adding a digital dimension to the artefacts I created and what that could mean for the understanding of services-as-persuasive systems.

Justification of including project

From the literature review, I also realized that design cybernetics, like cybernetics, is an abstract domain that is difficult to access to non-specialists or designers, who may not be familiar with systems theories cybernetic concepts. The case studies confirmed this. For example, in the Friends study, I organised a workshop and tried to introduce the design cybernetic concepts 'as they were' which resulted in confusion. It turned out that you cannot drop 'requisite variety' or 'autopoiesis' casually in conversations without getting weird looks from people. The first reflective practice, the Design Cybernetic Garden, helped me make explicit design cybernetic concepts, making it easier for me to understand them and what service design processes they corresponded to. This project further developed the materiality of the concepts, this project, the Conversational Stones, instead focused on exploring how conversations could be intentionally designed into a cyber-physical service-as-persuasive-system,

5.3.1. Design process

The conversational stones were developed in *three iteration*s of reflective practice, where each step contributed with new knowledge that enabled the following step. At the beginning, I did not know where the practice would take me and allowed myself to be open-minded about it. This exploration can be seen as a 'wandering', using Glanville's term for random design exploration. With my starting point in the sensitising concept, I set sails and let the clay lead the way.

5.3.1.1 Iteration 1 - Clay and connectivity

Purpose and goal

The session's goal was to create clay tablets with an embedded NFC tag, engraved with binary code. The first session was carried out in my home studio. The project's purpose was to develop a better understanding of design cybernetics by working with clay, a physical material. It was a reflective practice process (research through design) where new knowledge was created when making.

Preparations and materials:

- 1 kg of terracotta hobby clay
- 4x NTAG214 Stickers
- Plastic to cover the table
- Clay tools made from a disassembled pen

Process

I first made rough sketches of the engravings on paper (figure 56) and used an online service (Text to Binary Converter) to translate from text to binary code. I then transferred the binary code to the notebook.

The first engraving session took place in my kitchen in my apartment in Solna, Sweden, around 7 pm. I divided the clay into four lumps of equal size, roughly 250g per lump. Next, I made a flat circle from the clay using my hands. I placed an NFC tag (NTAG214, sticker) under the piece of clay to test the signal. At first, it did not work, and the phone (a Samsung 7S) failed to read the tag, however, after making the clay tablet a bit thinner (roughly .75 cm), it eventually worked.

Next, I placed the NFC tag inside the clay circle and folded it once, creating an 'envelope' for the tag, giving it a pirogue/taco shell shape. I shaped the tablet using my hands to a shape that I perceived as aesthetically pleasing and large enough to engrave the binary code.

I then proceeded to engrave the binary code on the tablet using the case of a pen and another part of a pen which I had broken off, to create the ones and zeroes. I transferred the binary code from the notebook to the tablet, and double-checked when I was done, making sure that it was correctly transferred. I also tested the NFC tag again once the tablet was engraved, to ensure that it still worked, and it did (figure 57, 58).

After having created the 'conversations' tablet, I wanted to create the 'autopoiesis' artefact. This time, I tried making a three-dimensional cone/pyramid, inspired by the Sumerian cuneiform cones. I cut the top off the pyramid and embedded the NFC tag. However, forgetting the learnings from artefact #1, I did not realize that the layer of clay needs to be relatively thin for the phone to recognize the tag, and when I tried to read the tag with the phone, it subsequently failed - likely for that reason. The positioning of the NFC tag was suboptimal.

The third artefact I created was also an ‘autopoiesis’ tablet, which came out both working and aesthetically pleasing. The tags could now be programmed with a web address, which automatically opens in the smartphone’s web when the tag was scanned.

Insights from the process

- 250g of clay is enough to create a clay tablet, roughly the size of a smartphone.
- I realized that there is a need to add a *signifier* (a sign) to the clay tablet so that the user understands that there is an NFC circuit embedded. Without a signifier, the user will probably miss out on the extra content inside. I tried to engrave a sign on freehand. However, it was challenging to make it look nice. Perhaps I could create a stamp which could be used for this end in future?
- I could feel ‘bubbles’ in the clay where the NFC tag was embedded. It will be interesting to see if this has any effect once the artefacts have dried.
- The tablets were easier to etch than the cone.
- It was challenging to find NFC tags that were compatible with the phone. I tried out a Mifare-chip, which could neither be read by an iPhone X or a Samsung S9. Instead, I got an NTAG214 NFC tag which eventually did work, however with a Samsung S7, an older version.

The exercise led to a series of new questions:

- Do NFC circuits survive the firing of clay tablets in a kiln?
- Can glazing be added and would it affect connectivity with the tag?
- What form is more useful for storing/transporting the tablets?
- How can you tell that there is an NFC tag embedded inside?
- Should the tablets be made smaller (or larger?)? What tools can be used to engrave smaller (or larger) objects?

I transported some of these questions to the second iteration of the project. The result from the exercise were these objects, which as far as I can tell, are unique.

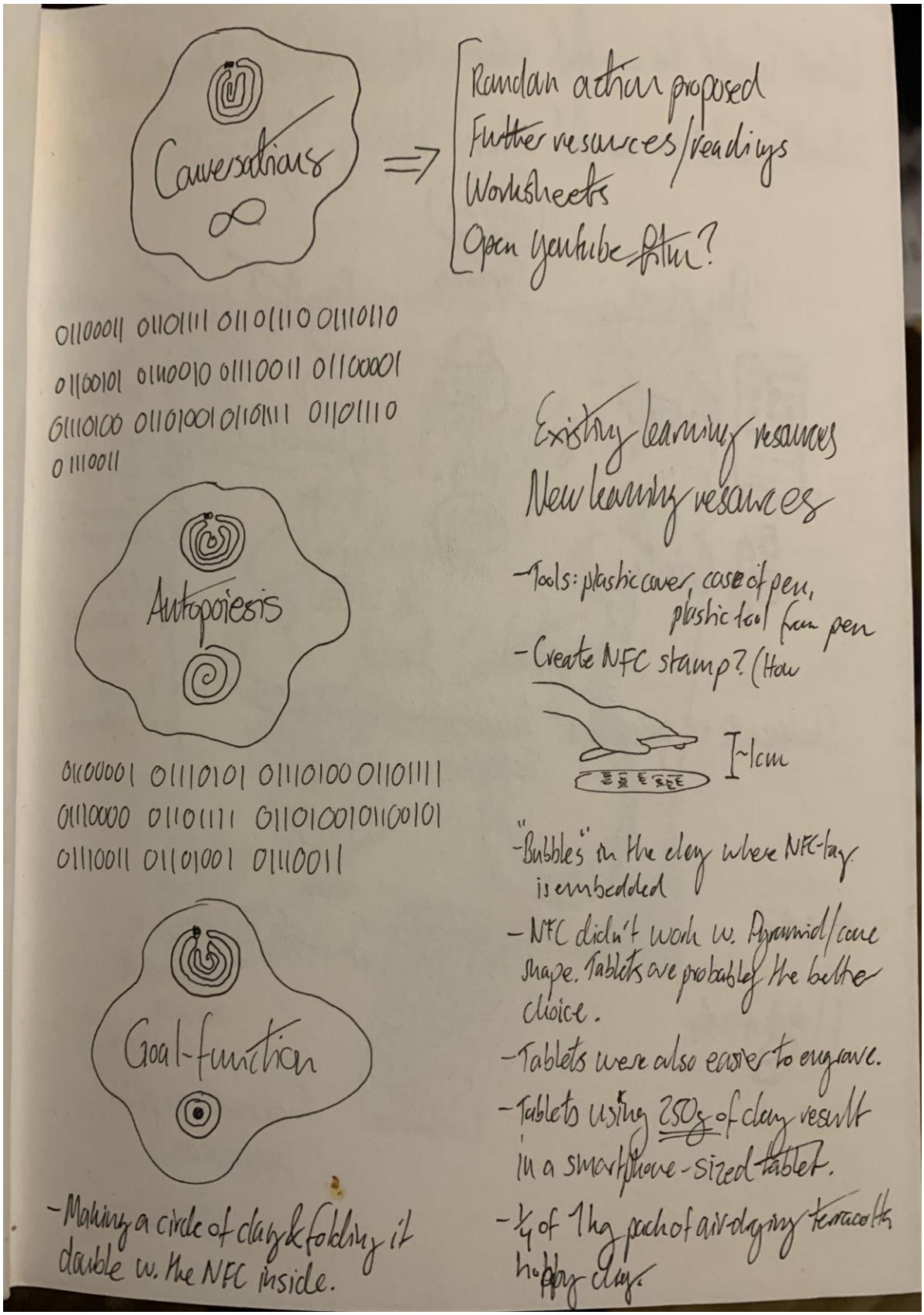


Figure 56: Exploration of design cybernetic stones.

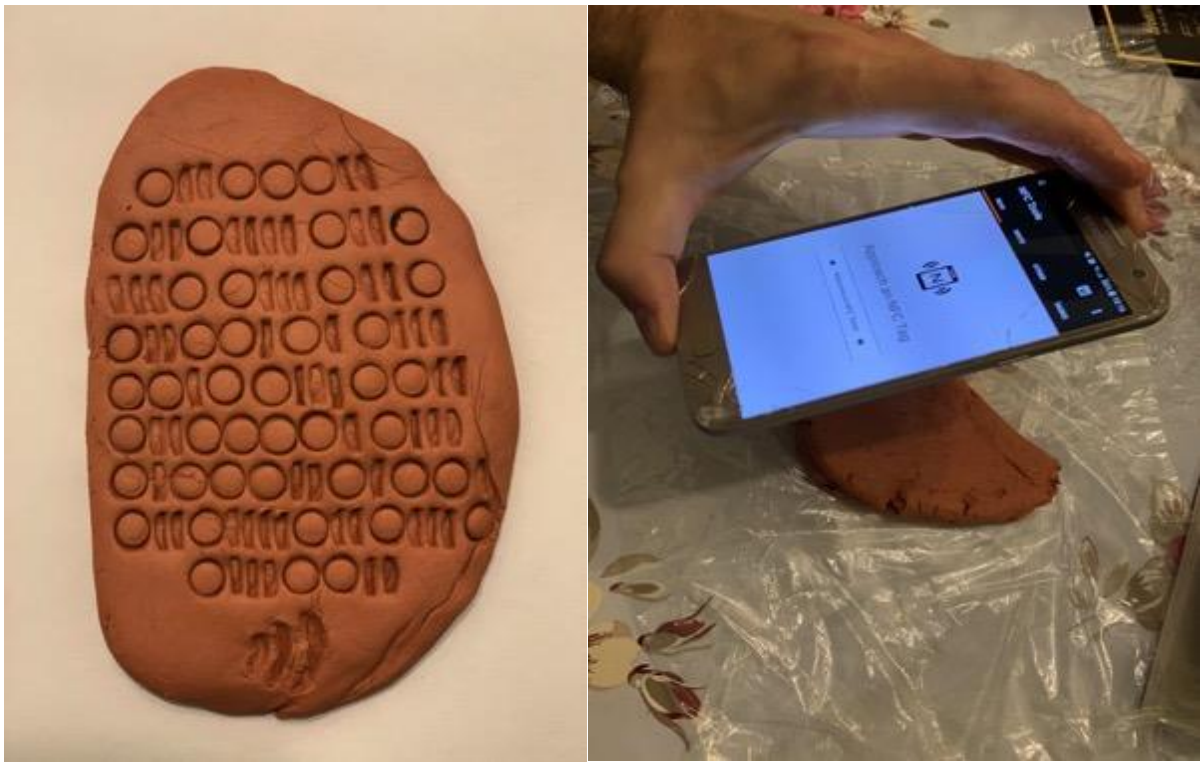


Figure 57: The making of NFC clay tablets.

Figure 58: The making of NFC clay tablets, cont.

The original inspiration to the clay tablets were Sumerian cuneiform tablets, such as the Kish tablet, which dates back to 3500 BC. It was discovered in Uruk, Iraq and is considered the world's oldest writing example (Woods 2010, pp. 33-50).

Figure 59: Limestone tablet from Kish. Ashmolean Museum, public domain.

However, similar contemporary artwork exists; for example, Hyperbody by Roland Arnoldt (2018) consists of laser-etched binary code on clay tablets, representing a binary version of an image of the artist. The artwork, however, is static and non-interactive.

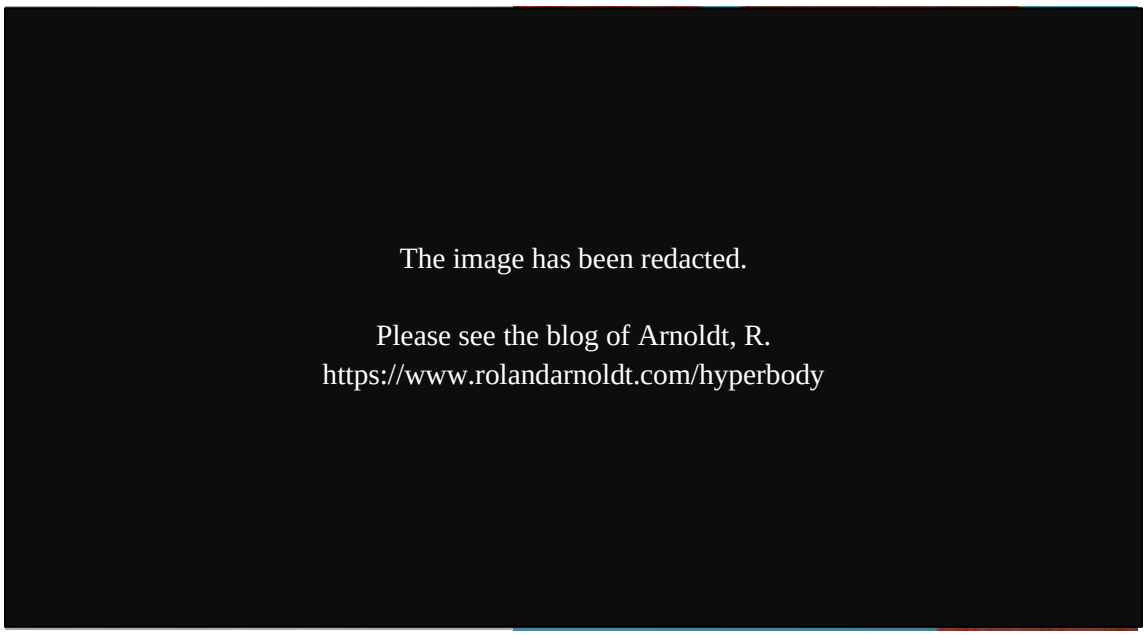


Figure 60: Hyperbody by Roland Arnoldt. Reprint from https://www.rolandarnoldt.com/hyperbody

Other similar artwork was made by Rhiannon Evans (2014), 'clay tablet and cylinders with Hamlet quote ('more things in heaven and earth') in binary'. These are not networked either, however.

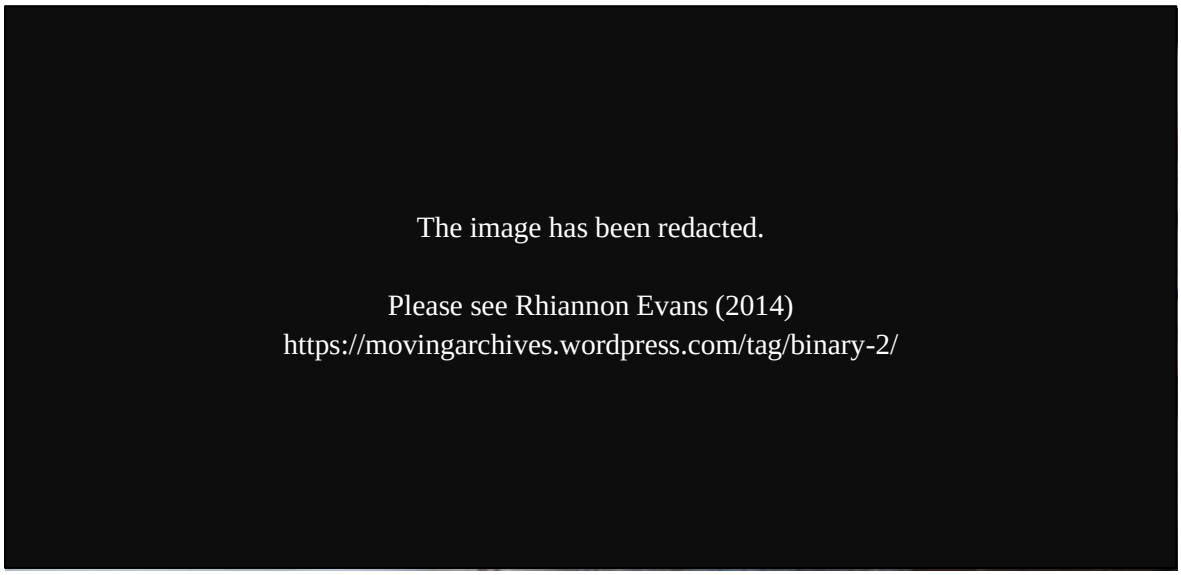


Figure 61: Clay tablet and cylinder with Hamlet quote. Rhiannon Evans (2014). Found at https://movingarchives.wordpress.com/tag/binary-2/

I concluded from the iteration that I had arrived at something reasonably unique, which I could develop in further exploration.

5.3.1.2 Iteration 2 - Networked stones, digital objects

The first iteration of the conversational stones was visually pleasing and worked great as conversation starters in meetings and presentations; the stones were *persuasive* eye-catchers which excited people and led to conversations about the stones and my research (the Rhetoric of Things were strong!). However, I did not make any real good use of the NFC tags, and I decided to develop the idea in further conversations with myself, to see how I could integrate a Rhetoric of Networks too. I was inspired by the concept of *design that keeps designing*, which generates expected and unexpected effects in the world after being released from the designer. Jachna (2019) stated that 'designed artefacts must be understood not only as things but as ongoing processes, or more precisely as evolving participants in processes of conversations.

In parallel to this design exploration, I struggled with the Friends project, as described in chapter 6. I had a reasonably clear idea of the current situation and had some idea of pain points for the organisation that I wanted to address with a service as a persuasive system. But what would my deliverable be? I brought that performance anxiety to the table for this next iteration.

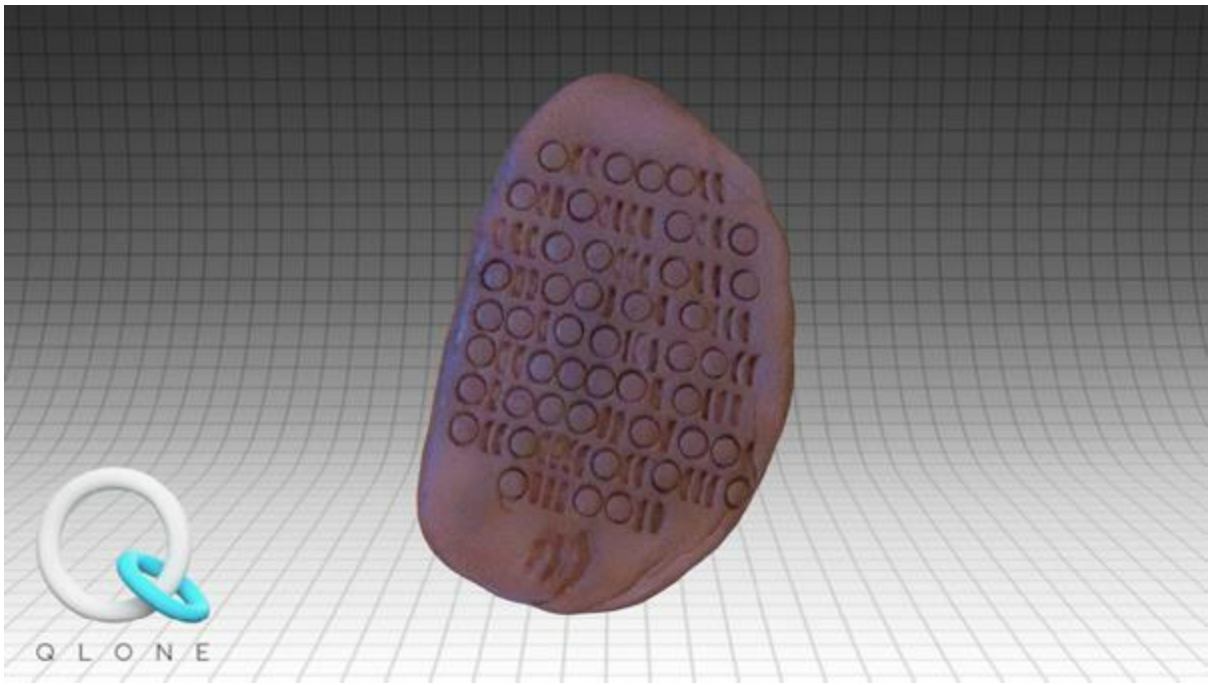
Purpose and goal

The clay tablets could connect to people or information resources over the internet or phone, with the NFC tags. However, they currently did not point to any specific actions. The stones were prepared to be networked but led to nowhere. In the second iteration, I explored how to bridge the cyber-physical divide and different ways of using the fact that the object was now machine-readable.

Process

The first virtual thing I explored was creating a *digital clone* of the clay tablets. The second part also took place in my home studio, which I was confined to due to the COVID19-crisis.

I used 3D scanning software to create 3D digital objects from the physical objects to achieve cyber-physicality. I tested out a couple of different 3D scanning software, but the choice fell on Qlone (https://www.qlone.pro/) an iPhone app which allowed me to scan 3D items using a smartphone camera. The objects were placed on a printed, checkered mat, which was used to align them. The items could then be exported to digital 3D formats and shared via email or web services. They could be shared as GIF images, as well as.OBJ images, and they could be imported in most 3D programs, including Windows Paint 3D, which worked surprisingly well.



