Breaking free from dark patterns in the era of smart product-service systems

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A.Y. 2022-2023

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1. ABSTRACT

The research in this dissertation discusses new scenarios opened by rapid innovations in the technological infrastructure of digital services through the lens of persuasive technology, showing tools already available to designers in order to craft Smart Product-service Systems S.PSSs. The dissertation frames the strategies that designers use to build smart technologies, which in turn significantly impact users' behaviour, and analyzes the risks associated with dark patterns which exploit individuals' cognitive biases for commercial advantages. Subsequently, the study cross-references the insights from an assessment of available literature with empirical evidence from a multi-method analysis of case study reviews and expert interviews. Hence, the notion of ethics within the design process is addressed with a specific focus on persuasive technology in order to synthesise an approach to responsible design S.PSSs based on the knowledge generated throughout the dissertation. The study reveals a fundamental need to go beyond the Human-Centred-Design framework, whose paradigm of seamless interaction effectively shields users from the complexity of today's networked society. Therefore, more mindful interactions are instrumental in developing sustainable and responsible smart product-service systems and new areas designers should be knowledgeable of are highlighted, such as data science and data governance.

Keywords: Smart Product-Service Systems, S.PSS, Design patterns, Dark Patterns, Persuasive technology

2. INTRODUCTION

Changes in design are now manifesting on at least three levels: the design object, the design process and the design agency with the discipline moving beyond luxury or everyday products to designing systems (Pierri, 2017). In fact, the growth of what is commonly referred to as Smart Product-Service Systems (S.PSSs) has been exponential in recent years. S.PSSs combine physical products with digital services which lead to an increased ability to capture and utilize data, enabling them to provide personalized services, better user experience, and improve operational efficiency. In fact, from the first tools and techniques invented by humans, the history of humankind has also been the history of (artificial) technologies: in essence, technology and society are intertwined (Heidingsfelder et al., 2019).

However, designers are faced with a new set of problems, as digital interfaces often persuade users to take actions preferred by choice architects. Therefore, emerging technologies have the potential to affect our minds, bodies, and society on a fundamental level (Heidingsfelder et al., 2019). In fact, there has been a rise in unethical design practices known as "Dark Patterns" which actually manipulate, deceive, and mislead users into taking actions they would not have taken otherwise. Users are effectively coerced into making decisions that are not in their best interests. Dark Patterns undermine user autonomy and trust, leading to negative outcomes such as decreased user satisfaction, loss of privacy, and even financial harm. While there is an extensive body of research on both S.PSSs and Dark Patterns, there is currently a gap in the literature that examines the relationship between the two with a design perspective. Therefore, the research question has been framed as such:

How and to what extent can design practice account for the potentially negative consequences in user behaviours (dark patterns) that might be generated in the context of digital services? And how is this linked to the mechanisms for data extraction, analysis, and synthesis that are central to designing Smart Product-Service Systems?

The research question has been explored first by framing the relationship between humans and technology. In fact, nowadays service ecosystems (SEs) are more and more incumbent in

people's lives and are shifting in the relationship between man and machines from a prosthetic paradigm to a collaboration approach (section IV). SEs are ultimately composed by bundles of Smart Product-Service Systems (section V-VI). SEs differentiate from Smart Product-Service Systems S.PSSs in terms of complexity and scale: for instance, a car might be part of an S.PSS but mobility is an SE as it might integrate different transportation systems (Section VII). S.PSSs have profound effects on users' behaviours which makes them a class of persuasive technologies with practitioners addressing conflicting values across and throughout design processes (Section VIII). In fact, S.PSSs are typically developed using design patterns (reusable design solutions) which sometimes could backfire transforming to anti-patterns, or directly manipulate users' behaviours being Dark Patterns (Section IX). As designers tackle increasingly complex problems, it becomes important to establish an approach to responsible design SEs and S.PSSs. Figure 1 shows how different concept spaces overlap with one another.

In essence, this thesis aims to contribute to the understanding of the relationship between SEs, S.PSSs, and Dark Patterns addressing ethical implications within and across their design processes. By providing a comprehensive analysis of the topic illustrated so far, this thesis will inform design practitioners about their accountability in creating deceptive digital experiences while providing an approach to responsible design safer digital interactions.