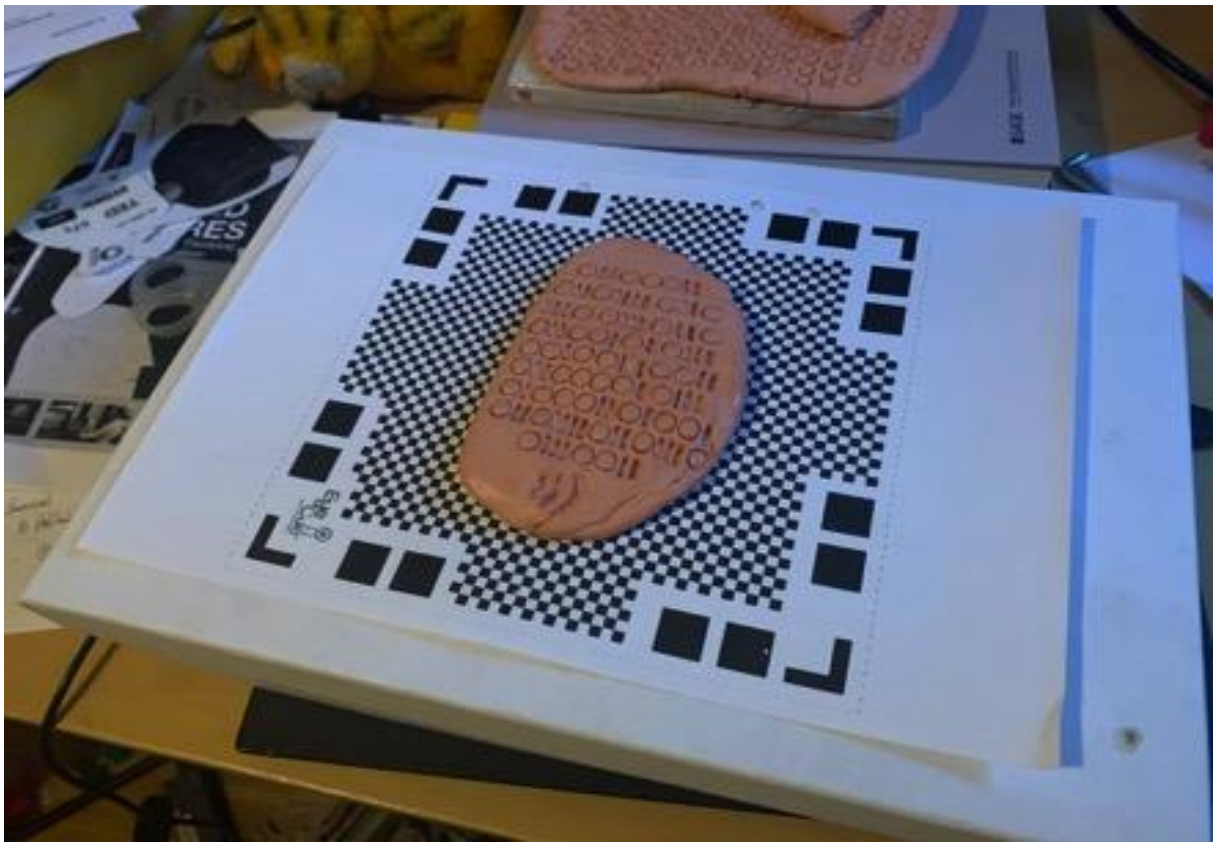


Figure 62: The process of making digital clay tablets.

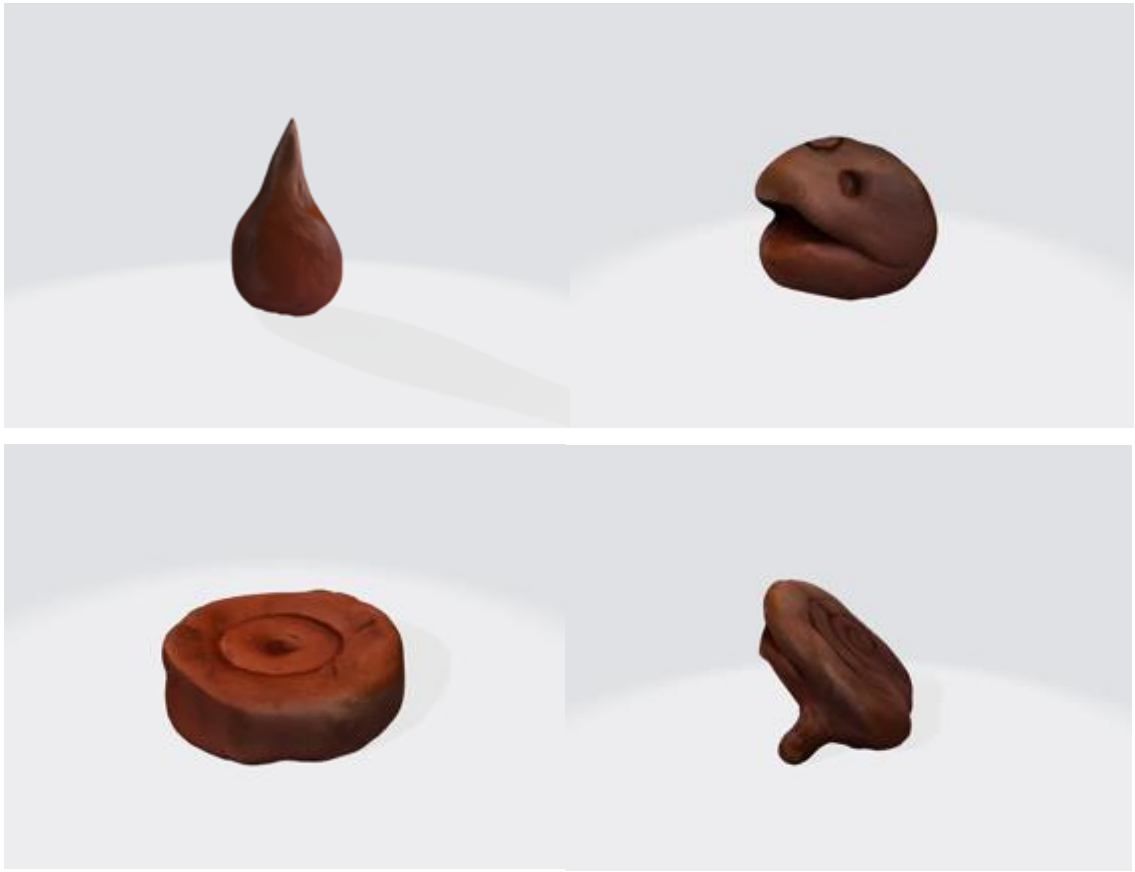


Figure 63: Sample of 3D scanned conversational stones.

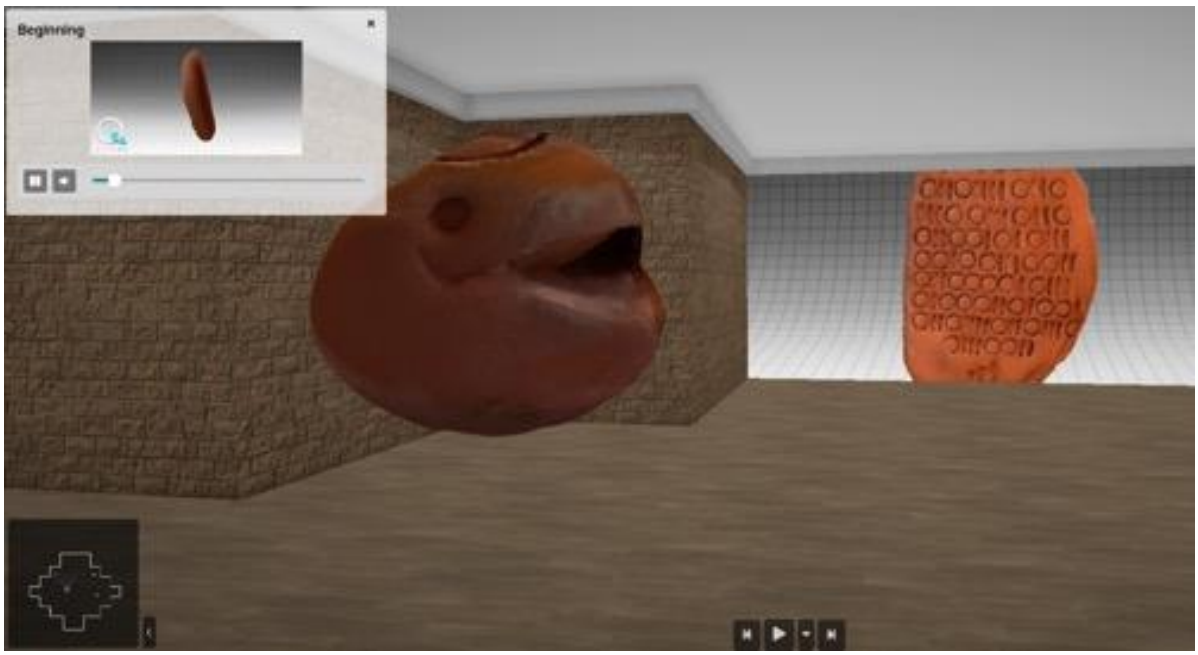


Figure 64: Conversational stones mounted in a digital showroom.

During the process, I learned about different 3D file formats and programs for manipulating the images and editing 3D objects. After a few attempts, I learned how to scan the tablets so that the outcomes were acceptable.

Once I had digitized objects, I explored different ways to apply them in different virtual settings. By creating *digital twins* of the objects, I could let the physical object connect to the digital object, creating a bridge between the two domains. It would also make it possible to connect either object to other resources, such as people (via phone numbers, text messages, emails).
At this point, I got an idea of turning the stones into an emergent persuasive service system. I envisioned how a network of artefacts, each with its personal, unique conversation embedded could lead people in and out of digital worlds, educating them as they explored the system. Each item, physical or digital, would require a certain biocost to create, distribute or consume. This insight informed the Friends project, which is described in chapter 6.

Insights from the process

Referring back to the findings in chapter 3, this iteration of the project allowed me to explore more deeply the 'persuasiveness' of the system and the physical-digital divide. Persuasive systems often lack materiality, but by starting with physical materials (clay) and working my way into the digital domains, I gained a deeper understanding of how the two worlds are interconnected.

This iteration's primary outcome was that I now had both digital and physical assets to work with in the service design project. I was pleased to see that the stones' digital versions came out almost identical to the original objects. The networked objects directly informed the Friends case study, which you can read about in chapter 6.2. Instead of clay stones, however, I turned one of their communicative assets, a heart, into a physical and virtual clay object and designed a conversational service system based on the object. I developed a backend for the service which would register its growth. I did use clay to create prototypes, which I could show to Friends. In doing so, I had effectively translated the epistemic service design to applied and useful knowledge.

When I went on to the next iteration, where I further explored the possibilities with networked clay tablets and artefacts, I had an exciting and solid design idea to build out a design cybernetic course concept from. For anyone more well versed in 3D creation, the process of digitising the objects would in itself neither be new, nor fascinating. Personally, however, it was an eye-opener when it came to the possibilities to persuade across cyber-physical systems.

Figure 65: Design cybernetic conversations – packaged.

5.3.1.3 Iteration 3 - Mixed conversations

In the third iteration, alluding to Glanville's concept of 'wandering', I felt that I finally arrived at the destination, which I was not looking for but which was waiting there for me to discover (Glanville 2007). I had mulled on the concept for some weeks and was inspired by a conversation with my tutor Nick de Leon, where we discussed the drastic turn to online education which Universities were forced to do because of the COVID-19 crisis. I realized that many online services suffer from a lack of physical materiality and that the persuasive service I was designing needed to be networked across physical and digital borders. Let me expand that notion a bit further.

I am old enough to have played the earliest versions of the popular computer game Sim City and seen the gameplay evolve from simple shapes on black/white screens to beautiful 3D-animated characters and buildings. The physical 'thing' I bought in the store was always a box with a digital medium (a diskette, a CD, a DVD) along with a small booklet or insert. However, most software is downloaded these days, which means that it has lost its physical materiality, or it has been reduced to a box only. The pervasiveness of digital services is confined to the digital domains; however, what would happen if that changed? How could, for example, an online computer game or a University course be packaged in a way so that both the offline and online experiences are persuasive?

Inspiration

To develop the mixed conversations, I was inspired by trading cards, Pokemon and other games where you can purchase booster packs of collectable cards and you do not know what type of cards the booster packs contain before you open them and find out. The theory of variable reward is a well-known gamification method and a common persuasive strategy in persuasive systems design. For example, Nir Eyal's Hooked model is based on (Eyal 2014), which was described in chapter 2. Now, how could you use the persuasive service system approach to stimulate new conversations?

Process

To address the challenge, I created a series of objects, and each was:

1) Based on the visual language of the Design Cybernetic Garden.
2) Easy to recognise and differentiate from the other objects.
3) Easy to scan in 3D.

The objects were made with air-drying clay, each with an NFC tag embedded. In this iteration, I explored more thoroughly what information was possible to embed in the NFC-tags and what actions or conversations they could trigger or enable. An NFC tag is essentially a physical link to a web URL, which allows anyone to access its content when scanned by a compatible smartphone.

The following are examples of actions which can be embedded in an NFC-tag:

- Shortcuts on the smartphone (start apps etc.)
- Locations
- Web links
- Texts
- Telephone numbers
- SMS

For example, an NFC ta could be ‘charged’ with instructions to send an SMS to a predefined phone number, display a text on the screen of the user, or send the user to a URL of choice.

Packaging

Figure 66: Packaging of cybernetic conversational stones.

Besides, I experimented with packaging which could carry a set of cybernetic stones. The packaging also needed to be customisable depending on the application area. I downloaded a free template for a pillow-box paper box and added some text and an RCA logo.

Application and usefulness

The conversational stones now had a form and packaging, which could be customised for different design projects. It also had numerous opportunities to connect them, effectively allowing them to tap into the persuasive power of networks and thereby expand their persuasive potential. In their current form, the conversational stones could be inserted in either a digital service system, a physical service

system, or both. By hooking them up with people or informational resources, they could embody a persuasive intent.

The stones now used several of the more well-known persuasive tactics to engage people. By adding *character* to the stones, I perceived that they were now even stronger on the Rhetoric of Things (Buchanan 1985). They were also *networked* and incorporated a variable reward. The user would not know when they use the stones which conversation or content they would lead to, creating the same effect as the tactics described by Fogg and Eyal. They can communicate *authority*, depending on which logo they embody and *scarcity*, by offering limited edition conversations, in line with Cialdini's concepts outlined in the literature review (Cialdini 2001). The conversational stones now had a nice package, a strong meta-design-concept which I could be creative with and adapt to different situations. The stones were essentially a meta-design-structure for a persuasive service system, in which one could experiment and be creative with its possible applications.

However, there was a risk that the packaging is less persuasive than the stones. It might even be useful to remove the packaging altogether to lower the barrier for interaction with the conversational stones. It was also a risk that the stones needed further explanation to be useful, why I also considered using a symbol or sign to communicate to the user that a smartphone or NFC tag reader was required to use the stones.

5.3.1.4 Iteration 4 – A Design Cybernetic Learning Experience

In the final iteration of the project, I tried to tie all loose ends and synthesize the reflective practice and new knowledge. As the purpose of the thesis is to create new communicable knowledge. It made sense that the final iteration led to a few reflections on an educational service concept that embodied that ambition. Reflecting on my position as an observer/researcher/designer is also in line with the 'next step of cybernetics' proposed by Scholte (2020). I again considered the second research question:

R2: How can different concepts from design cybernetics be applied in a persuasive service system design project, to create more understandable and valuable service propositions??

Based on the insights from the literature review in chapters 2 and 3, I reflected that to address the wicked problems in persuasive service systems; the world needs more *design cyberneticians* - people who *practice* applied design cybernetics and who *identify* as design cyberneticians. Becoming a design cybernetician may include learning the history, concepts and models of cybernetics and design, however, in my view, it also includes developing tacit knowledge and adapting the practice and identity of a cybernetician. A design cybernetician is both a *medium and agent*, a carrier of design cybernetic values that contribute to maintaining and expanding the design cybernetic discourse community with their actions and performances.

There are several descriptions of how cyberneticians sometimes find themselves clashing with the academic system (Richards 2020, Dubberly and Pangaro 2007). Cyberneticians' work seldom fits into a single discipline, why they have challenges finding funding for their research and getting legitimacy for their results in traditional academic settings. However, their work is still research, as in a search for knowledge, whether it can be fit into the academic system or not.

In a constructivist world, it seems like there exists a persuasive metasystem for each researcher and her research. These persuasive metasystems concern how 'well' the researcher manages to package and disseminate their ideas, developing a persuasive system as a vehicle to bring them into the world. It does not matter how brilliant one is, or how ground-breaking ideas one has if one cannot initiate conversations about it with other people, get attention for the results, share the research with the academic community, or spend time researching. Are the *metasystems* of academic research being as important as the actual research?

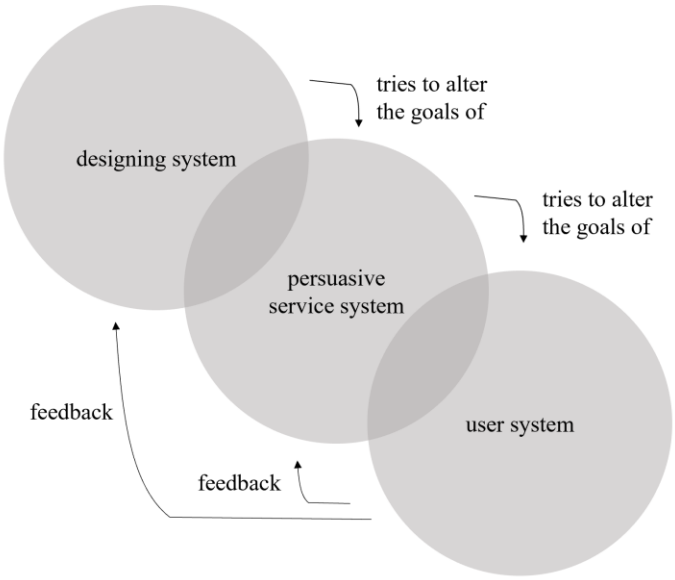
The same insight of course also applies to service designers of persuasive systems. The metasystems constitute governing second-order systems, which effectively governs the design researcher or practitioner. However, this layer is seldom made explicit or described as an essential part of the design researcher's role. It is rarely recognized as a critical persuasive system for the researcher's success.

Now that I had materials, I decided that this step would explore how I could create a design cybernetic *learning experience* based on the persuasive service touchpoint concept I had developed. Having reached this point in my research, creating a format to pass on my newfound knowledge and train other people in design cybernetics was a way to weave together the different strands that emerged over the PhD course. First, designing a 'training machine' is in itself an exercise in reducing complexity. It forced me to make explicit governance questions and related ethical issues. Also, educational formats, methods, courses, and programs can be considered services-as-persuasive-systems, allowing me to explore the frameworks' applicability. Third, it was a way to package the new knowledge created in a communicable format, allowing other people to access it.

Gordon Pask spent a substantial part of his career designing 'training and teaching machines' for stimulating conversations between people and machines, where the device acted as a conversational partner. Like *Musicolour* adapted its actions to the actions of its 'dance partner' (see section 3.2.1.2), his teaching machines were adapted to different market applications (such as keyboard training), offering variation to stimulate its users to 'keep playing' (Pickering 2010, pp. 329-334). Modern adaptive learning platforms, such as Alta or Khan Academy, works on similar principles, but with more advanced underlying algorithms. When designing a learning experience that promotes design cybernetics globally, I wanted to build on Pask's ideas of training machines and develop my personal take on them.

Process

Building on the cybernetic stones as conversational artefacts, I began exploring how a training machine that would honour the cybernetic tradition of non-conformism could be designed and delivered as a persuasive service system. I wanted to create a service that could act as a timeless conversational partner to explore design cybernetics. Conversational, in a cybernetic sense, which could both provoke people to upgrade their personal thinking, but they could also contribute to enriching the conversation over time and keeping it going and proliferating in the world. It is a 'cathedral project' that is not meant to be completed in our lifetime, but that future generations can enjoy and build on. I used the working name 'A Dance in the Design Cybernetic Garden', alluding to Pickering's 'dance of agency' and Pask's embodiment of this dance in the Colloquy of Mobiles, subsequently recreated by Pangaro et al. at the Centre Pompidou in Paris. (Pickering 2010, p. 21, Pangaro and McLeish 2018). That would be an appropriate addition to my cybernetic garden, and it would also contribute to generating new, communicable knowledge. I mapped the structure to the design cybernetic governance model defined in chapter 3, to identify possible influences and limitations. I 'observed myself' as an observer and part in the project.



System level	Definition
Designing system	Myself
Persuasive service system	The cybernetic educational service
User system	The envisioned users of the service

Figure 67: Model of the persuasive service system.

The operating system for the design cybernetic course was *conversations*, which are central to design cybernetic. By having a conversation with the object in the box, it stimulates to second-order reflections. The reflections are guided by the researcher who curate the box with a personal configuration of content (which the stones are lined to), depending on the user.

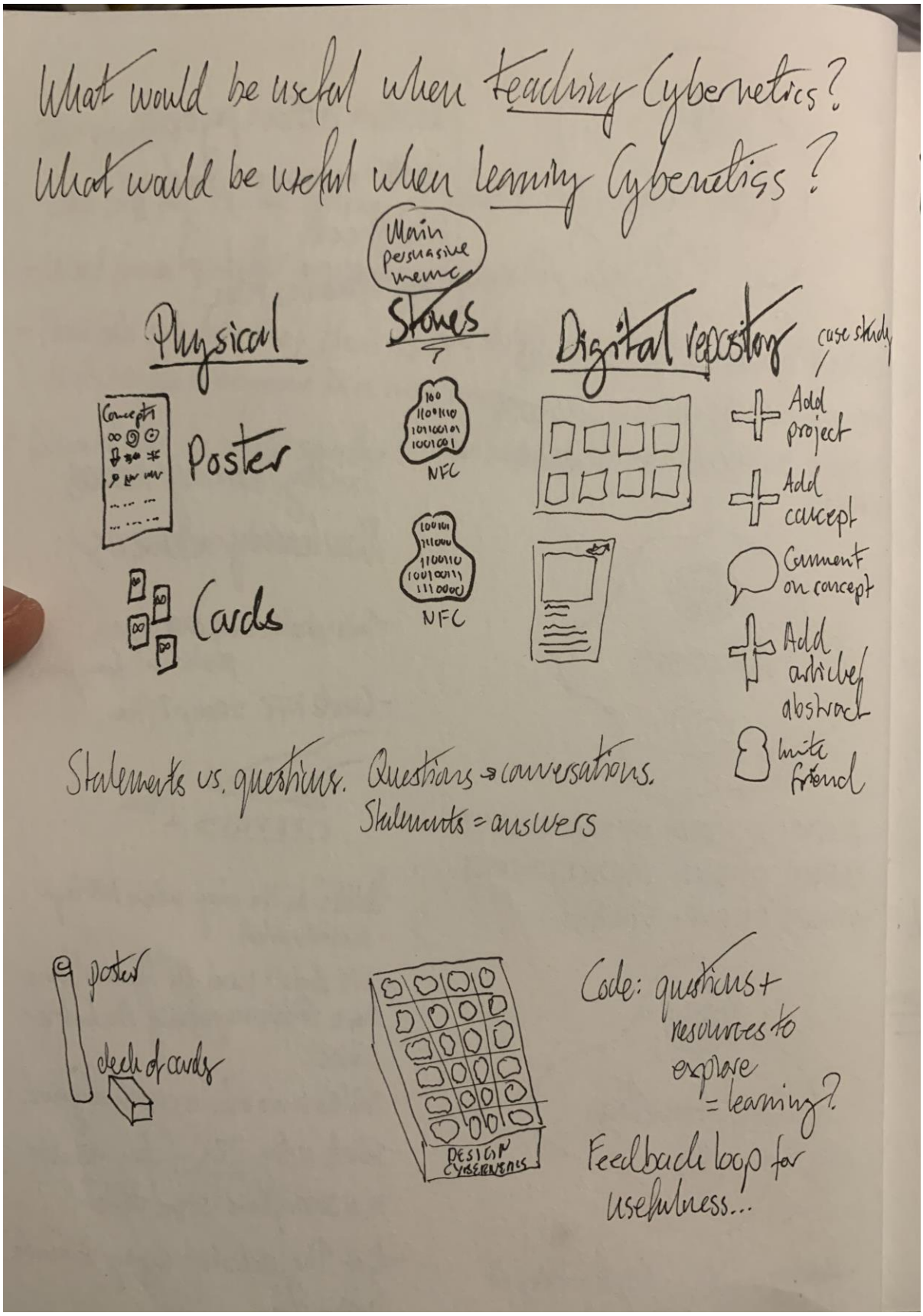


Figure 68: Exploration of learning experience.

Figure 69: A Dance in the Design Cybernetic Garden.

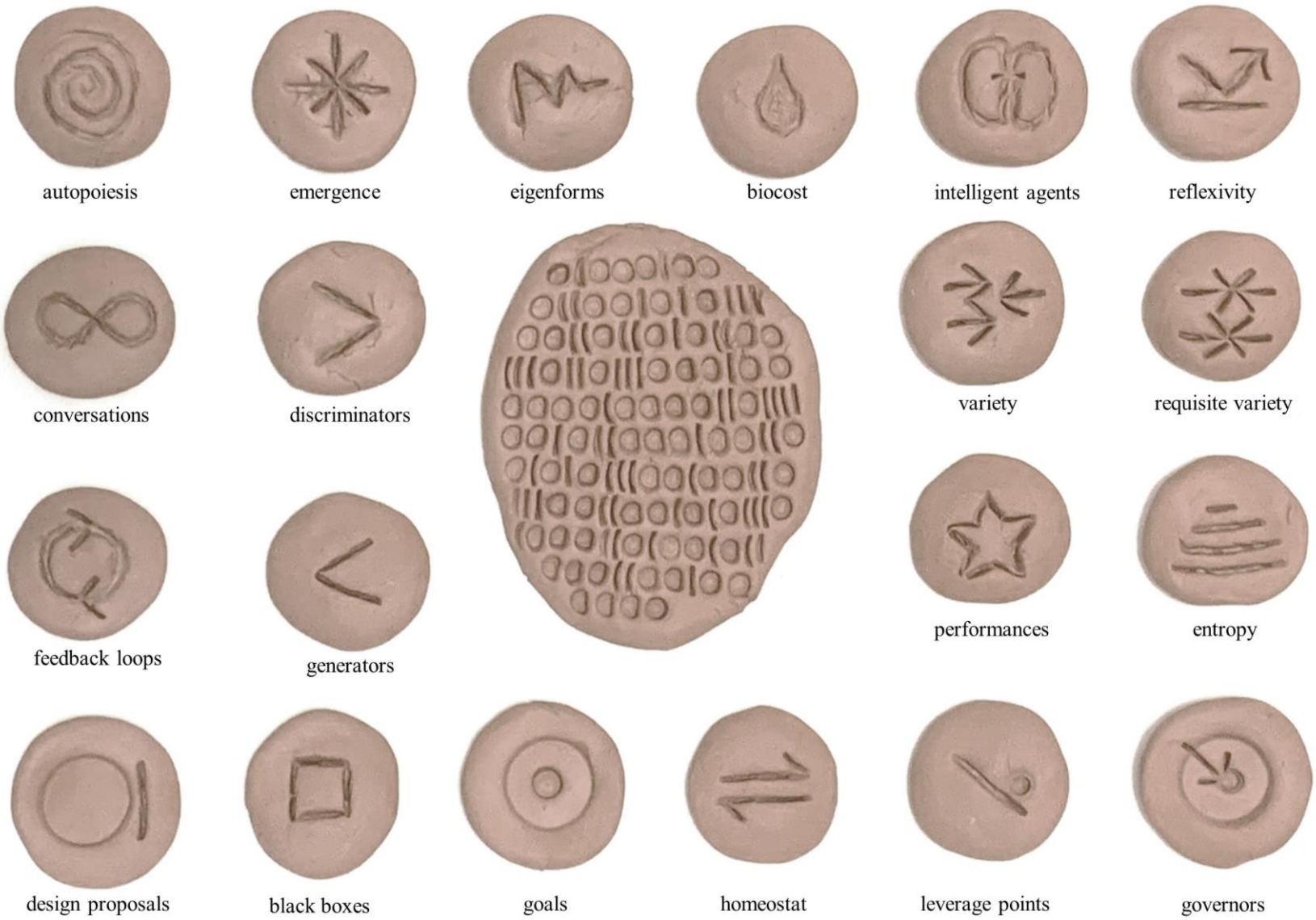


Figure 70: Overview of components.

Service Concept: A Dance in the Design Cybernetic Garden

Conversations
The user can get in touch with the researcher and have a direct conversation with him/her.

Reflexivity
A provocation by the researcher, to evoke a reaction from the user.

Goals
An invitation to the user to to state the purpose and goal of his/her research and personal interest in it.

Feedback loops
Point of interaction where the user can ask for a reflection from the researcher or from another user.

Variety/Requisite variety
Increasing the variety of the user by assessing her ability and presenting a 'playlist' of conversations which would increase his/her variety.

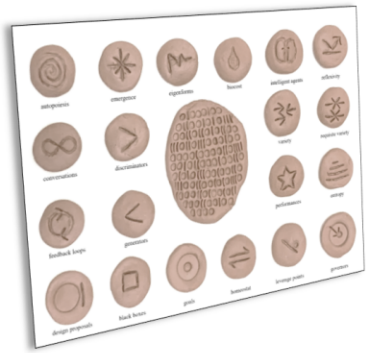
Biocost
Carrots and sticks to motivate the user to spend biocost developing their practice. Competitions, challenges, grants etc.

Autopoiesis
A shop where the user can subscribe to the researcher's output and purchase extra services, generating revenues that sustains the system.

Emergence
A map of the user's output over time. A link to a virtual 'digital garden'.

Black box
Allows the user to post questions that they are wrestling with, and an invitation to contribute.

Governors
Limiting factors which influences the user and methods to increase variety to overcome limitations.



Explore with your smartphone.

Converse with yourself and with others.

Create persuasive design proposals.

Perform and share your learnings.

Intelligent agent
A personal learning partner or tutor: machine or human.

Performances
A playlist of events: lectures, seminars, exhibitions and other opportunities to perform one's research.

Discriminators
Tools to help the user narrow down their briefs and focus on what's important.

Leverage points
Suggested challenges to take on and methods for identifying leverage points.

Design proposals
Current design proposals that the researcher is working on, with an invitation to contribute.

Generators
Design briefs/challenges for the user to take on. Tools for generating new ideas when stuck.

Eigenforms
Ideas that are at an early stage. Ideas for research or design projects that the user wants to realise.

Entropy
A dashboard with statistics of the system usage on indivdual and global level.

Figure 71: Service concept, A Dance in the Design Cybernetic Garden.

Insights from the process

First, the process made me reflect on how a specialist and a non-specialist audience could explore my version of design cybernetics. As described in the literature review, the cybernetic conceptual world can be intimidating and too theoretical to many. Reducing the first touchpoint to a clay stone with a symbol, perhaps the journey can come to a more leisurely start.

Second, the process made me reflect on how cybernetics' performative nature could be embodied in an educational service. The answer was to turn the learning journey itself into an experience, considering the persuasive nature of each touchpoint and the persuasive goals for the system as a whole. Instead of providing a prescribed journey, the user could explore freely, like being handed a box of chocolates without knowing what's inside each praline.

Also, I realized that the service needed *a strong supporting second-order persuasive metasystem*, a designer or designing system who actively works to realise the first-order system, not only by creating it but also by breathing life into it over time. That is very much in line with the idea of autopoietic social systems, that strives to 'live' and survive over time. Without a robust, persuasive second-order system, the first-order system would never make it into existence, nor become sustainable/autopoietic. This insight was consistent with my observations in the Friends project (chapter 6) and further explored some of the models created.

Applications and usefulness

The result from the final cycle of the reflective practice was a persuasive service system designed to make people excited about design cybernetics. The concept embodied several concepts from design cybernetics, which was used as building blocks, like LEGOs, to shape the service system. It is designed in the spirit of my personal research practice and can be expanded over time. There are several similar concepts applied to different contexts, not in the context of Design Cybernetics, however. Sánchez et al. (2011) created interactive and educational games for kids to collect animals in a museum, and in another context, where a game stimulated them to outdoor exercise. Jimena Medina et al. (2019) deployed an NFC-powered system to teach history at the University of Córdoba, and a similar structure was suggested by Lee, Huo and Ksu (2015).

The main limitations of the approach which put constraints on its execution were time (to create the objects), knowledge (to understand the logic) and resources (to realise the prototypes) and inspiration (to generate creative solutions). To meet these limitations, I developed new knowledge and methods that allowed me to increase my variety in these areas and eventually arrive at an acceptable concept. These constraints shaped my design choices and the output of the project.

5.3.2 Application and usefulness

The *conversations with the self* helped me generate answers to

R2: How can different concepts from design cybernetics be applied in a persuasive service system design project, to create more understandable and valuable service propositions??

The conversational stones evolved over three iterations and resulted in a new meta-service learning concept that can be deployed as a platform for other people to develop their practice. I formulated a component of my cybernetic garden, which could be deployed in physical or digital rooms to attract and engage people in exploring the conceptual world of design cybernetics. The service concept itself was designed using design cybernetic principles and embody design cybernetic conversational logic. What made this particular service design process different was its epistemic nature. The focus of the epistemic exploration was not to deliver on a client brief but to generate a personal understanding of design cybernetics, by designing a service inspired by its conceptual world. Throughout the project, I shifted between the role of an observer and maker.

Limitations of approach

I identified a few limitations to my design approach, that put constraints on my reflective practice. *Time*, *resources*, *knowledge* and *inspiration*, were some of the main constraints which governed my process. I regularly used conversations with texts, people or places to break out of mental blocks which hindered me from being creative and advancing the projects. I also found writing, which has been described as 'thinking on paper', to be a useful method to understand what I had done, what it meant and where I was going. Obviously, I am neither a graphical designer nor a sculptor, why the aesthetic output of my practice can be considered questionable.

A second limitation is that not all prototypes were tested on people in the real world. Some concepts were tested in conversations with others, as described in chapter 6. However, there were several ideas which were purely a product of my practice.

A third limitation is that not all concepts made it past the prototype stage. When realizing that there were no benefits in going down a particular path, I abandoned those projects and moved on to the next. Apart from the projects described herein, I have about a dozen other concepts and plans which I did not use or deem interesting enough to write up or document. However, I have kept these abandoned ideas in digital and physical folders if I would be inspired to pick them up sometime in the future.

5.3.3 Future applications

The Design Cybernetic Garden is a first step towards making design cybernetics accessible to new target groups. A natural next step would be to develop high-engagement content for the different parts of the service. In order to achieve broader adaption, other design cybernetic researchers could be invited to develop services on the framework and refine further the theoretical concepts which underpin it. The idea could be commercialised to reach a wider audience and create value in a more formal setting.

Second, it would be interesting to explore creating a sculpture based on these principles as a platform to deliver non-traditional cyber-physical courses and educational experiences. Instead of delivering the educational experience in the form of a box, it could be embedded in an interactive, ambient environment.

5.4 Summary of learnings from the projects

In this chapter, I described my *reflections-on-action* of two projects that informed my research, resulting in communicable new knowledge. The design method used can be characterised as epistemic service design, where the overarching purpose of the design activity was not to arrive at solutions for clients, but rather to explore the research questions related to services as persuasive service systems and answer RQ2*: How can different concepts from design cybernetics be applied in a persuasive service system design project?*

I explored different cybernetic concepts, eventually arriving at a service concept and packaging the solution/language in a cyber-physical system. The reflective practice led to new personal knowledge and generated new ideas and unique concepts and new knowledge to answer the research questions.

1) The first insight was that the practice helped me translate abstract cybernetic concepts into physical and digital artefacts that I could use in my service design practice. New communicable knowledge was created in the form of a poster with design cybernetic concepts, a concept for conversational stones and a service concept for an educational experience.

2) Second, the projects embodied several of the theoretical concepts and ideas that I identified in the literature review and were conceived using a design cybernetic praxeology. Observing myself in practice, I switched between reflection-in-action, analysing the subject of design (the service and the artefacts) and reflecting-on-action, on the implications of my design, adding a second-order learning loop to the first-order activity that upgraded my personal knowledge.

3) A particularly interesting learning related to the conversational stones, was that the exploratory, generative service design exercise directly informed the Friends project. The conversation with the self informed the conversation with others and aided me in the creative process, to take the more traditional external service design project forward.

The practice also raised new questions concerning the nature of persuasive systems and their relationship with their designer. I developed a sensitivity towards my personal goals, motivations and design methods and evolved them by introducing new concepts from design cybernetics.

6. Conversations with others

6.1. Conversations with others

The following case studies provide partial answers to research question R2: *How can different concepts from design cybernetics be applied in a persuasive service system design project, to create more understandable and valuable service propositions?* It operationalises the insights from the literature review and from the personal reflective practice, using an action research process to generate new knowledge about service design of persuasive service systems. Not knowing whether the interventions would be useful or not, I chose a careful approach to deploying the theories in 'the wild'. I gradually moved from being a passive observer to an active observer (agent).

The purpose of the conversations with others was to anchor the research in reality by pursuing a naturalistic inquiry into the research questions. Whereas the conversations with the self were aimed to generate new personal knowledge, this section describes how I expressed the personal knowledge, design cybernetic ideas and persuasive systems ideas in the context of live service design projects.

In the first project, described in section 6.2, I embedded myself in *Friends*, an anti-bullying organisation. The project with Friends was followed by a design studio, described in section 6.3, with three student teams, who worked on a brief which I co-produced with *Planethon*, a consultancy focusing on planet-friendly business models. Making the journey from observer to actor, I observed and accounted for my personal role as a researcher and service designer while developing new knowledge about the processes I was a part of. The selected case studies also aimed at generating services designed to tame wicked problems.

	Project	**Function**	**Contributed to**
6.2	Friends	Contextual understanding of the usefulness of design cybernetics	Method
6.3	Planethon	Understanding of how and where design cybernetics is useful Understanding my role as an observer	Method Tools

Table 18: Overview of conversations with others .

6.2. Friends

The purpose of the first case study was to contribute to a contextual understanding of how to apply design cybernetic concepts in a persuasive service system design project. By initiating and driving a real-world design project, I could collect rich data for the study and inform my reflective cybernetic practice, while learning more about a cause I care about.

During my formative years, I was like many other kids, a victim of bullying. Although it contributed to shaping me to the person I am today, I would probably be better off without the memories of regular harassment, name-calling and beatings. However, I recognize that many kids are not as fortunate as I and that bullying is still a persistent, global challenge. That was the primary motivation to why I engaged in conversation with *Friends*, one of the world's oldest anti-bullying organisations. Friends were interested in learning more about how service design could address cyberbullying, which initiated our conversation. I chose to engage with Friends because I wanted to engage in a design project where I could participate in a new service development project and be free to experiment with different approaches. Friends gave me that opportunity, and I am forever grateful for their faith in me. The project ran in 2019-2020 and was rounded off at the project's delivery in August 2020.

6.2.1 Background and purpose

Friends is an anti-bullying organisation with its headquarters in Solna, Sweden. The organisation focuses on preventive work and primarily addresses the target group 'adults who care about children' rather than directly engaging with children. Their offering includes educational programs which they provide to schools, as-in-person programs or online programs. Since the COVID-19-crisis, online programs have become more critical. A study carried out by friends indicated a slight increase in cyberbullying during the crisis. The research took place at Friend's offices in Solna, Sweden and in Dublin, at the World Anti-Bullying Forum organized by Friends.

Cyberbullying is an aspect of bullying which takes place through digital media. According to an expert at Friends, kids do not distinguish between the digital domain and the real world and bullying flows seamlessly between the two spaces.

I defined the objective of the Friends study to get a contextual understanding of a challenge related to good governance of pervasive industry platforms, by carrying out a service design research project to support managers in implementing anti-bullying solutions on digital platforms. The initial design brief which was formulated in concert with Friends was:

How can service design tools inspired by design cybernetics be used to improve decision-makers' knowledge about bullying in pervasive industry platforms?

In part, the brief was vaguely formulated because there was no single problem that stood out for them and in part because I wanted to observe the 'system', following Meadows' recommendations, before suggesting any interventions (Meadows 2008). The question should therefore be seen as a starting point for exploration, a 'sensitising concept', using terminology borrowed from grounded theory, described by Charmaz (2014, pp. 30) as concepts which 'give researchers initial but tentative ideas to pursue and questions to raise about their topics.'

Methodology

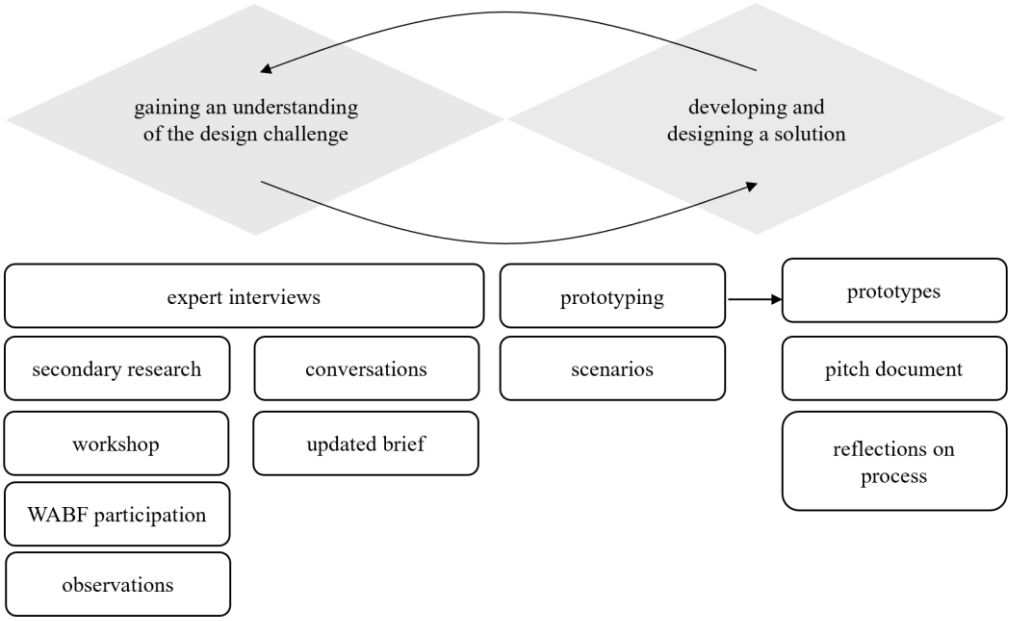


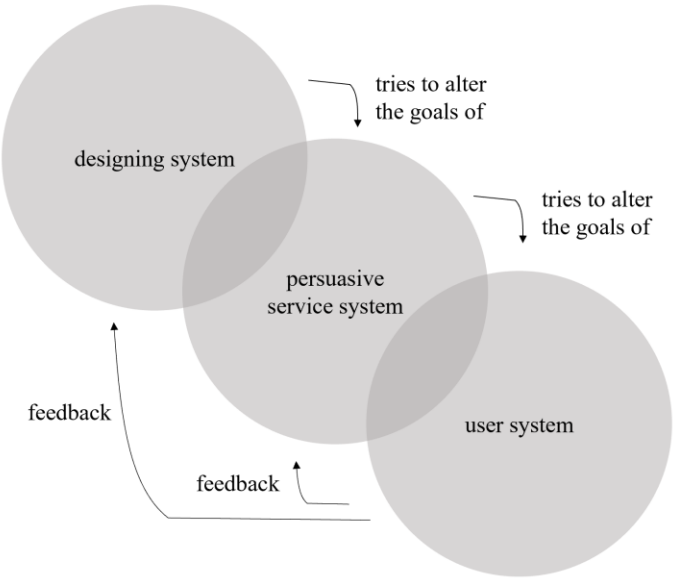
Figure 72: Methods used in the Friends project.

As described in chapter 4, I used a service design methodology inspired by design cybernetics to structure the project. The process consisted of four phases, a research phase (discover, define) to gain a better understanding of the challenges and a practical phase (develop and deliver) where I developed and iterated a solution (Figure 72). The process was not linear but *circular*, and in practice, I moved back and forth between the different stages throughout the project. Throughout the project I tried to integrate design cybernetic thinking in various aspect of the work, considering my ongoing reflections on design a second-order system.

My position as a designer/observer and actor

Interpreting the project using the design cybernetic model for persuasive service systems described in chapter 2. The three levels interact in two distinct conversations, where the persuasive service system conversation describes a first-order cybernetic system that aims to influence the goals of its users, as

per our definition of a persuasive service system. The design conversation is the second-order cybernetic conversation that seeks to shape the service's constraints, *governing* it in practice.



System level	Definition
Designing system	Myself
Persuasive service system	The service I designed for Friends
User system	The envsioned users of the service

Figure 73: Model of the persuasive system used in the case study.

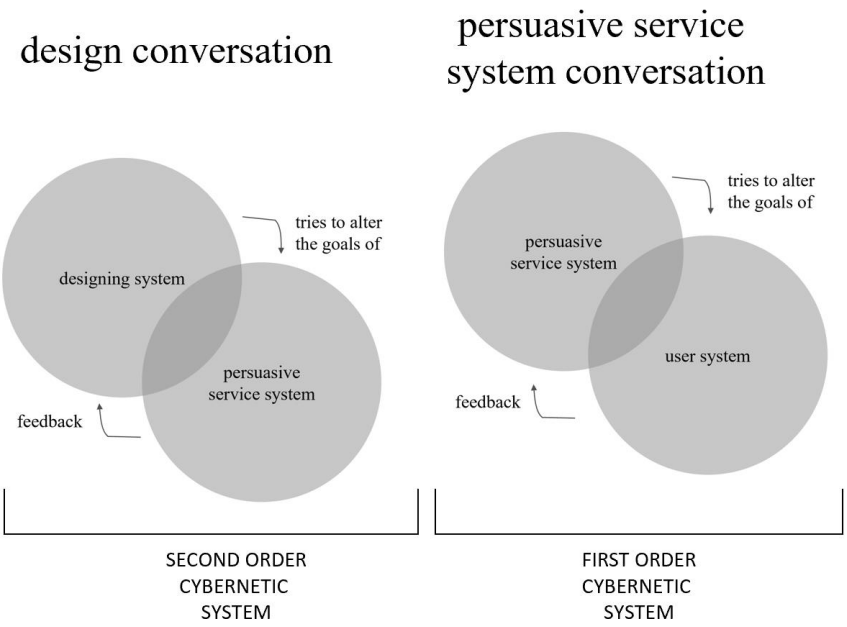


Figure 74: Models of conversations.

6.2.1.1. Definition of cyberbullying

Bullying is a pervasive, global challenge which fulfils the definition of a 'wicked' problem. While some countries do not currently have a working definition of bullying, other countries do and developed methods for addressing bullying in schools and online. A useful working definition of bullying, that Friends has adapted is that by Olweus (Olweus 1992, as cited in Gaffney, Farrington and Ttofi 2019):

1) An intention to harm
2) Repetitive in nature
3) An apparent power imbalance between perpetrator and victim

Online hate speech, sexual harassment and violence between children are all overlapping areas of inquiry and, although these acts could be a part of bullying, the definition differs slightly. *Cyberbullying* is not easily defined. The research community has not concluded whether cyberbullying should be considered a separate domain from bullying in the physical world or not (Zych et al. 2017, p. 5). It fits the definitions of a *wicked problem*, as described in chapter 1. According to Friends, bullying that takes place in real life spills over in the digital domains. Although adults often consider these domains as separate, for children, the boundaries are virtually fluid. Online harassment is a widespread phenomenon. A recent survey of 10 384 kids 9-19 years of age revealed that 33-45% of the children had experienced online harassment. The study also revealed that 14-24 % of the children surveyed experienced that the COVID-19 crisis had led to an increase in online harassment (Friends 2020).

The adverse effects of bullying are well documented. Bullying may lead to increased suicidal ideation, social anxiety and depression. Bullies are more prone to carrying weapons or use drugs. Longitudinal studies have also reported adverse long-term effects of bullying (Gaffney, Farrington and Ttofi 2019). However, it has been challenging to put a monetary value on the impact of bullying. Based on the resulting societal costs of healthcare, unemployment and rehabilitation, Friends had calculated that one year of bullying costs the Swedish society (10 million inhabitants) approximately 17,5 billion SEK (1,75 bn EUR), over the following 30 years. The study indicated the societal cost of the challenge, as a complement to the well-documented human suffering resulting from bullying.

Platform companies and anti-bullying-organisations

In chapters 1 and 2, I described some challenges of pervasive, digital industry platforms such as social media platforms, which are becoming more influential in shaping people's behaviours and attitudes. Despite their increasing impact in society, Friends have had minimal direct contact with the platform companies. However, Friends do not have a straightforward strategy to engage with them either. I was

told that it was difficult to connect with the platform companies and that there were few clear communication channels available for local NGOs who wish to engage with them. Instead, Friends engage with them indirectly, by creating alliances with other influential brands in the tech industry, such as Dataspelsbranschen (The Swedish Games Industry) and Telia (the largest telecom operator in Sweden. By building alliances with strong partners, they could to have a more significant impact despite limited organisational resources.

6.2.2 Conversations

6.2.2.1 Conversational structures

Throughout the project, I carried out *semi-structured interviews (*see methods section 4.2.2.2) with employees at Friends and to dig deeper into some of the issues raised; I organised a *workshop* to refine the issues. The interview at Friends can be considered *expert interviews (*see methods section 4.2.2.2), as the team members were all very experienced as professionals in the field. The team graciously provided their time to teach me about the field. Although the interviews followed a script to some extent, the interviews were in practice *conversations*. I listened and sometimes shared my reflections on the issues being discussed, to provoke more profound reflections from the interview subjects. The purpose of the interviews was to understand the context and be generative, creating new ideas and concepts that could inform the design process. These interviews can be seen as *pragmatic interviews*, with the purpose to yield practical and useful insights, as applicable in action-oriented qualitative research (Patton 2015 p. 436).

The interviews took place at Friend's office and were sound recorded. After each interview, I listened through the material and wrote up the main insights, transcribing only the critical parts of the interviews, which referred to those insights. The design project did not call for full-length transcription or translations, because what mattered was their contributions as inspiration to the overall design process. Besides, I wrote down a short *reflection on the interview method*, in my research diary, to create a conversation with the self, a feedback-loop to hone my interviewing skills. The formal interviews resulted in a richer understanding of Friends work, bullying in general and cyberbullying in particular. It also gave me deeper insights into how Friends operates.

Inter-view no.	Date	Location	Gender	Organisation	Profession/role	Length (in min)
1	23/04/2019	Friends office, Solna, Sweden	F	Friends	Research Fellow	33 min
2	23/04/2019	Friends office, Solna, Sweden	F	Friends	Development Lead	47 min
3	24/04/2019	Friends office, Solna, Sweden	F	Friends	Educator	40 min
4	24/04/2019	Friends office, Solna, Sweden	M	Friends	Education manager	46 min
5	16/5/2019	Friends office, Solna, Sweden	F	Friends	Communicator	38 min

Table 19: Interviews, Friends.

Workshop

To begin exploring Friends' capacity to address cyberbullying and test out some cybernetic concepts, I organised a *workshop* to which I invited key stakeholders at Friends. The workshop was held at Friends office and five people, including the Managing Director and the Head of Research, participated. The workshop's purpose was to introduce some cybernetic ideas to describe some of the issues raised in the interviews. Building on the CLEAT conversational framework developed by Pangaro (2014), we explored three areas: *goals*, *languages* and *channels*. The workshop's focus was to discuss why it would make sense for Friends to engage with platform companies and vice versa and generate ideas of how that could be done. The workshop was about 1,5 hours long.

The first insight from the workshop was that there seemed to be a challenge already at the (C), the channel for conversation. The workshop participants agreed that it is challenging to get in touch with platform companies. The only ways they have gotten in touch with them in the past was through personal contacts. The platform companies seem to be untransparent in the sense that it is difficult to know who to speak with. Formal channels to initiate a conversation were perceived to be non-existent. Concerning (L), shared language, the CLEAT model states that shared vocabulary is a prerequisite for conversation. We explored which different languages Friends master, broadly speaking, concluded that Friends speak a wide range of languages. Examples of suggestions coming out of the workshop were ‘grown-up language’, ‘donation language’, ‘politically correct language’. Existing languages included Swedish, English, Farsi, Lithuanian, Arabic. Also, people in the organisation mastered different forms of artistic expression: dance, film, podcasts, lectures, workshops, journalistic. These illustrate the variety of languages available for Friends to act in the world and drive their agenda.

Last, we discussed Friends working methods and why platform companies would want to engage (E) with Friends. In their approach to cyberbullying, Friends usually asked: *What* do we want to influence and *why*? Reasons, why Friends would want to engage with platform companies, may include, goodwill, contributing to a better culture, contributing to product development and

contributing to customer/user satisfaction. Preventive efforts were preferred, rather than a band-aid on acute events.

6.2.2.1 Insights from the conversations and the workshop

In addition to insights generated in the workshop, I also had the opportunity to explore the workshop format's affordances and constraints and explore the research question.

- Regarding the *format*, I experienced that the cybernetic terminology was more confusing than illuminating. I tried to introduce conversation theory by explaining it in a few slides. However, I perceived the theories to be too abstract to be useful in this context.
- Regarding the *content*, the workshop was useful to better understand the organisation's relationship with digital platform companies. The workshop also provided some insight into how cybernetic concepts could be applied in a workshop setting.
- There seemed to be a challenge to open a channel for conversation to engage with them, which would prevent any mutual exchange of knowledge according to the CLEAT model. That does not necessarily mean that there are no channels available to have these conversations, personal connections, for example, seemed to work.

However, this last point exposed a deeper issue with digital platform giants, which I was further exposed to at the World Anti-Bullying Forum (WABF), which I will account for briefly. To better understand how bullying interventions, take place on pervasive industry platforms such as Facebook and Instagram, I got the opportunity to participate at WABF which Friends organised in Dublin, in May 2019 where the top managers responsible for online bullying from companies such as Facebook and Microsoft participated.

At WABF, Facebook's Head of Security was scheduled to speak, and it was evident that the audience had numerous questions about Facebook's work with cyberbullying and online harassment. The speaker did not take any questions and promptly left the stage after the presentation. That is by no means unusual: people in power tend to want to control their attention and reduce the risk of being exposed to questions which may expose them to risk. By controlling who gets to converse with them, they can manage who gets to *educate* them. A similar example from another context was Ivanka Trump's speech at Doha Forum 2019, a high-level political conference where Ms Trump was the keynote speaker. She did not answer the audience either but was instead questioned by her press secretary (Steadman 2019). This raises the question that if conversation is considered ethical, can choosing not to engage in conversation be considered unethical? Does it imply that you are not open to changing your mind?

One of the main challenges with platform companies is that they are multinational, thereby tricky to regulate and work with on a national level. Several of the FAANG platform companies have more employees and larger budgets than nation-states. These often only have local offices in Sweden, making communication with decision-makers even more complicated, when the recipient is in another country.

Properties of cyberbullying

From the interviews, I could derive the following insights about cyberbullying and Friends' work, which I brought into the design process. According to Interviewee #3, some apps come and go, as well as the established giants. Apps that kids use include Snapchat, Instagram, Tiktok and other 'small apps splashing around'. An anonymous web allows young people to explore and play around with different identities. Interviewee #1 explained that for young people, there is no distinction between life offline and online. They were born with the Internet and have not experienced anything else. Older generations, however, usually make a clear distinction between the two domains. There is a popular saying (that I haven't managed to locate the source for) which goes 'When we were young, we used to go online. Now we are always online and go offline.'. That emphasises the need for Friends to understand and be present both in the online and offline worlds.

Interviewee #3 did not believe that there was more bullying online than offline, but online bullying had a higher impact. They experienced that bullying with images and video is more impactful than bullying with text. We speculated afterwards that perhaps this is related to the properties of the computer medium and its advantages. I was also informed by Interviewee #1 that cyberbullying is difficult to define and distinguish from other, similar acts of psychological violence online. Semantics is essential when determining the challenge: online *hate* versus online *bullying.* There is a thin line between online harassment, online hate, and illegal acts online.

The architecture of digital spaces was described in different ways. Interviewee #3 said that 'I see online as different 'rooms' or 'spaces'. There are actors with big rooms and small rooms. You can feel the atmosphere when you walk into a room.' When people jumped from the local bridge in town, they raised a fence to avoid it from happening. Perhaps we could do similar things online, raising digital 'fences' in rooms with threats. Interviewee #4 mentioned how culture and norms are, to some extent, discussed in metagames. There is a meta-gaming layer for many online games, where informal discussions take place, about norms, culture, rules, etc. Some of these discussions eventually make it to features in the games, but the 'political' debate primarily takes place there.

Friends' relationship with platform companies: where and how to engage

To engage with kids in places where they hang out online, Friends has collaborated with the Swedish e-Sport association. The first step in the partnership with the e-sport association was to make a baseline survey to get an image of the current state of bullying in games. The purpose was to create a report that could be used to initiate conversations with other partners and funders and be published to generate strategic awareness of the issue. By engaging one group (gamers) in work on values and attitudes, this work may spill off into other groups, according to interviewee #4.

It was also clear that the organisation is dependent on external funding to execute all and any projects. The funding feedback loop is as critical and important as the execution of the projects.

6.2.2.4 Summary and analysis: Guidelines for design

The formal interviews and the serendipitous interactions with the staff over the project gave me valuable insights into the organisation's working methods and challenges. The experts in the organisation shared their knowledge of cyberbullying, state-of-the-art research papers and insight in their practical work. The following main insights and guidelines were brought into the design process and contributed towards an 'updated brief':

- The fight against bullying now takes place both in digital and in physical spaces. Understanding how to intervene in digital spaces is a prevalent challenge for designing anti-bullying efforts.
- It was difficult for Friends to work directly with the large platform companies which facilitate online spaces. Instead, teaming up with strong regional partners and developing joint initiatives together with them seemed to be the most promising way forward.
- Friends had already had successful partnerships in the e-sport community and wanted to build on those relationships. Any concept which could deepen the collaboration between friends and their partners would be perceived as a success.
- However, funding is a prevalent challenge, why any approach or concept needs to be financially sound.

6.2.3 Design approach

6.2.3.1. Overall approach

In their work with cyberbullying, Friends decided to narrow their focus from 'bullying on the web' more broadly to focus on *e-sports*, specifically. This strategy allowed the organization to focus their limited resources on a more concentrated area and engage in conversations with actors with a shared

interest in good governance of bullying taking place online or offline. This approach also generated donor interest and resources to realize the project.

I realized soon that a critical aspect of any intervention is *funding*. A precursor of funding is identifying problems that are so valuable to solve that a donor or company is willing to pay the organisation to carry them out. At this stage, I connected the concept of biocost with an organisational challenge. No funding means that Friends will have no biocost to spend on the work, why attracting financing is a crucial *second-order metagame* that needs to be successful to make the first-order persuasive system viable. However, acquiring funding also implies spending biocost, why the biocost gained must exceed biocost spent for the system to be viable. By acknowledging that the governance systems would not exist unless there are funds to spend on projects, the project needed to design an intervention which included both a first- and second order persuasive systems. To enrol the stakeholder groups into the project of design, conversational channels are needed. Without conversational channels, mutual agreement on action is impossible. (Dubberly and Pangaro 2009a) Operationalizing concepts from conversation theory is, therefore, a desirable approach to design. Dubberly and Pangaro's theories of conversation capture the dynamics of the situation. Also, the service can be seen as a persuasive system, which is growing through conversations—the more and better conversations with the target group, the higher chance for successful outcomes.
Because services can be defined as goal-oriented persuasive systems (see chapters 1 and 2), design cybernetics is an appropriate approach to frame the project. The implications for a designer is that the intervention can be designed to create more and better conversations. 'Better' in this case means delivering the desirable persuasive outcomes, meaning that the conversations lead to the desired actions.

A persuasive service system approach

As described in the literature review, a persuasive system does not only consist of its digital artefact but includes all other stakeholders: its designers, owners, managers, users and others. Friends overall approach to governance is to persuade critical stakeholders, defined as partner organisations, to influence other stakeholders (users), which make up the target group for Friends. The user groups include parents, teachers, deans, coaches and other people who work directly or indirectly with children.

However, Friends' challenge is that the organisation has *limited biocost* to spend on formulating projects and reaching out to potential partners and funders. More financial resources mean more biocost to spend on activities and projects.

To achieve this, the overall design objective for the persuasive service system became:

1) Design a viable proposal for a donor or funder (second-order persuasive system)
2) Design a viable service (first-order persuasive system)

6.2.3.2. Design a ‘good’ proposal for a donor or funder

In this context, a viable proposal is what Krippendorf refers to as a ‘successful’ design proposal, a proposal that manages to enrol necessary stakeholders in its realisation (Krippendorf 2019). So I based the system's persuasive model on three forms of rhetoric, as described in chapter 2. The ideal outcome for Friends would be to acquire more partners and funding, who they can work with to influence more people. The proposal needs requisite variety to be viable, meaning that it will need to be persuasive enough to convince a donor or partner organisation to invest their biocost (money or resources) in engaging with Friends. Furthermore, the design proposal's desired property is a *feedback-loop which lets Friends know why proposals are successful or unsuccessful*. By learning continuously, they can improve the success rate over time.

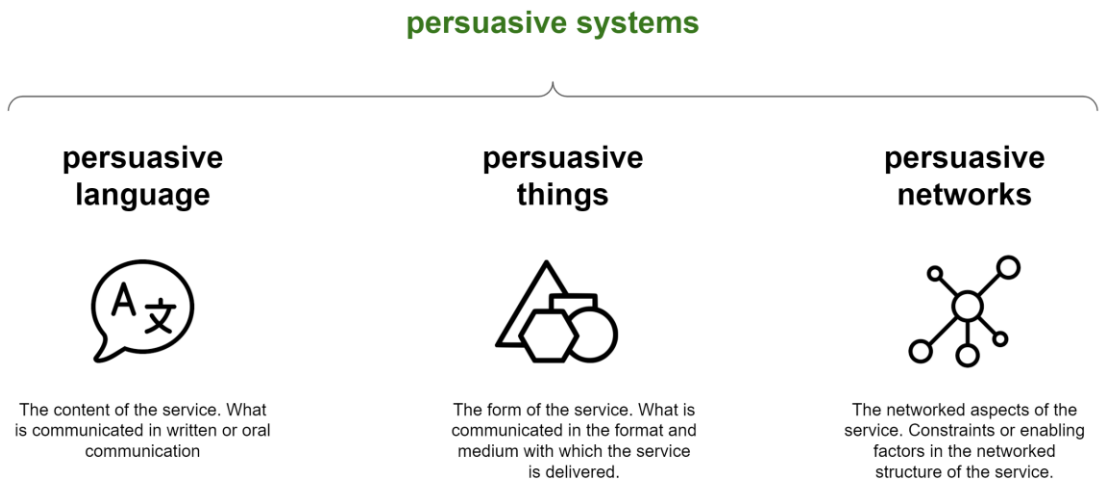


Figure 75: Model of a rhetorical persuasive system.

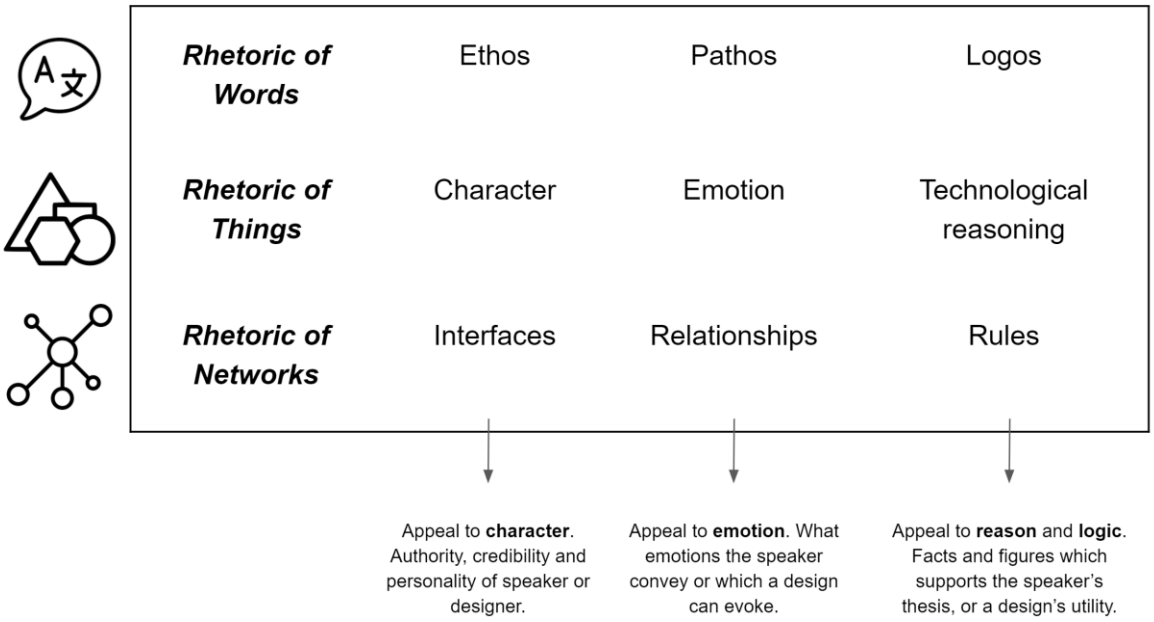


Figure 76: Sketch of a matrix describing a rhetorical persuasive system.

6.2.3.3 Design a repetitive conversational process

As part of my reflective process, to better understand my understanding of the case, I developed and iterated a double-loop cybernetic *model* to simulate properties of the desired system (Figure 77, 78). This model was meant to support my personal reflective process and should be seen as a rough sketch. That was the first sketch, which eventually led to the simple model described in chapter 3. It was based on the insights I gained in my reflective practice described in chapter 5. Both the symbols from the Design Cybernetic Garden and the concept for a second-order persuasive metasystem informed the design.

A functioning second-order metasystem would imply that the system is 'successful', meaning that it is persuasive enough to justify for its observers the relevance of its existence. In the best of worlds, this system would have a *basic reproductive rate* above 1, meaning that it is *autopoietic* - the resources gained from the project would be enough to execute the projects, the proposal process, thus sustaining the organization. It also included the biocost on a system-level, reflecting on the system bioreserve: the total 'biocharge' (entropy?) of the system which it can spend on actions. In an autopoietic system, the bioreserve is never exhausted, but self-replenishing, meaning that there is always hours or cash available to spend on realising the persuasive system.

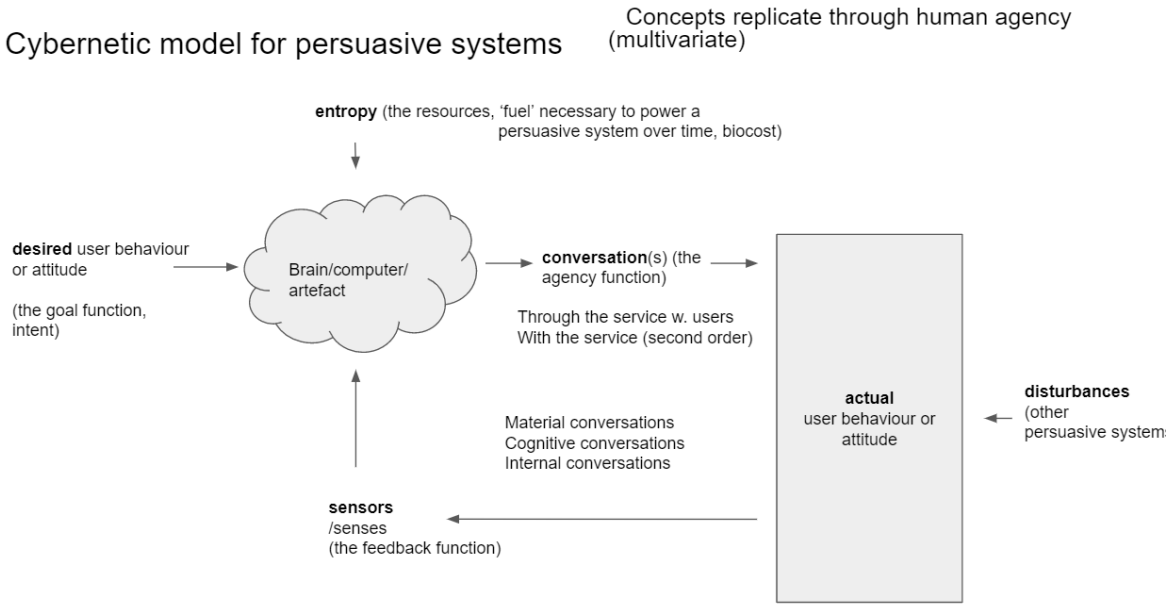
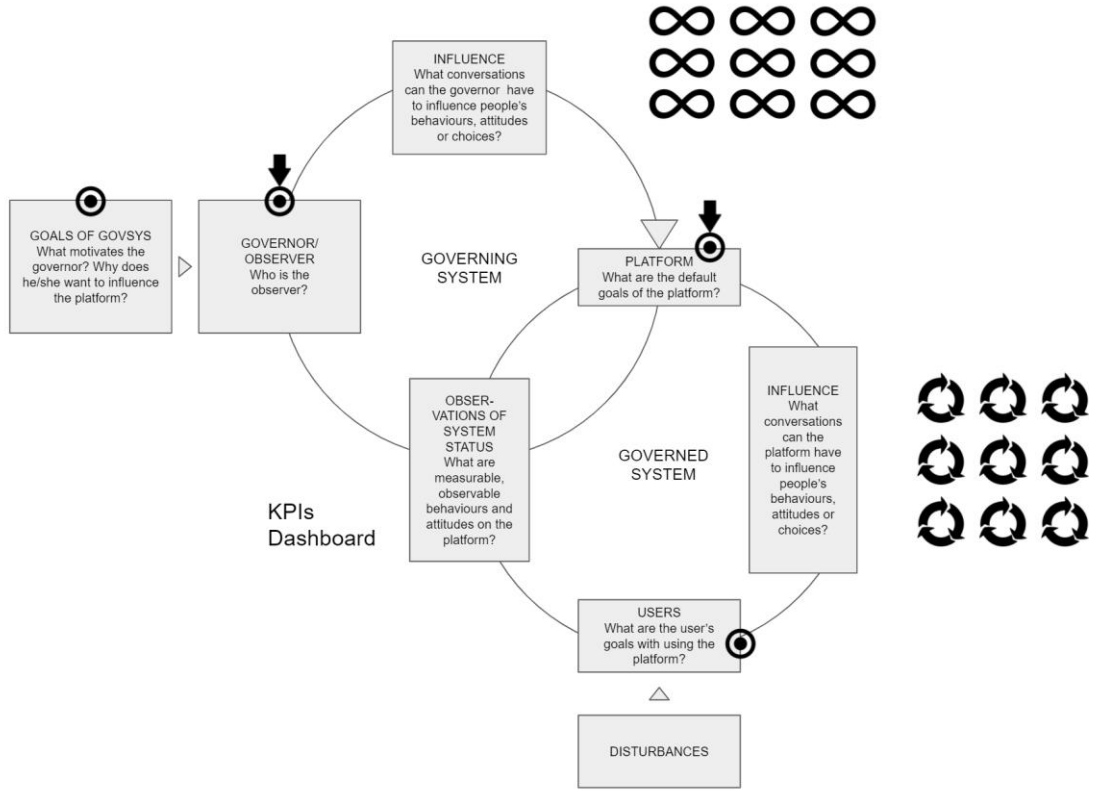


Figure 77: Sketch of a model for a cybernetic persuasive system.



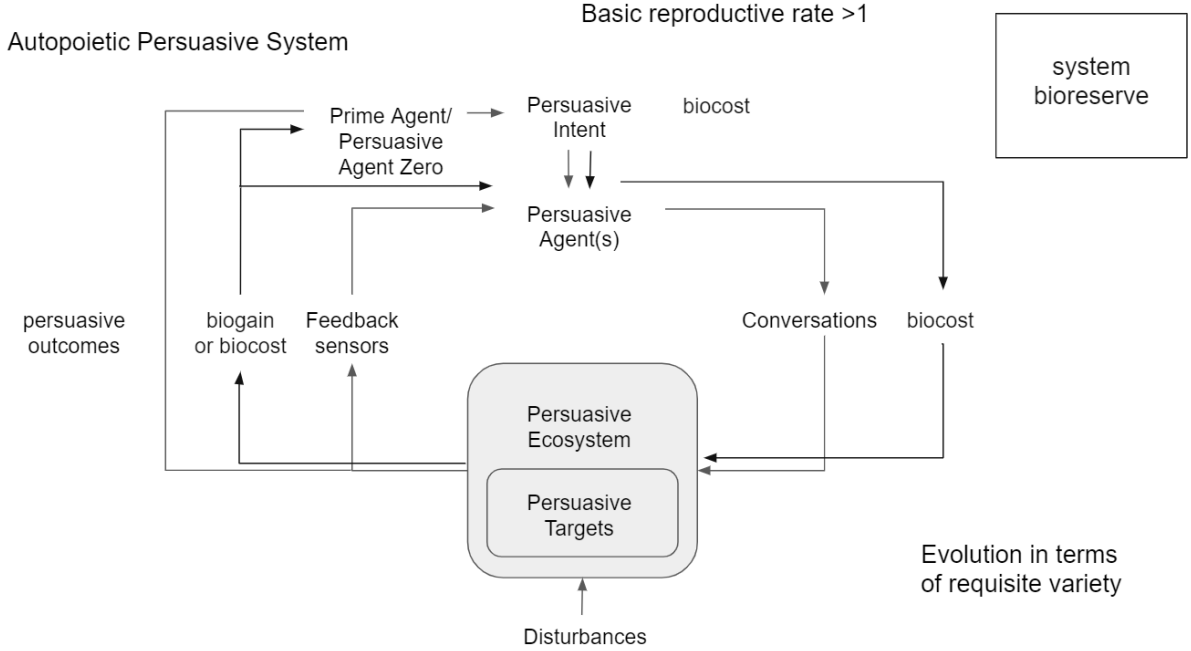


Figure 78: Two conceptual sketches of a cybernetic persuasive system.

6.2.4 Service proposal: Conversations-as-as-service

After I had formulated the model for how the persuasive service system would need to behave to grow, I needed to devise a persuasive system to build a service concept around. From the interviews, I had concluded that a solution needed to be 1) anchored in Friend's existing operations and possible to integrate with Friend's service portfolio and the service portfolios of their partner companies, 2) fluid between digital and physical worlds in which Friend's operates and 3) leading up to conversations for action. At this stage, I was working in parallel with the conversational stones in my epistemic service design project, as described in chapter 5.3. The conversational stone concept was translated to Friend's setting, which resulted in a *meta-service* for Friend's current service offerings named Persuasive Conversation Touchpoints.

A Persuasive Touchpoint Conversations System

The heart is a key symbol in Friend's visual language, it can be found in their logo and other communication material. The heart signifies friendship, love and care and is universally regarded as a positive symbol. In the Cybernetic Conversational Stone project described in chapter 5.3., I developed a series of prototypes in clay with embedded NFC tags that could 'connect' the stones to digital content and bridge physical-digital 'rooms' that Friend's operated in. For the project, I adapted the concept developed in chapter 5.3 to this project's context and created networked hearts in clay, as interfaces between people and the digital world. The core idea of the concept is that *networked hearts can be 'charged' with different conversations or connections.* They can be designed differently depending on the content, and they can be exclusive or non-exclusive. The service concept was presented with an in-depth presentation which outlined a frontend, backend and use cases, along with a brief positioning matrix, a proposed business model and mock-ups of how the concept would look if integrated into Friend's service portfolio or in their partner companies and organisations' service portfolios.

Figure 79: Friend's heart.

Prototype: A Persuasive Frontend

The clay heart became the 'interface', a *touchpoint,* in any service system where the target group could start a conversation, devised by Friends to achieve a selected persuasive goal. Depending on which function in the organisation wanted to increase the number of conversations, the hearts could be tailored for that particular end and integrated into existing service systems.

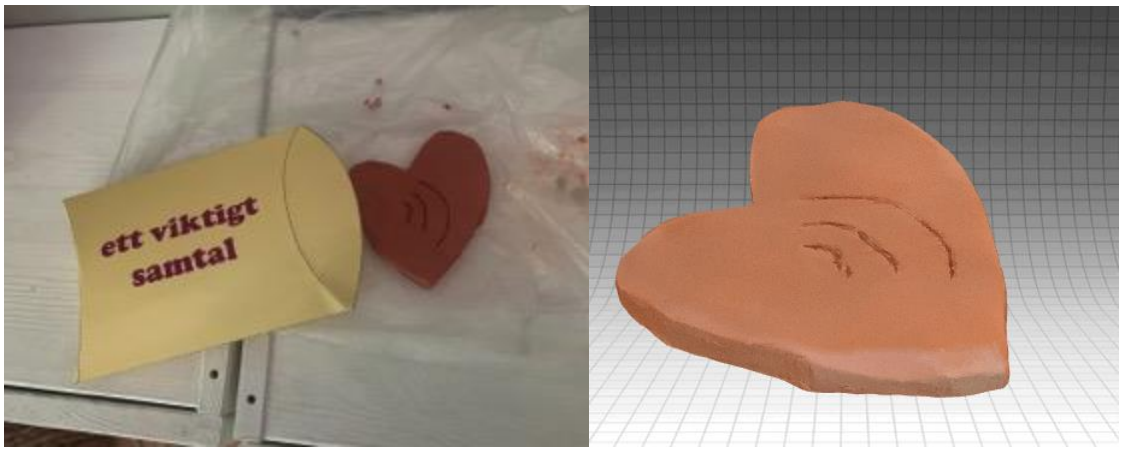


Figure 80: Prototypes of NFC-infused hearts

Prototype: A Useful Backend

I also developed a service backend prototype, that would allow Friends to track and trace the different heart campaigns they were currently running. The primary function of the backend was to 1) get an overview of all current campaigns that Friends had initiated, 2) facilitate the creation of new campaigns and 3) to measure the outcome of the campaign and in doing so, creating a feedback loop to allow the service system to improve over time. The backend could expand over time with more advanced functionality and integration of machine learning, making it adaptive and learning.

Nr.	Actor	Heart type	Connection	Channel	No. of hearts	Effective-ness	URL
1	Friends	Digital	CEO	Online	10	72%	[URL 1]
2	Friends	Digital	CEO	Online	5	30%	[URL 2]
3	Friends	Physical	Henrik	Event 1	10	12%	[URL 3]
4	Friends	Physical	Henrik	Event 1	10	88%	[URL 4]
5	Telia	Digital	CEO	In person	10	3%	[URL 5]

Figure 81: Prototype of a cybernetic backend for the persuasive service.

Benefits of the approach include that the heart offers a variable reward, a common persuasive tactic described in the literature review - you do not know who you get to converse with before you read the heart. The heart can be embedded in the physical environment and online social settings: computer games, other websites. They are also adaptable to different situations, and there are numerous creative opportunities to build out the concept. The service would directly integrate Friend's partner companies and organisations and offer several creative variations to fit as an add-on with different products or services. The physical-digital nature of service would allow the heart to be embedded both in physical and digital touchpoints. Embedding the solution as virtual objects in computer games would reinforce their strategy.

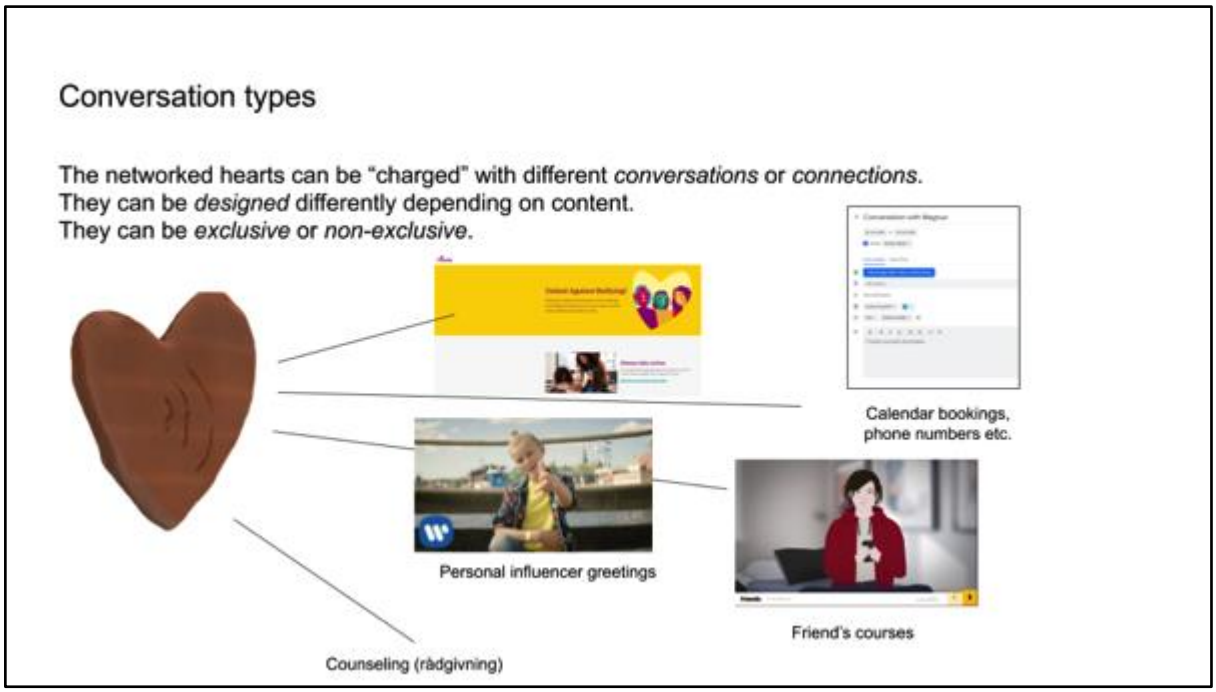


Figure 82: Integrating the heart as a persuasive touchpoint into other services.

Figure 83: Integrating the heart as a persuasive touchpoint in a computer game.

Feedback from the team

The service concept was presented to the team in July 2020, and it was well-received. The team particularly liked that the concept bridges the physical and digital world, giving them new opportunities to integrate their existing content into their partner's services. A manager from Friends wrote: '*A modern and thoughtful concept which can be used for all our target groups. Because it is so flexible, it can be used for children, caregivers, the public, school staff and faculty, sponsors and so on.'* Although we did not go as far as to implement the concept, the concept was now ready to fulfil its role in a second-order persuasive metasystem and be integrated into a funding application.

6.2.5 Design cybernetic learnings from the project

In parallel with the project, I developed my reflective practice and learned about the various cybernetic concepts. As I designed and reflected on the process, I tried to identify opportunities to apply the knowledge in the design process and integrated cybernetic ideas in my working process and into the system design. By reflecting on design cybernetic concepts with others in a practical design project, I understood the difficulties of using cybernetic concepts 'as they are', as other people are not familiar with them.

I learned that cybernetic concepts needed to be 'decoded' to be accessible to the organisation. Because of my reflective practice, I personally understood them reasonably well; however, I did not do a very good job communicating the concepts directly to the team. However, when speaking about the product and the effects of having more and better conversations, everyone understood the benefits. The 'prototype did the talking' so to say, and was an important part of the *performance* of research.

The study showed that embodying the cybernetic concepts in the persuasive model for a service and its artefacts (the cybernetic stones) then explaining the service, the service became an epistemic object about which we could have a communal dialogue. Therefore, an essential outcome of the project was that the resulting concept incorporated and embodied cybernetic principles. The service design process helped me personally clarify the concepts, but it also helped me create an artefact through which I could perform the knowledge gained through reflective practice and demonstrate its usefulness to the client.

In the table below (table 21), I have mapped the insights against the potential uses for design cybernetics, and the following design cybernetic concepts were observed:

Concept	**Design Governance Conversation (Systems governing my actions and thoughts)**	**Design Conversation (Myself, designing)**	**Persuasive Service System Conversation (The Persuasive System)**
Feedback loops	Institutional requirements from RCA and Friends. Internal compass, values and motivations.	My design process: integration of reflective practice with the real-world applied case.	A system for engaging Friends with their external stakeholders.
Goal function	Institutional goals from RCA and Friends. Personal motivation.	My goals were guided by 1) institutional requirements and 2) search for a good solution.	To persuade its users to engage in conversation with Friends.
Conversations	Conversations to navigate how to design. Conversations with the self	Conversations to navigate what to design.	A tool for lowering the barrier for engaging in a conversation with Friends.
Variety	The variety of resources in terms of money, time, expertise and knowledge I had at my disposal.	The actual design tools that was available for designing the service system.	The methods, tools and persuasive tactics used in the system.
Emergence	The process in which the supporting system that enabled the project emerged.	The sequence in which the plans for the system unfolded in my mind and drawings.	The sequence in which the system ‘unfolded’ for Friends in their road to implementation.

Autopoiesis	The process in which my beliefs and values were shaped.	The viability of my design methods and research methods.	The sustainability and resilience of the solution.
Black boxes	The transparency of the process in which the project was conceived.	The transparency of my process and goals to Friends and other stakeholders.	The transparency of the system's functions and intentions to the user.
Governors	The institutional rules and environment set the boundaries for my engagement with Friends.	The constrains on my tools, knowledge, social network and imagination to shape the persuasive system.	The constrains of the format and content of the persuasive service system.
Biocost	The control systems put in place by RCA contributed to that I spent my biocost on doing the 'right' things, in order to bring the system to life.	Í spent biocost in designing the service. I also involved others in spending their biocost into the project.	The 'cost', or effeort involved in using the service, for people in the target group.

Table 20: Learnings from the Friends case study.

6.2.5 Limitations and critique of project and approach

Due to the limited scope of the project and the sudden interruption by COVID-19, it, unfortunately, became impractical to test out the solution in a real-world setting. Implementing a solution test would be a natural next step to further validate the concept's practical value-in-use. However, the concept is developed to a stage where Friends can easily integrate it into grant proposals, campaigns and operations with reasonable effort.

The research turned out somewhat more expert-led rather than participatory, mainly because the design cybernetic concepts were clear to me, but I had difficulties in communicating them to the team. Despite intending to 'design cybernetically' all the way, I leaned on a traditional service design process based on the double-diamond-model, because it was easier to communicate. However, I still brought my personal knowledge about design cybernetics into the design process, and its concepts influenced the resulting design.

6.2.6 Summary and learnings from the case study

After having delivered an outcome useful to the host organisation, I deemed that it also satisfied my research goal. Through the practice of designing a persuasive service system, I had demonstrated that the knowledge developed in my epistemic practice (the conversational stones) was not only useful to myself but also indirectly to others and I had additional evidence that design cybernetic concepts were useful when designing persuasive systems. I had also gained additional knowledge about how to use (and how not to use) design cybernetic concepts in a live service design project. As one of the criteria for the PhD degree is to create communicable knowledge, I deemed that this case study contributed to that goal. So did I answer the research question which I posed at the beginning of this chapter? *How can service design tools inspired by design cybernetics be used to improve decision-makers' knowledge about bullying in pervasive industry platforms?*

Yes and no. I did arrive at a persuasive concept which, in theory, would aid the team in having more and better conversations with key stakeholders. However, I did not arrive at a conclusive answer to the research questions because it was never implemented. However, I developed new knowledge in the form of a concept for *persuasive touchpoints*, providing a partial answer to research question 2. The resulting service concept was a persuasive service system that aimed to support Friends in delivering good proposals, as per the above definition, repetitively to the target audience.

The most important learning from Friends case study was that it is important to add a reflective loop to the design project, consider the designer's position in the system and how he influences the service concept as the system's properties (The Persuasive Service System). This included the efforts needed to realize the idea (biocost), the motivations and interests of involved actors (goal-functions), what variety that is necessary for the system to be autopoietic (variety, autopoiesis), and what feedback loops of behaviours or attitudes which it seeks to reinforce. So how was design cybernetics useful in the project? In the table below, the learnings were summarized and mapped to the hypotheses formulated in chapter 3:

Hypotheses	**Observations**
H1: Design cybernetics can offer a holistic framework to describe persuasive systems	The project shows that design cybernetic concepts can be used to model processes on multiple design levels: on a first-order persuasive service system level and a second-order designing system level.
H2: Design cybernetics can be used to facilitate understanding of goals in higher-order systems.	The project allowed me to continuously reflect on second-order cybernetic principles that included the observing system. By observing different meta-design levels in the system, I could analyse their qualities and mechanisms of influence.

H3: Design cybernetics offers an ethical approach that can improve governance and ethics in persuasive service systems.	The persuasive service system governance model was useful to describe the relationships between the interacting levels in the service design project. It was, however, difficult to identify any direct ethical benefits.

Table 21: Observations mapped to hypotheses.

6.3. Planethon

6.3.1 Background and purpose

Next, I have included the Planethon case study because it was influential in forming the framework and contributed with several distinct insights into the challenges service designers face when developing service proposals. The study aimed to understand how and where to integrate design cybernetic concepts in a service design project, where persuasive systems were part of the solution. Having learned from the first project to not go in with a too broad approach, I now decided to hone in on New Service Development (NSD). In this servogenesis process, a completely new service design proposal is developed from a brief. I decided to both be an observer to the process of formulating the brief and following the teams who took on the brief. In this project, I shifted my role as an observer to being a more active part in the formulation and execution of the project, effectively becoming a part of the 'Governing Design Process'. Planethon is a planet-centred design studio in Stockholm - a group of entrepreneurs, scientists and change-makers focusing on turning problems into opportunities. Planethon collaborates with scientific research institutions, such as the Stockholm Resilience Centre (SRC) at Stockholm University. They address the wicked problem of climate change by facilitating an ongoing exploration of new ways to interact between the sciences, business community, and society. They also test how scientific results can be put into practice. The project started with formalising a design project with Planethon and understanding their need. The following objectives were identified together with the research partners:

1) Exploring ways to bridge the gap between earth science and business development by developing services that contribute positively to a sustainable social and ecological future.
2) Explore services that can enforce planet positive action, with the help of Service Design (SD).

The concrete deliverables of the project were:

- A persuasive service design proposal.
- Thoroughly researched B2B service concepts which integrates earth science into business development/innovation.
- Visualisations of the service design process, through stakeholder maps, user journey mappings, service blueprints, prototypes et cetera.
- Persuasive storytelling, including a narrative describing the problem the service addresses and how the solution is grounded in earth science.
- A clearly described business model and idea of how the service can be launched and implemented.

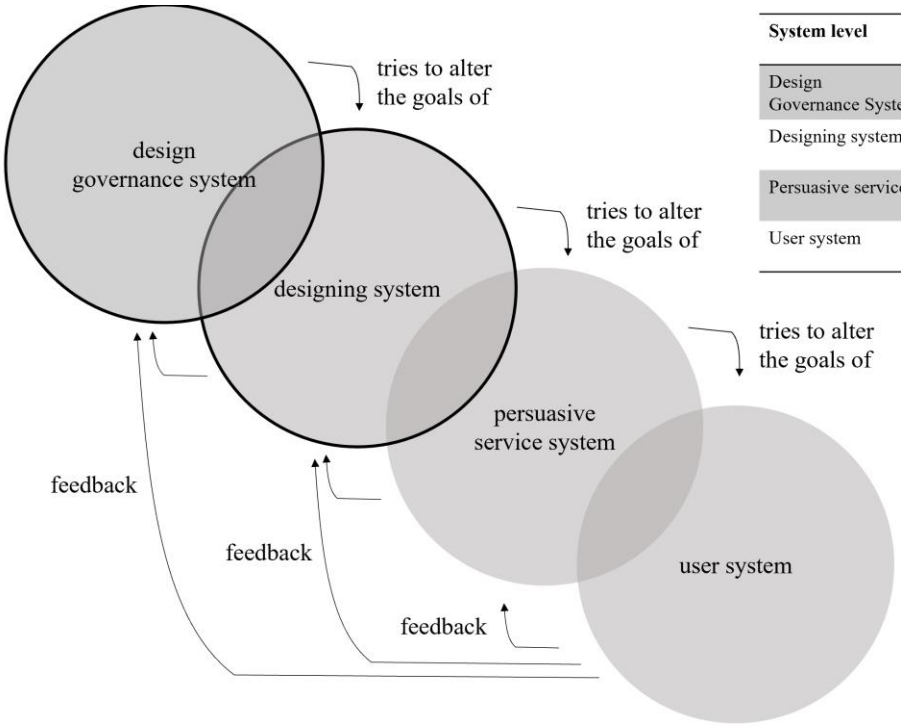
The intention was to meet the objectives by inviting student teams to work on solutions in a studio-based process. Student teams were invited to work on the brief and in my role as observer/researcher, I followed the NSD process from ideation through to service concept. The project took place in fall 2019 as part of the curriculum of the second year of the Service Design program. The brief was presented for all students, and three teams signed up for the brief with one, two and three team members respectively.

The teams were provided with the brief and followed a semi-structured design process where there were weekly lectures, seminars and tutoring sessions to get feedback from the teachers. They could also access RCA's staff and tutors, the mentors from Planethon and other sustainability experts. The resulting concepts were presented at an event at RCA in December, where the team's shared their presentations and concepts. Some concepts were also presented at the RCA work-in-progress show in January 2020.

6.2.2 Conversations

Building on the first project's learnings, I wanted to try to 1) make design cybernetic ways of acting implicit in the project, rather than explicit, to avoid confusing the students with the concepts. 2) assume a different position as a passive observer and try to discern if and how the projects could be described cybernetically. This time, I did not embed myself as part of the team - my main interactions with the team were through conversations in tutoring sessions and formal interviews. On the theory side, I had begun to develop an idea of the perceived dance between first- and second-order persuasive systems; however, I had difficulty understanding exactly how that interaction took place. I desired to be able to articulate those ideas better at the end of the second case study.

This time, I added a systemic level to describe the forces that influence how the designing system thinks and acts. Let us call this a *design governance system*. The design governance system strives to set the goals and constraints of the designing system. Using William's definition of persuasive systems stated above, this is also a goal-oriented system. That brings us a third loop to consider, which I call the *Design Governance Conversation*, between the tutors and the three design teams.



System level	Definition
Design Governance System	Myself/Planethon/Tutors
Designing system	The designing student teams
Persuasive service system	The services they design
User system	The planned users of their services

Figure 84: Model of the persuasive system.

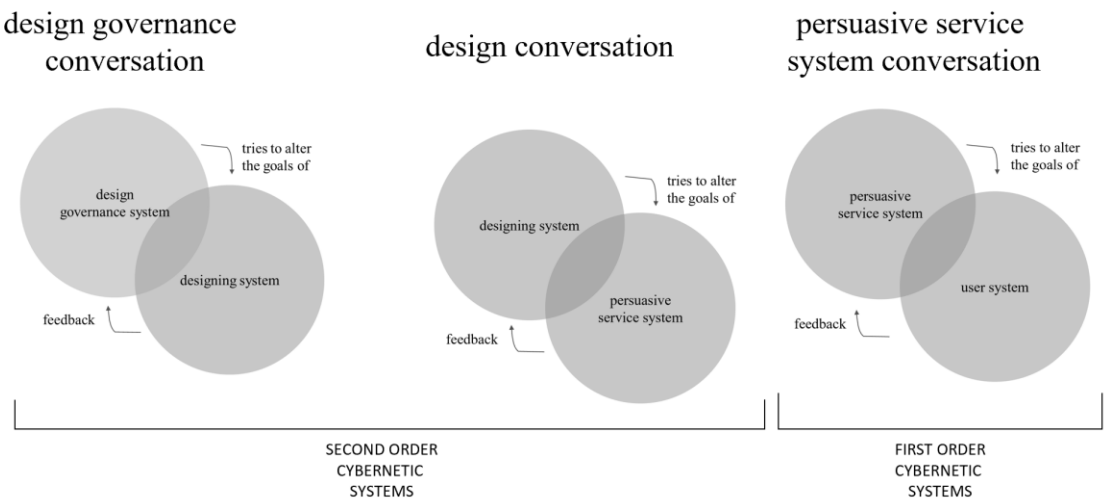


Figure 85: Model of the layers of conversations.

6.2.2.1 Conversational structures

At the conception of the project, interviews were done with Planethon's representatives, and I regularly checked in with them throughout the project. The brief was designed to encourage the teams to have many conversations, both in a more structured way, with regular check-ins with their tutors, and to go out into the world and interview practitioners. The RCA also encourages students to get out into the real world as quickly as possible, and engage with people. The initial interviews with Planethon took place in their offices in Stockholm, Sweden. The interviews were semi-structured and informal and aimed to understand their needs. The brief was captured in a document which summarized the conclusions from the meeting. The brief was discussed between Planeton and myself and in conversation.

I presented the brief to the RCA students in September, whereas three teams signed up for it. Throughout the project (September - December 2019), I facilitated conversations between Planethon and the teams, participated actively at tutoring sessions, attended the concept presentations and did ex-post interviews allowing the teams to reflect on the project, the process and their learnings. The interviews were sound recorded, and the parts relevant for the study have been documented in the narrative below. I used design cybernetic concepts to guide the development of the questions. (figure 86)

Interview No.	**Date**	**Place**	**Gender**	**Organisation**	**Position**
1	14/01/2020	RCA, cafeteria	M	RCA	MA students
2	14/01/2020	RCA, SD studio	F,F,F	RCA	MA students
3	15/01/20	RCA, SD studio	F,F	RCA	MA students

Table 22: Interviews, Planethon project.

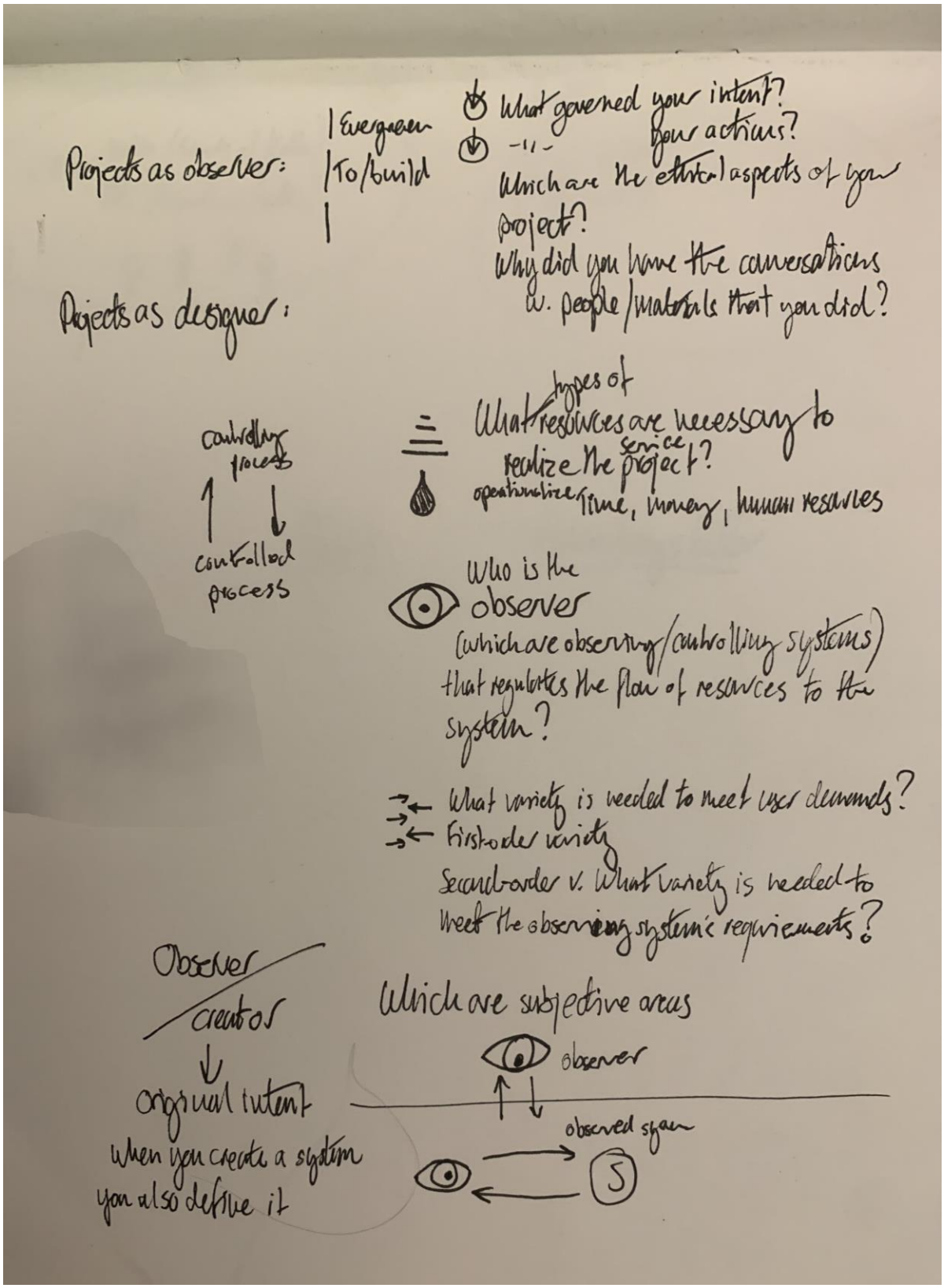


Figure 86: Creating interview questions from design cybernetic concepts.

6.2.2.2. Observations and input

All three teams expressed a challenge in narrowing down the brief from a high systemic level. The challenges were specifically to:

1) define the systems which they target and
2) identify which leverage points in the systems they wanted to influence
3) understand which specific behaviours and attitudes the service should influence.

The concepts' high-level direction was partially guided by the brief and were anchored in the students' personal interests.

6.2.2.3. Feedback from the interviews

On goals

All teams described the initial search for a leverage point that made sense both from a logical perspective and from a personal perspective. On the question of why they chose to engage with the project, to begin with, one of the students emphasised the combination of internal intent and goals and external factors.

Team 1, P1: "*What do I have knowledge of, what am I passionate about, where can I add value.*",

That suggested that the student's motivations were crucial factors in deciding to engage with the project. Another student said:

Team 3, P2: "*You suddenly start noticing things everywhere which are related to this particular topic.*"

They were suggesting an initial goal-seeking mode. As the designers were completely free to choose what systemic issue related to climate change to work on. It sounded like the issue itself needed to be persuasive to the designer. The problem itself is also a design proposal, introduced by a governing system, to influence the designing system's action and goals. Parallels can be drawn to 'sensitizing concepts' from grounded theory, a challenge or insight that constitutes the starting point of exploration. In this case, the sensitizing concept can be considered the brief provided by Planethon. Subsequent developments, however, were developed in the reflective processes of the team members.

Conversations and governance

It may sound obvious, but the first-order systems, the service concepts which were the 'systems being designed', did initially not exist. They were developed and emerged throughout the project. As the teams had more and more conversations, internally between each other and with industry actors, their academic tutors, and Planethon, they continuously iterated and honed the goal-functions and purposes of their designed services. All teams worked between strategic and tactical levels, initially, a few teams changed industry focus and others changed the point of intervention. One of the teams describes the conversations that led them to settle for a particular approach. These conversations ranged from *nudges* to *epiphanies*, conversations leading to insights about opportunities for creating value where their personal interests and skills align with an industry challenge. One student described how the regular conversations gave them energy and motivation, which propelled the project forward.

Team 2, P1: '*Every time you had a conversation with someone, kind of mapped out, maybe doubted it a bit, we had another interview, we always had another interview, get a quick view, bring it back to them and move in a slightly different direction. Always having something like that to look forward to.'*

I interpret it that the conversations helped the students 'correct the course' towards their desired future, consistent with the cybernetic view of design, as previously accounted for.

The students also described how the conversations they had between one another were enjoyable and allowed them to explore concepts mutually, thus upgrading their thinking with internal conversations. They explained how shifting between external conversations, conversations with each other and conversations with themselves created a balance that encouraged different ways of thinking.

Team 2, P2: *I think it was a good balance between collaborative discussions and both appreciating having heads down so there is time to just process and think. I think we think in different ways and prefer different ways of brainstorming by ourselves or visualizing things. It was nice to bring these two ways of thinking together'*

It did not seem that they expected that these particular conversations would have that effect, and it would be difficult to predict that they would have such a profound impact on the direction of the project. However, the conversations acted as governors because they had disproportionate influence over the direction the projects would take. They effectively governed the project direction by reducing the oscillations and stabilizing the goal function for the team. Without drawing too far conclusions from a single case, it makes sense that the more conversations you have, the higher the probability that you encounter a novel perspective that resonates with your inner compass. Since the teams do not know the goal-function at the beginning of the project, at the beginning of the search for

a goal, the goal can be seen as a black box which the teams gradually try to whiten by conversations. Through conversing with actors in the environment, the designers allow themselves to have their goals influenced and invite other systems to influence them.

Biocost, autopoiesis, conversations, resilience

To take the ideas to the next level and realising them, would take significant investment in biocost for uncertain returns. One student explained it this way:

Team 1, P1: '*If I inject all my energy into this thing, it is going to take two years of my life and energy. And would it then even be a success?*'

Interestingly, the student did not refer to money, but to 'injecting my energy', recognizing the human effort, i.e., biocost, it would take to move the idea forward. One team also described how repetitive conversations about their design proposal, now with more stable goal-function conversations, would facilitate moving the idea forward.

Team 3, P1: '*I think that if we decided that we wanted to continue with the concept and create it for real, you probably need to be more resilient, so just to keep going. We have been 'up and down, exciting research, concept, ideation', and then it would be that right now we just need to go and say it to a lot of people and then say it again and say it again until someone is interested. So that it is more constant than up-and-down.'*

On the question of when an idea could be considered resilient, one of the team members replied:

Team 3, P1: '*...when it is self-sustaining, when there are enough people to believe in it to happen, even if we weren't involved. Then it would be a really resilient idea.'*

This comment provoked thoughts about persuasive service systems eventually becoming autopoietic: when the design proposal self-replicated without the original team members involvement. As illustrated by the above conversations with the students, several descriptions were consistent with a cybernetic philosophy. These findings, along with my other observations, are summarized in table 26.

6.2.2.4 Resulting concepts

The service concepts were very satisfying, much because of the diligent work by the teams. I will only provide brief summaries because studying the resulting concepts is not the central purpose of the research activity (Findeli 1998, 2001). Instead, the focus is on the learnings for future design which are drawn from observing the process. Despite the relatively broad brief, they narrowed it down to specific, circular concepts that used persuasive service solutions to modify behaviours and attitudes in specific target groups. The project resulted in the following concepts:

Project 1

The purpose of Project 1 was to influence the choices of building materials by informing design decisions which determine the materials used and where it is sourced. By integrating a persuasive system into software that architects use, sustainability can be embedded from the design concept phase. Throughout the project, the team had conversations with construction companies, architects, project managers and sustainability managers.

Project 2

Project 2 was designed to address sustainability challenges in the food system, particularly those related to food waste. The team had conversations with farmers, experts, supermarket staff and entrepreneurs and tested six prototypes on key focus groups. The resulting solution matched food waste producers to connect with industries that could use the waste for different ends, thus reducing the food that goes to waste.

Project 3

Project 3 recognized that there are few useful tools available for investors to understand the environmental impact of investments. The proposed investment management platform was a decision tool for venture capitalists to make environmentally sound investment decisions. Throughout the project, the team had conversations with investment managers, principal investors, and startups' founders.

These concepts were all substantial persuasive service systems, designed with the specific intent to influence certain leverage points in their respective user systems, addressing climate change. They show how crucial interdisciplinary innovation is for addressing a wicked problem such as climate change and how persuasive systems may help realize that ambition. The teams developed their solutions further and exhibited the ideas at the RCA work-in-progress show in January 2020.

6.2.3 Limitations and critique of project and approach

This project was somewhat challenging and it was the only project where I was not personally engaged in the first-order design process. Having shifted to a more passive observing role, I found it challenging to understand what to observe in the student teams' interactions. It was also difficult to know how to integrate design cybernetic concepts in practice while having a tutor's more passive role. On the one hand, I wanted to develop and deploy tools which the students could use. On the other hand, I was afraid that I would interfere too much in the projects. I decided to only give feedback through the normal tutoring-sessions, where I had a 'licence' to provide feedback and ask questions and instead study how the project unfolded, 'watching the system to understand how it works', paraphrasing Donella Meadows.

In hindsight, I could probably have intervened more than I did. The students were very open to suggestions, and perhaps they would even be more susceptible to cybernetic concepts than others. Doing so could have provided more granular evidence for- or against the usefulness of the design cybernetic approach.

6.2.4 Summary and learnings from the case study

By observing and structuring this project, I could confirm certain aspects of the theoretical framework for persuasive service system design, outlined after the first project. Under these projects' duration, I worked in parallel with reading and understanding the cybernetic concepts, which eventually led up to the Cybernetic Garden. Also, I observed several circular relationships: between Planethon/myself/RCA's tutors, the student teams and the service being designed, which was eventually formulated more eloquently in the Cybernetic Governance Model. The 'Designing Systems' in this case were the student teams. The 'Persuasive Service Systems' were the service concepts they developed as part of the project, and the 'Design Governance Systems' were me, Planethon and RCA. In this project, I took a more active role, supporting Planethon in developing the brief, tutoring the student teams throughout the project and giving them feedback on their concepts. The exit interviews also asked what the students speculate in what would happen next with their concepts. A more active role also brings more responsibility, and my interventions were likely governing both the brief and the concept development to some extent.

As described above, one team indicated that feedback from external conversations helps the teams formulating the goal-function for the service concept (the service intent) and that they help them 'steer' towards, for them, desired outcomes.

From the Planethon case study, the following design cybernetic concepts were observed:

Concept	**Design Governance Conversation (Me/Planethon/Tutors)**	**Design Conversation (the students)**	**Persuasive System Conversation (the service concepts)**
Feedback loops	I gave formal feedback in the tutoring sessions and informal feedback in one-on-one conversations with the teams.	The students iterated their goal-functions throughout the project, based on their conversation between each other and external actors.	The students described the desired changes in behaviours or attitudes, which they intended their services to deliver.
Goal function	My goal was to help the students to 'steer' and navigate to increase their variety and create a viable design proposal.	The students described their motivations in choosing their approaches to design	After having had conversations between each other and with external actors, the students arrived at stable purposes and goals for their services.
Conversations	I had structured conversations with Planethon, with my co-tutor and with the student teams.	The students described the conversations they had between themselves, how they used materials and prototypes to reflect on their concepts and how it advanced their thinking.	The students described the HCI conversations that the users would have in the service and how the services would be designed to stimulate these conversations and connections.
Variety	Through the conversations with the students, I could spot similar challenges in the groups and thereby increased their variety (and mine).	The students expanded their variety by exposing themselves to different views and meeting with different actors, which helped them 'correct their projects' course.	Because the students had second-order conversations, their services could have more requisite variety and better satisfy real needs.

Emergence	The relationship between myself and the students evolved dynamically throughout the project.	The teams working practices emerged throughout the project.	The teams described how the purpose of the service developed and emerged throughout the project due to their internal and external conversations.
Autopoiesis	I supported the students with ideas of how they could make their systems sustainable from different perspectives.	The students described what they thought was necessary to make the service self-sustaining.	The projects were too short of making the proposals self-sustaining.
Black boxes	On the one hand, my goal-function was shaped by the requirements for the PhD and on the other, the formal requirements from RCA and Planethon regarding the project outcome.	Initially, the students were confused about how to design, but the process got more transparent over the course of the project.	The desired goal-functions for the service were initially black boxes, which whitened as the students had more conversations.
Governors	By listening to other groups, I could help my teams better navigate the task's demands.	The student's converged eventually on a goal-function for the projects, which would eventually govern the services' functionality.	The goal-functions of the services were defined and codified by the students, and the desired changes in behaviours and attitudes changes embedded in the service concepts.
Biocost	I needed to spend my limited biocost to interact with all stakeholders in the project.	One student described how they invested energy into the project and how that determined the project's success.	The service needed biocost to be brought to life. No biocost spent on realising the system would mean no system.

Table 23: Observations mapped to cybernetic concepts.

Reflections on the case study

The Planethon case study unveiled several situations in the service design process which could be interpreted using design cybernetics. It was a case study where conversations were a crucial part of the design process. Observing the process unfolding from an active observer's position allowed me to get a qualitative understanding of the dynamics between the team and the stakeholders with whom they engaged process. I do not think that the design cybernetic concepts were directly useful, or even visible to the participating students. However, they were helpful as an approach to designing the project brief and guiding my thinking throughout the design process.

The case study's central insight was that it provoked thoughts about how conversations provided a circular relationship between the service concepts, the designers and the tutors. Developing design proposals and making them more persuasive is a widespread exercise at design schools. However, the second-order cybernetic perspective, capturing the designer's intent to engage with the project and what their purposes are, is rarely made explicit in the process. For some students, the ambition with the project ends when it is presented, while others continue building on it after the academic exercise is over. Suppose the main activity for service designers is to produce different aspects of service design concepts. In that case, it is reasonable to spend more time understanding how the concepts can be brought to the world, not only by developing a business plan, but to examine how persuasive service systems become genuinely sustainable.

Development of service design practice

As stated in the introduction to the project, the study's purpose was to understand how to better articulate aspects of design cybernetics. The case study revealed several interesting things which helped me in understanding the dynamics of the service design process and the second-order persuasive metasystem of the project:

1) Conversations were a significant part of altering the direction of the projects. The students mentioned both conversations with mentors, with tutors and between each other as influential on the development of the service concept.
2) The goals for the service concepts fluctuated over time, to eventually stabilise. The students used the knowledge gained from the conversations with others to arrive at a stable state.
3) The students used prototypes to some extent, to support their conversations. By showing and sharing their ideas in material form, they could articulate them better and thus get feedback.
4) Attracting resources seemed to be connected with making the idea clearer, and the design proposal persuasive. The student teams thought that further conversations were vital to attracting resources to develop their concepts further. The persuasiveness of a system was thus connected to the possibility to realize that particular system.

The value which the design cybernetic perspective added was that it provided insights into processes which would otherwise be hidden or likely not reflected upon. It

6.5 Summary and learnings from design projects

In this chapter, I described two studies of projects carried out to inform the research questions.

The two design projects provided a partial answer to research questions 2 and 3:

R2: How can different concepts from design cybernetics be applied in a persuasive system service design project, to create more understandable and valuable service propositions??

The first project (Friends) was directly informed by the reflective practice described in chapters 5.2 and 5.3. At first, I tried to apply cybernetic concepts directly in workshops and conversations at Friends, which did not work out very well. The cybernetic vocabulary needed to be decoded before it could be applied and useful. The cybernetic stones, however, embodied cybernetic concepts, and could easily be integrated into the project. The cybernetic stones were both valuable and performative, in the sense that they attracted the attention and interest of the audience when incorporated in the service design concept. Findings suggest that there may be merit in 'translating' cybernetic ideas via metaphors and conversational, persuasive, *performative* concepts. Filtering the cybernetic concepts through a design researcher's reflective practice, in this case, turned out to be a viable method for generating new service concepts which embodied the cybernetic credo of conversations. The researcher thus acted as a 'translator' of concepts to a service design context.

The second project (Planethon) directly informed my Cybernetic Garden (chapter 5.2), helping me match metaphors to real-world situations faced by service designers. By observing the service designer's challenges and struggles, I could better understand how and where there were connections with corresponding cybernetic concepts, which improved my reflective practice and developed new knowledge I could subsequently use in other projects. In this case, knowledge flowed both ways, from the conversations with the self to those with others.

The findings also suggest that to deliver cybernetic concepts through a service, they need to be repackaged in understandable metaphors to become useful. That is not a new idea, Dubberly and Pangaro have been very successful in modelling the many abstract concepts in cybernetics in understandable ways, with diagrams, models, and examples.

Finally, the reflective practice supports the claim that design cybernetics is useful for modelling persuasive metasystems of persuasive service systems, defined as the second-order designing systems. These 'control' the design and goals of first-order systems and their chance of being realized.

However, this research suggests more to be done here and that even more performative metaphors are needed to integrate design cybernetic concepts in service design successfully. The

performative metaphors should be persuasive metaphors, which aim to be engaging, inspirational, and invite conversation and engagement, thus catering to strengthening the ‘E’ in Pangaro's CLEAT-model.

7. Analysis and discussion

7.1 Recapitulation of the research

In this research, I have explored how design cybernetics can be used in service design practice, for designing persuasive service systems. Through a research practice based on conversations with the self and conversation with others, I developed a new approach and tools for this end. In the process, new knowledge concerning the challenges and opportunities with using design cybernetics in service design of persuasive systems was uncovered.

The research suggests that there are merits to further explore using design cybernetics in the design of persuasive systems, and to include the observer/designer as an actor in the systems analysed. I have provided evidence in the form of a theoretical review, extensive reflective practice (chapter 5) and action research projects with different actors (chapter 6) and described how the two modes of research informed each other. The two explorations informed each other, creating new personal knowledge and new communicable knowledge in an emergent process.

Specifically, it is suggested that *designing cybernetically*, as a service designer who recognises her role as a reflective agent and who subscribes to cybernetic philosophy, can be a way to work with persuasive metasystems of persuasive service systems and in doing so addressing issues of complexity, ethics and governance in the design of services as persuasive systems. When designing cybernetically, observing, reflecting and acting on and in second-order cybernetic systems which influences first-order persuasive service systems, they become more tangible. In theory, cybernetic design approach embodies ethical qualities which will become even more critical as service designers gain influence and power to modify other people's decisions and behaviours through the services they design. These insights are significant, given that cybernetics, since the reflexive turn to second-order cybernetics has been struggling for some time to find practical uses. By demonstrating how a design cybernetic approach can contribute to the design of persuasive service systems, its value-in-use as a theoretical approach becomes more apparent and tangible.

7.1.1 Summary of new knowledge and insights derived from practice

In chapter 2, I reviewed the field of persuasive systems and described some current challenge areas, which included:

1) Systemic design methods to address wicked ethical problems.
2) Systemic approaches making it easier to understand and value persuasive intent
3) Translating theoretical ethical guidelines to practice.

In chapter 3, design cybernetics was introduced to address these challenge areas. From reviewing critical cybernetic concepts, I formed three hypotheses of how Design Cybernetics could create value:

H1. Design cybernetics can offer a holistic framework for understanding and designing persuasive service systems.
H2. Design cybernetics can facilitate the understanding of goal in higher-order systems, where many emerging issues related to governance and ethics is located.
H3. Design cybernetics offers an ethical approach that can improve governance and ethics in persuasive service systems.

Mapped to the three hypotheses, from the literature review, I identified six areas in which cybernetics could potentially contribute to the design of service as persuasive systems (see table 7). The following table summarises the new knowledge gained by the conversations with the self (chapter 5) and the conversations with others (chapter 6).

Areas in which cybernetics can contribute to SD	**Conversations with the self (CwS)**	**Conversations with others (CwO)**	**Suggestion**
H1: As a conceptual framework to describe persuasive service systems.	The CwS contributed to learning the language of cybernetics. Through the reflective practice, I made sense of and internalised design cybernetic concepts	The CwO contributed to knowledge of how the cybernetic concepts could be applied in service design. Throughout the projects, I converted my personal knowledge to knowledge -in-use.	**Yes**. The research indicates that design cybernetics is useful for describing and designing persuasive service systems.
H1: To illustrate the emerging human-computer design relationship.	I developed my theoretical and applied skills in working with cyber-physicality and applying cybernetic concepts in my personal	The projects worked as an arena where I could apply my newfound personal knowledge and share it to create value for others.	**Inconclusive**. The reflective practice led to new personal knowledge in this domain. It was not a central feature though.

	practice.		
H2: For meta-designing the reflective second-order layers of services.	Through the CwS, I got a better understanding of my personal goals, purpose and process. By reflecting on my position as an active observer, I defined myself as a persuasive service system and could shape it better to cater to my goals.	I learned how to empathise with the goals of other designers. The importance of metasystems for the success of persuasive systems.	**Yes**. The research indicates that a design cybernetic approach was useful to reflect on second-order design of services.
H2: New approach to governance of persuasive service systems.	The CwS helped me understand my position and power as a designing system acting to persuade others through my research and design practice. That led up to the theory of persuasive metasystems.	Although the impact was limited, the CwO allowed me to influence the formats in which others designed persuasive systems (the Planethon case). That is evidence of how one designing system can influence other designing systems' direction, thus influencing their vectors.	**Yes**. The research suggests that design cybernetic approach can be used to stimulate endogenous design governance.
H3: To provide a new approach to embed ethics in service design practice.	According to cybernetic theory, ethics should be intrinsic in the designer's actions. By reflecting on my personal practice, I developed a heightened sensitivity towards ethical issue.	Through the CwO, I learned more about my responsibility as a designer, towards other people or institutions. That was reflected both in informal and formal agreements on action.	**Inconclusive**. Although the empirical research did not notably support this theory, it did not refute it either. In theory, there are benefits to a design cybernetic approach.
H3: To describe relationships between organisations and the persuasive service systems they develop.	The CwS allowed me to reflect on my position as an observer/researcher and the influence I could have in the world, depending on how and where I focus my attention and effort. It made me reflect on how I direct the vector of my personal persuasive system and what change it can bring about in the world.	An insight from the CwO was that it is not enough to have an effective persuasive system, you also need to have a persuasive meta-system that powers the primary system to create a vector of change. These meta-systems need to be analysed when designing persuasive systems.	**Inconclusive.** Instead, the research demonstrated the relationship between the designer/designing system and their work and did not describe the relationship between the designer and their institutional environment in greater detail.

Table 24: Summary of new knowledge derived from practice.

7.2 Acting Cybernetically to tame governing metasystems

I conclude from my research that design cybernetics indeed have potential for describing governing second-order metasystems of persuasive service systems. Until now, service designers of persuasive systems have not yet learned how to work with, or design, governing metasystems of higher-order, which influences the goals and purposes of persuasive service systems. That is reflected in the existing models for persuasive systems design, reviewed in chapter 2, which do not fully capture the complex second-order cybernetic properties of persuasive systems. Existing frameworks also fall short in ubsability and proper recognition of circularity. This research suggests that there is a value in systematically extending the service design vocabulary further, including second- and higher-order cybernetic systems, to capture the designer's reflections, intentions, and nuances of service's purposes, values and action potential. Design cybernetics offers a conceptual toolkit that can assist designers, such as myself, to express situations that emerge in the design process.

One of the most potent governing metasystems for services as persuasive systems are its *designers*, or *designing systems*. This research suggests that service designers crafting services as persuasive systems should spend more effort understanding their personal roles as observers/designers and design metasystems, conditions, which govern the persuasive properties and agency of the services they design and study. It suggests that 'designing cybernetically' as both an actor and an observer simultaneously and translating cybernetic concepts to a service design context can be a useful approach for service design researchers and practitioners, to arrive at desired outcomes.

Existing models, listed in chapter 2, describe the persuasive system dynamics in greater detail. However, they do not give enough recognition to the designing systems. By making a greater effort to observe the observer, there is much to be won.

7.3 Service design - a new arena for cybernetic performances?

As described in chapter 3, cybernetic has been criticised for not being useful or exciting any longer, and it has even been declared dead (Kelly 1994). However, the promise of design cybernetics to revive performative components of cybernetics is recognized by Richards (2020).

My research suggests that cybernetics in the context of design is not dead at all. Service design is an arena where the cybernetic concept is useful and can be *performed* in new and persuasive ways. *Useful*, to describe the growing galaxy of persuasive systems, digital-physical services and design, and provide a conceptual framework from which new services can be developed, and existing services can be analysed. Beer, Pask and others demonstrated that first-order cybernetics could be commercialised and even be applied to country-scale governance issues, which contributed to the popularity and expansion of the field. Since then, however, with a few exceptions, cybernetic ideas have arguably lost the exciting and attractive performative component, but service design just might be an area where design cybernetics is a 'killer app' (pun intended). *Performed*, meaning that it not

only needs to be communicated but enacted to be rhetorically persuasive, effectively, a *persuasive system* as described in this thesis. Krippendorf (2019) described cybernetics as a design project worth enrolling in. I concur and suggest that additionally seeing the cybernetic design project as a persuasive system that can be *successful*, according to a dynamic definition of success, may help understand how and where to start working on its self-realization.

Renewed relevance in a world filled with services as persuasive systems

As described in chapter 1 and 2, human infosphere is becoming increasingly complex and populated with more and more services as persuasive systems. These digital-physical services embody many of the technologies that flowed from early cybernetics: artificial intelligence, machine learning, cybersecurity et cetera. What we see now, in my view, are crises in the second-order domains of cybernetic systems, which governments, companies and individuals have difficulties in handling. We do not know how to regulate platforms based on persuasive systems properly precisely because we do not observe the observers properly and apply the ethical imperatives of second-order cybernetics in governance processes. There is not only an opportunity to do an awful lot of social good by solving these issues, but there is also an awful lot of money to be made for anyone who tames second-order cybernetic aspects of services as persuasive systems. In this research, I have explored these forms of governance, through reflective practice and design, which opened a path to realizing this ambition.

As I have demonstrated in this research, cybernetic concepts can be used in service development, as part of early-stage service design projects. By performing epistemic service design projects, it can be used as an *approach*, a simultaneous research and working process that interweave theory and practice to produce new knowledge and practice. Chapter 5 described how I developed a design cybernetic toolkit, which I subsequently applied in my personal research, teaching, and service design practice. It is an approach that can be developed into a method, but further research is necessary to do that. Since design cybernetics offers 'no prescriptive methodology', I do not aspire to establish a firm standard for designers to use. Instead, I share a unique approach that can inspire people to develop their personal design cybernetic practices.

7.4 A Performative Turn: Rise of the (Design) Cybernetician

To realize the full potential of second-order cybernetics and fulfil the promise of cybernetics as a language for design, the meta-discipline needs to develop robust performances that prove valuable, exciting and thought-provoking to people outside of the tight cybernetic community. A performative turn needs *performers* and, in this case, they may be designers calling themselves cyberneticians. If there are merits to a cybernetic approach to design, and we assume that there is, how do you become a design cybernetician? At some point, a researcher is either making it explicit to themselves, or somebody else gives them the label. Rich accounts of the process of 'becoming a cybernetician' has

been provided by Von Glaserfelt (1992) in *Why I consider myself a cybernetician*, and Bernard Scott (2018) in *On Becoming a Cybernetician: Highlights and Milestones*. Von Glaserfeldt describes how he realized that he had 'adopted a cybernetic way of thinking' that reflected in his teaching, interactions with students and the compatibility with his worldview. Scott's account was published as part of a World Futures special edition called *For the Love of Cybernetics*, edited by Jocelyn Chapman (2020), which consisted of nine accounts from researchers who tell their story of how they 'fell in love' with cybernetics.

It is well documented that many cyberneticians were people with strong personalities and identities who did not fit neatly into existing disciplines or structures. Although their theories engaged theoretical researchers across disciplines, it was arguably their personal exploratory practices that made cybernetics exciting and accessible to a broader audience. To revive cybernetics and further promote the discipline, epistemology, and concepts, more *designing* cyberneticians would probably be desired. Several scholars have pointed to the difficulties of doing transdisciplinary research within the framework of the existing educational system. My albeit brief, personal experience with the academic system and bureaucracy strongly suggests that so is the case. It is my view that different forms of cybernetic design practices need to be explored to fully capture the promise of cybernetics.

Does a Design Cybernetician design differently?

Drawing from the learnings from the conversations with the self (chapter 5) and the conversations with others (chapter 6), there are reasons to believe that a cybernetic approach to design may reflect in every designer's practice. I suggest that these operations are grounded in a *belief* in design cybernetics as a philosophy, *in* its concepts and its innate ethical approach.

When and how does one begin to design as a cybernetician and is there a distinction between a design cybernetician and a 'regular' cybernetician? At the ALU Conference in Bolton 2013, a group of researchers initiated a conversation about the term 'cyberneticist' versus 'cybernetician'. The discussions resulted in a paper which concluded that *cyberneticists* should work on the science-side of cybernetics. In contrast, *cyberneticians* should work on the design side, so that the field could self-organize along those two lines to grow sustainably. (As a perhaps irrelevant side note, a search for 'cyberneticist' yields 430 000 hits on Google, while 'cybernetician' yields 106 000 hits, 'design cybernetician' 6 results only)

Given that discussion, is the word 'design cybernetician' necessary? I believe so for a few reasons. First, cybernetics still carry positivist connotations. Although those familiar with the term may distinguish between the nuances of cyberneticist versus cybernetician, it does not emphasise enough the roots in design that design cybernetician carry. By making *'design'* explicit, it is clear to anyone skimming it that this is a designer who 'acts cybernetically' and follows cybernetic philosophy. One might say that a design cybernetician is a subset of a designer, a designer who

believes in, and practices cybernetics. Now, you might say, isn't that what all designers do? Isn't that the point?

Part of labelling someone as a cybernetician seems to highlight an intellectual separation and independence from traditional, positivist science and signal that one subscribes to an interpretation of the cybernetic philosophic tradition. Taking a university course in cybernetics may thus not be enough to call yourself a cybernetician: a cybernetician has received the teachings and actively chosen to join the tribe. Scholte (2020) suggests that a cybernetic approach perhaps needs to be housed outside existing academic disciplines, whether scientific or design-based, because if cybernetic practice grows out of existing disciplines, 'we must continue to appear responsible and well-balanced members of the home disciplines in which we are actually employed if we (cyberneticians) are to be credible in those respective communities.'. What Scholte means is that it is difficult to claim a cybernetic approach and identify as a cybernetician if one also has to adhere to the description of a 'scientist' or a 'designer', because of the many preconceived ideas of what scientists or designers are expected to do and produce. He further describes that the subject of study for cyberneticians may be to 'observe the observers' and proposes a guiding principle to be that *"a theory of the observer is insufficient. Each and every observer must develop their own, specific theory of themselves as an observer."* That means that they need to formulate a stable understanding of their understanding of themselves as cognitive, learning beings and doing so until they have arrived at a stable representation of their identity, a self-referential state. It also means that cyberneticians need to develop stable representations of the discursive domains in which they do research, of their position as a researcher/observer in the domain and arrive at a *vector of intent* - what change they personally want to see in the world (desired future) and how they can enact that change, given the opportunities and constraints of the individual researcher and the systems he or she can access. Not coincidentally, this would also be an abstract 'map' of a persuasive, cybernetic system which is designed with the intent to influence your behaviour, an 'endogenous' persuasive system as per Fogg's definition. Each area of understanding requires interacting and internalizing a set of metaphors or eigenforms, representations, words, objects, practices, etc. that one needs to adapt to understand and contribute to that particular sphere of knowledge.

On the point of observing the observer, *ethics* is another reason why self-reflection is essential. Von Foerster wrote that '...the observer who enters the system shall be allowed to stipulate his own purpose: he is autonomous. If we fail to do so, somebody else will determine a purpose for us.'. If we do not recognize people's autonomy, they are incapacitated and blame others for their shortcomings. Thus, understanding and owning one's goal and purpose become central to an ethical approach to design, which is urgently needed to tame the many wicked problems related to persuasive service systems, defined in chapter 2. This research does not deliver conclusive evidence to confirm that, but it indicates that there is potential to do so.

8. Conclusions

8.1 Summary

This research investigated the merits of using design cybernetics to address wicked challenges related to complexity, ethics and governance of persuasive service systems. I conclude that design cybernetics can indeed contribute to a new approach to service design. For this end, I have developed new theory and tools for service designers and other stakeholders working with services as persuasive systems.

The research questions investigated were:

R1: How can a design cybernetic approach contribute to the understanding of services as persuasive systems?

The research indicates that:

1) design cybernetics is useful for describing and designing persuasive service systems.
2) a design cybernetic approach is useful to reflect on second-order design of services.
3) a design cybernetic approach can be used to stimulate endogenous design governance.

Framing persuasive service systems as goal-oriented, purposeful systems makes it possible to use cybernetic systems thinking and concepts to holistically describe persuasive services. Using that approach, the observer (the designer or designing system) is present as an integral part of the observed persuasive service systems. The design cybernetic conceptual world based on second-order cybernetics then provides a new approach for describing relationships between observing second-order *metasystems* and observed persuasive service systems, previously difficult to articulate. It proposes an *endogenous* approach to governance and ethics where the responsibility for persuasive service systems' designs is formed in reflective second-order conversations with the designing systems. Although the research indicates that there are ethical benefits of a design cybernetic approach, the ethical qualities were only demonstrated to a limited extent. Further research is needed to understand if and how this approach can contribute to more ethical practices.

R2: How can different concepts from design cybernetics be applied in a persuasive service system design project, to create more understandable and valuable service propositions?

Based on my personal reflective practice, I conclude that designers benefit from engaging with cybernetics and cybernetic philosophy to apply design cybernetic concepts in practice. By actively observing one’s role and motivations as a designer in a service system, and exploring design cybernetic concepts in reflective practice and conversations with others, one can internalise these

concepts while practising design. In this research, I developed a service design praxeology based on my personal reflective practice, allowing me as a designer/researcher to familiarise myself with design cybernetics, through explorative service design, which resulted in concrete concepts prototypes. Having internalised the concepts by personal reflective practice, I could incorporate the useful elements identified from design cybernetics. I observed and participated in live service design projects, which I documented as case studies, with ongoing reflections and data collection.

In my research, I explored the merits of designing cybernetically, acting according to design cybernetic philosophy. I propose a contribution to practice; an approach that I denote epistemic service design, to integrate cybernetic ways of acting into the service design practice. A way to achieve that is to devise epistemic service design projects, where the purpose of the projects is not to deliver on an external brief but to allow the designer to reflect on how a service design practice generates new knowledge, inspired by a sensitising concept as a starting point for exploration. Design cybernetics is proposed as an approach to such a project and I share my tools as inspiration to anyone who wishes to do so.

My original contributions to new knowledge are:

Theory	a formulation of three governance issues related to the design of persuasive systems.	Chapter 1 and 2
	a formulation of six possible ways that design cybernetics can be used to support the design of services as persuasive systems.	Chapter 2 and 3
	a theoretical foundation for reflective, persuasive metasystems (second-order cybernetic persuasive systems).	Chapter 3-6
Tools	a Design Cybernetic Garden: a visual language for learning design cybernetics and a framework for how it can be applied in New Service Development (NSD) of persuasive systems.	Chapter 5
	Cybernetic Conversational Stones: a service concept for a physical-digital touchpoint for starting conversations.	Chapter 5
Approaches	First steps towards a new research approach for cybernetic service design, and an example of how it can be used in a service as a persuasive system research project.	Chapter 4-7

Table 25: Original contributions to knowledge.

As described in chapter 2, service designers often work with intangible properties of designed processes such as behaviours, attitudes and intents. The evidence that I have gathered through my research indicates that to some extent, designers, design teams or designing system's purposes, motivations, action potential and abilities to orchestrate resources is as central to the success of a persuasive service system as the mechanisms of the service system itself. The research also suggests that studying meta-design aspects of services as persuasive systems is also central to governance and ethics issues. Yet, many service designers are primarily concerned with service blueprints, user journeys and personas and stakeholder maps, that describes 'the things' rather than its creator's motivations and relations to the things.

This research also indicates that although persuasive systems get much attention, their second-order persuasive metasystems carry much power. The thesis provides a first sketch of a cybernetic theory of persuasive metasystems and indications of an approach and tools for working with these in a service design setting. I have identified *design cybernetics* as a viable path to realising this ambition and provided evidence of the approach's usefulness in the form of two case studies and two reflective practice design projects that have explored the area.

I argue that the designing system (the designer) is an influential metasystem that calls for further attention and a design governance system that influences the goals of the designing system. As Mary Catherine Bateson wrote, '*By changing how we think, cybernetics transform how we behave, thus increasing possibilities for positive systemic change.*' (Bateson 2016). The research suggests using design cybernetics as a language to influence how service designers think and design endogenously. Cybernetics makes it possible to be more explicit regarding the second-order perspective of service design services as persuasive systems. I have demonstrated that it is useful in the early stages of the service design process, a stage in which governance issues related to ownership, intent, values and ethics are essential to address. If designers can act cybernetically, they may be better equipped to deal with wicked problem of complexity, ethics and governance in services as persuasive systems.

Although it is not reasonable to generalize conclusions based on this thesis alone, it is my personal belief that persuasive metasystems, which encompasses the purpose, function and action potential of a designer/designing system, always work behind the scenes of any persuasive system. Although this research does not have the ambition to prove that thesis, there is a reason for future research to explore if these findings can be generalized to all forms of persuasive systems.

8.2 Contributions to theory

This section summarises my conclusions, which are more extensively described in section 7.1-7.4. The research contributes to and extends existing theory in the following ways:

In *cybernetics research*, it stretches the agenda of second-order cybernetics further into the design domains. In particular, it contributes to the research agenda for second-order cybernetics outlined by Müller and Riegler (Müller and Riegler 2017), 'offering foundational frameworks as well as reframing and contextualizing research problems across all scientific disciplines', 'creating reflective circular practices within applied disciplines' and 'building special circular reflexive approaches for special niches within artistic domains'. This research has done so by introducing design cybernetic theory and praxeology into service design of services as persuasive systems. See section 7.1-7. 4 for a deeper discussion. I have also created a set of tools in the form of a poster, Design Cybernetic Stones and an education experience (chapter 5).

Service design may also be a new arena for performative cybernetics and it may revitalise the discipline, which attractiveness has suffered from its introspective reflexive turn towards second-order cybernetics (Richards 2020). The research provides concrete cases of how a performative design cybernetic approach can add value to a service design process. I argue that the interplay between the first- and second-order perspectives (between the designer and 'the thing which is being designed', as well as conversation with the self) which is central to design cybernetics, is particularly useful when designing services as persuasive systems. See section 7.4 for a deeper discussion.

In *persuasive systems research*, there have been calls for further research into *ethics and governance* (as discussed in chapter 2). This research introduces design cybernetics as an approach to frame persuasive metasystems, thus extending the vocabulary of persuasive service systems design further into axiological domains, which allows for explicit conversations about second-order aspects such as a service system's ethics, values and purpose, connected to its design process. It indicates that the approach may have ethical qualities, but further empirical work is needed to confirm that claim. See section 7.2 for a deeper discussion.

In *service design research*, I *extend the service design vocabulary with design cybernetic terminology*, allowing service designers to tap into a useful set of concepts that can lead practice when designing services as persuasive systems. It complements the models reviewed in section 2.4.1. and constitutes the first formulation of a new research approach to persuasive service system design based on a design cybernetic epistemology, which future researchers may pick up and build on. See sections 7.1-7.3 for a deeper discussion.

8.3 Why is this research relevant?

As technologies blend seamlessly into the environments in which we live, work and play, it is becoming more difficult to discern their properties and goals. Interdisciplinary academic discourses regarding the ethics of technology and 'ethical AI' have become extremely popular. Ethics of AI is, of course, a genuinely important and significant area to discuss, however, I believe it is crucial that ethical discussions have a more holistic approach to cover *all* sorts of computerised services and products and not just those which incorporate AI specifically. The broader questions concerning technology and behaviour and attitude change have been mulled for decades in the persuasive technology community, why I believe it is the right research community to involve in answering the difficult question 'How do we make sure that these technologies are on our side?'. In practice, in the context of this research, this means that we need to get better at understanding the goals of platforms which use persuasive technologies, how they are aligned with our human goals and how these goals are negotiated. In 2019, there were several calls for better governance of platforms, where Gorwa wrote that *"Given the rapid pace and development of the platform ecosystem, as well as the dynamic nature of the platform companies in question, new models for digital governance will likely need to be developed*." (Gorwa 2019). Similar calls to action were voiced at the 14th Persuasive Technology conference, and although there are several studies which address subsets of the topic, there are as of today no studies that explicitly describe the governance of persuasive systems or second-order persuasive systems in persuasive technology literature.

Significant regulatory and managerial challenges remain with pervasive industry platforms across all domains. As persuasive platforms grow in influence, there is a need for better practices and actual enforceable guidelines for governing persuasive technologies and platforms to ensure that they meet human needs and are ethically sound. That involves developing procedures for checks and balances - essentially evaluating and controlling the persuaders and designing processes for setting and negotiating acceptable ethical goals and means.

New technologies pave the way for new persuasive experiences, methods, strategies and tactics which will add complexity and diversity to design in this interdisciplinary area of research. Since more or less all domains are now computerized to some extent; eventually, *all scientific and design disciplines* and human social, cultural, political, philosophical, ethical and even moral spheres of knowledge, will be affected by persuasive technologies. This calls for *interdisciplinary* and *transdisciplinary* system's approaches to problem-solving, perhaps even *antidisciplinary*, to use the term coined by Joi Ito, to describe the 'space between disciplines (Ito 2016a) or *alterplinary* which recognises that the unknown is a necessary starting point for any future-oriented project (Rodgers and Bremner 2011).

8.4 Where to now?

It may be the case that the design cybernetic era begins now. Perhaps we have crossed the chasm from a time where cybernetic ideas mainly circulated among researchers, innovators and early adopters, to reach the early majority. In my view, the technological possibilities are now at par with the ambitions of Wiener's ideas of 'communication and control in the animal and machine' and Stafford Beer's grandiose vision for computer-supported governance and management. What was impossible to achieve in the 1960s is not only possible; it is a reality today.

Services as persuasive systems are not only here to stay, and they will play a central role in facilitating interpersonal human interaction and human-computer interaction in the future. As the technological megastructure emerges and unfolds, service systems will grow more and more persuasive, complex, and less transparent, increasing the pressure on service designers to develop new methods to govern them. This research hopefully provides a platform for those who wish to explore how designers can work more effectively with services as persuasive systems.

This investigation has opened up the following new lines of inquiries:

1) **Further research into persuasive service systems.** As discussed in the thesis, there is an expressed interest from the persuasive systems research community to bridge the gap between research and practice further. In particular, developing tools for regulators, managers or owners to better understand and work with persuasive technologies are sought after. A way to achieve this is to focus on *persuasive metasystems*, second-order cybernetic systems which govern first-order cybernetic persuasive systems. Having completed this PhD journey, I am confident that this is a fruitful direction to pursue further. There will be many opportunities available for anyone who wishes to work in the intersection of persuasion and service design on the governance level.

2) **Research into using cybernetic terminology to describe persuasive metasystems**. In this thesis, I suggested a few ways in which cybernetics, can be used to describe designing systems as second-order persuasive metasystems. I have pointed to a few broad areas in which it might be useful and scrutinized some of the cybernetic concepts closer to identify how it could be useful in service design. This research has provided a first glance of what benefits there are with that approach. Future researchers are invited to expand further the language of service design, where I especially encourage further development of *visual languages* and *conversational methods*.

3) **Integrating design cybernetics into service design education.** Future research should continue to explore the relationship between design and cybernetics, in a service design context. As we shift from a product- to a service-oriented economy, service design practices need to evolve, to meet the needs of ethics and governance. I believe that acting cybernetically is a way to achieve that, and this thesis provides some evidence pointing in that direction, along with a few methods and tools to use. In this thesis, I did a few early tests of my approach, but stopped short of integrating my findings into an actual educational program. Hopefully, this thesis's theoretical foundation may provide a base for future teaching and program development. I encourage scholars to further explore how cybernetics can inform service design and be inspired by its rich conceptual world, dive deeper into its ontology and epistemology and not least, embrace the performative aspects of design cybernetics.

4) **Exploring cybernetic service design as a method.** This thesis has proposed (and used) a novel approach for generating endogenous knowledge, based on cybernetic, conversational principles. The approach focuses on the researcher/designer's intents and creative process, meaning that it is contextual and personal. The approach is the first step towards a more formalised method, and future scholars may want to investigate how that can be explored further.

Appendices

Appendix 1 -Design Cybernetic Mapping

Aspect	Second-order	First-order
Goals 	Define closer what you want.	Define the purpose of the service in terms of what behaviours and attitudes it aims to alter.
Feedback loops 	What personal feedback-loops do you/your team need to understand if you are strategically going in the desired direction?	How do you know if the service is successful in altering the behaviours and attitudes? Define qualitative or quantitative measurements. Define who is responsible for these measurements?
Variety/RV 	Define what skills or understanding you have and what skills you need to make the service successful.	Define the requisite features to alter the behaviours or attitudes of the user.
Biocost 	Define which are the key resources to power the principal agents who will work on the service (the key design proposal).	Define the stocks of resources in the system. Define the flows of key resources in the system.
Black boxes 	Define the most important things you do not know about: - Yourself/your own team - The challenge - The solution	Define what you do not know about the service system. Which are your unknowns?
Conversations 	Define which conversations you could have to strengthen the team's understanding of the goals, gain new knowledge. Define which languages you understand or need to understand.	Define and design the key conversation with the users in the service.
Governors 	Define your personal constraints in the service.	Define the current constraints in the service, which hinders the user to act or believe what you want them to.
Agents 	Make a list of stakeholders which could improve your personal/team's performance.	Make a list of stakeholders which could improve the services performance.
Design proposals 	Define what key design proposals you will work on. Define what mediums you will work with for the service design proposals *for* the service.	Define which are the key design proposals (touchpoints) in the service. Define what mediums you will work with for the service design proposals *in* the service.

Figure 87: Design cybernetic mapping – template

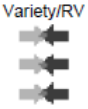
Aspect	The Designer Company owner + team]	The Service being Designed
Goals  *The top goals for the designers and the service.*	Shift existing executive education programs to online learning, to create a new revenue stream for the business.	The purposes of the service is to [redacted]
Feedback loops  *The core processes in the service.*	Internal meetings and internal documents to create a shared understanding of the service system, including the business system. ⟳ **1** Evaluate the working process regularly, to ensure that everyone in the tem is aligned with the goal, focused on the right issues and that they contribute to the realization of the service.	Focus on two main feedback loops which relate to the 2 goals above. ⟳ **1** Sales and marketing loop User [redacted] User User User ⟳ **2** Course loop User [redacted] User User User's User's User is
Variety/RV  *The team's and service's requirements.*	Understanding the composition of the team and their skills is crucial to delivering a persuasive service. Evaluate regularly what skills are needed to deliver the two feedback loops. Regularly assess learning needs of the team and complement where necessary.	The properties of the digital medium are substantially different from physical courses. The delivery of the program (the experience) [redacted]
Biocost  *The resources that can be spent on realizing the service.*	Assign a person as responsible (owner) for each loop. Define what resources are available today and tomorrow and set boundaries for delivering the service, in terms of employee hours and money that can be spent. For loop #1. [redacted] For loop #2. [redacted]	Make a map of [redacted] As a rule of thumb: aim to make the service effortless on the user's behalf.

Figure 88: Design cybernetic mapping – example (1)

Black boxes  *Understanding what is known and not known.*	Regularly evaluate which information that is needed from the user to improve on the service. Think of non-invasive ways of collecting the information.	Embed a series of 'conversations' (surveys, chats, one-on-ones) with the users where they can give feedback on the service and the discrete parts of it. Use the feedback to decide on new features and changes in strategic direction.
Conversations  *Key conversations that drive the project forward.*	Which conversations can you & the team have that upgrades their thinking? Set up regular meetings and chats with people who can improve their skills and imaginations in the areas of service development.	Define the key conversations for the two loops, how and where they will take place: ⟳ 1 [redacted] ⟳ 2 [redacted]
Governors  *Project constraints, perceived and real.*	Define the constraints for the project: [redacted] 4)	By defining the user journey, through the formats you choose, you set the constraints for how interaction will take place between the faculty, administration and the users. Consider how different conversation solutions (webinar, chat, dock, videography etc.) allows for different kinds of conversations and how these can be used to drive user behaviors and attitudes.
Agents  *Stakeholders, internal and external.*	Define the key stakeholders for making this project come real (in short term) and sustainable (over time). Who can contribute to developing the structure and format of either of the two feedback loops (sales loop OR education loop)	Define the key stakeholders who can actually deliver the different parts of the service. Who can contribute to increasing either of the two feedback loops: ales or educational outcomes.
Design proposals  *The things you make in the project.*	Map out the internal forums/meetings where the team's conversations will take place over the course of the project. Decide who will make what. Assign responsibilities for everything that has to be made.	Set up meetings where the things you make are shared and discussed, internally, perhaps with external experts, perhaps even with users. Discussing prototypes is very powerful. Map out the main things you have to 'make' to deliver the service: ⟳ 1 Sales loop [redacted] ⟳ 1 Education loop [redacted]

Figure 89: Design cybernetic mapping (2)

Appendix 2 – Ethical forms

Workshop ethics form

Royal College of Art
RESEARCH & INNOVATION

Participant Project Information & Consent Form

(One signed copy of this form should be retained by the Participant and one copy by the Project Researcher)

Good Governance of Persuasive Technologies

For further information
Supervisor: Nick de Leon
Nick.leon@rca.ac.uk

May 21, 2019

Dear Potential Participant,

I, Gustav Borgefalk, am a research student in the Service Design department at the Royal College of Art. As part of my studies, I am conducting a research project entitled Good Governance of Persuasive Technologies. You are invited to take part in this research project which explores how technologies that are designed to be persuasive, meaning that they actively aim to influence people's behaviours and attitudes, should be governed, to better serve its users and society.

If you consent to participate, this will involve participating in a **design workshop** where you will explore and discuss design challenges related to persuasive technologies in a group setting. You have been recruited to this study because you knowledgeable in an aspect of the problem area.

The workshop will take **approximately 120 minutes.** The workshop will be **video and sound recorded** and written material produced from the workshop will be collected and analysed. The workshops will use design methods inspired by **conversation theory**, where you will have conversations on the above stated theme with yourself, other participants and with fictive organizations. I will provide materials to stimulate the discussions. **The results from the workshops** will be analysed and used to **develop concepts** to address problems in digital platforms using persuasive technologies. The results may be published in academic journals and in my dissertation. By participating in the study, you consent to this treatment of the workshop data. Any data in which I can be clearly identified will be used in the public domain only with my consent.

Research Office Royal College of Art Kensington Gore London SW7 2EU
t +44 (0)20 7590 4126 f +44 (0)20 7590 4542 research@rca.ac.uk www.rca.ac.uk/research

Participation is entirely voluntary. You can withdraw at any time up to the point of publication and there will be no disadvantage if you decide not to complete the study. All information collected will be confidential. All information gathered will be stored securely and will only be used within the scope of the study, for research purpose.

By participating in this workshop, I consent to letting the researcher use my data (video, sound, materials produced) In the ways described above.

If you have any concerns or would like to know the outcome of this project, please contact myself on gustav.borgefalk@network.rca.ac.uk, or my supervisor Nick de Leon at the above address.

Thank you for your interest.

I *(please print)* ..... have read the information above and all queries have been answered to my satisfaction. I agree to voluntarily participate in this research and give my consent freely. I understand that I can withdraw my participation from the project up to the point of publication, without penalty, and do not have to give any reason for withdrawing.

I understand that all information gathered will be stored securely, and my opinions will be accurately represented. Any data in which I can be clearly identified will be used in the public domain only with my consent.

Participant Signature.....

Researcher Signature.....

Date: .....

Complaints Procedure:

This project follows the guidelines laid out by the Royal College of Art Research Ethics Policy.

If you have any questions, please speak with the researcher. If you have any concerns or a complaint about the manner in which this research is conducted, please contact the RCA Research Ethics Committee by emailing ethics@rca.ac.uk or by sending a letter addressed to:

The Research Ethics Committee
Royal College of Art
Kensington Gore
London
SW7 2EU

Royal College of Art

RESEARCH& INNOVATION

Participant Project Information & Consent Form

(One signed copy of this form should be retained by the Participant and one copy by the Project Researcher)

Good Governance of Persuasive Technologies

For further information
Supervisor: Nick de Leon
nick.leon@rca.ac.uk

insert date

Dear Participant,

I, Gustav Borgefalk, am a research student in the Service Design department at the Royal College of Art. As part of my studies, I am conducting a research project entitled Good Governance of Persuasive Technologies. You are invited to take part in this research project which explores how technologies that are designed to be persuasive, meaning that they actively aim to influence people's behaviours and attitudes, should be governed, to better serve its users and society.

The interview will take **approximately 60 minutes.** No images will be collected; however, the interview will be **sound recorded** and transcribed. If you wish to see a copy of the transcription, let me know. **My goal is that your views and opinions should be honestly represented.**

All information gathered will be stored securely and once the information has been analysed all individual information will be destroyed. The interview will be analysed and results from the study will primarily be published in academic journals and in my dissertation. By participating in the study, you consent to this treatment of the interview data.

Participation is entirely voluntary. You can withdraw at any time up to the point of publication and there will be no disadvantage if you decide not to complete the study.

(a) At no time will any individual be identified in any reports resulting from this study.
(b) Images or quotes, which may allow you to be identified will only be used with your express permission.

If you have any concerns or would like to know the outcome of this project, please contact myself on gustav.borgefalk@network.rca.ac.uk, or my supervisor Nick de Leon at the above address.

Thank you for your interest.

I *(please print)* …… have read the information above and all queries have been answered to my satisfaction. I agree to voluntarily participate in this research and give my consent freely. I understand that I can withdraw my participation from the project up to the point of publication, without penalty, and do not have to give any reason for withdrawing.

I understand that all information gathered will be stored securely, and my opinions will be accurately represented. Any data in which I can be clearly identified will be used in the public domain only with my consent.

Participant Signature……

Researcher Signature……

Date: ……

Complaints Procedure:

This project follows the guidelines laid out by the Royal College of Art Research Ethics Policy.

If you have any questions, please speak with the researcher. If you have any concerns or a complaint about the manner in which this research is conducted, please contact the RCA Research Ethics Committee by emailing ethics@rca.ac.uk or by sending a letter addressed to:

The Research Ethics Committee
Royal College of Art
Kensington Gore
London
SW7 2EU

Royal College of Art

Gustav Borgefalk <gustav.borgefalk@network.rca.ac.uk>

Ethics form for your consideration

RCA Ethics <ethics@rca.ac.uk> 24 January 2019 at 13:46
To: Gustav Borgefalk <gustav.borgefalk@network.rca.ac.uk>

Dear Gustav
Apologies - I was trying to send you a formal approval and didn't change the name.
Many thanks for your Research Ethics Application, which has been categorised as Yellow and reviewed by the Student Research Ethics Panel.

Based on the project details submitted, your Research Ethics Application has been approved. Should you amend your project or methodology in any way, you will require additional approval. Please note, that the Information/Consent Forms will need translating and sending through for approval should participants not be fluent in English Language.

Good luck with your future research.

With many best wishes

Research Ethics Team.

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