Figure 1. Concept Map

3. RESEARCH PROCESS

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The research process that led to the final version of this dissertation could be summarised in two distinct moments: on the one hand, a literature review on the topic of Dark Patterns, resulting in a short paper delivered for a curricular exam in the M.Sc. program in Product-Service System Design at Politecnico di Milano; on the other hand, a literature review on Smart-Product Service Systems (S.PSSs) probing the state of the art in the domain. In addition, an update of the literature review on Dark Patterns was performed in parallel to the second step in order to expand knowledge about the topic with a more detailed scan of the literature available. The following paragraphs illustrate each step more thoroughly.

3.1 LITERATURE REVIEW ON DARK PATTERNS

I came across the topic of Dark Pattern during a lecture performed by R. Chianella during the class of Service Design & Innovation held by prof. M. Mortati (Tutor: C. Schillizzi) at Politecnico di Milano (A.Y. 2021-2022). The selection of papers suggested during the lecture helped to build a general understanding of the topic as well as define the keywords used within the academic database "Scopus" (Table 1). Therefore, the adopted keyword combination is "Design Patterns," "Dark Patterns," "Human-Computer Interaction"; conversely, "Light patterns," "Bright patterns," and "HCI" were eliminated since Scopus showed, after their addition, either no results or no significant improvements in the filtering of the references. At this point, a temporal approach was applied, which consisted in reading and analysing the references from the very first articles to the latest ones. This step was essential for understanding the basic terminology concerning the topic and the evolution of the research agenda through time. In addition, a secondary scan of the specific references in each paper was performed to go further in depth to understand the connections between different topics and reveal intersections with additional domains of knowledge. Finally, the list of references provided by darkpatterns.org was consulted - considering solely academic articles and excluding magazine articles - to consolidate the knowledge already built so far. The articles were all printed on a paper support which enabled taking notes in the margins and collecting insights later reported on a digital support[1]. Hence, a concept-centric approach was adopted, which identifies the main concepts while highlighting their connections (Weber & Watson, 2002). The output of the first step of the research was a short paper[2] which highlighted a significant gap in the knowledge concerning Dark Patterns within highly digitalized interactions. Therefore, the preliminary literature review was significantly expanded during the second step of the research process.

[1] https://polimi365-my.sharepoint.com/:x:/g/personal/10683961_polimi_it/Ee6y-9YMkOdNmp5qJOulXNoBI5C_xXD7H-qQVw6_rS464A?e=ATEGCE

[2] https://polimi365-my.sharepoint.com/:b:/g/personal/10683961_polimi_it/EXExOq3muVdJo8vJrc719HwBHHXul5c6LWFg2BZeiWSHhA?e=hWZnCP

Table 1. References consulted the first step of the research.

1. Suggested readings	2. Early articles	3. Keywords scanning	4. Secondary scanning	5. darkpatterns.org
Attfield et al., 2011; Bösch et al., 2016; Luguri and Strahilevitz 2021; Verganti et al. 2020; Widdicks et al., 2020	Brignull, 2010; Brignull 2015	Booth et al., 2020; Chivukula et al., 2019; Fitton et al., 2021, Bongard-Blanchy et al., 2020, Moser et al., 2020	Bardzel and Bardzell, 2013; Bardzell et al., 2012; Berdichevsky and Neuenschwander, 1999; Fogg, 2009; Lockton, 2012; Chivukula wt al., 2018; Friedman et al., 2002	Narayanan et al., 2020; Gray et al., 2018; Lockner and Bonnardel, 2015; Maier and Harr, 2020; Chivukula et al., 2018; Fansher et al., 2018

3.2 LITERATURE REVIEW ON SMART-PRODUCT SERVICE SYSTEM

Table 1 shows that the topic of DP has been increasingly iTable 1 shows that the topic of DP has been increasingly investigated over the last years, with nine papers published between 2020 and 2021 compared to five papers published between 2018 and 2019. Meanwhile, significant research shows that services are increasingly mediating people's everyday lives, and these services are increasingly becoming digitalized with machines with higher degrees of autonomy. However, at present the relationship between Dark Pattern and the domain of knowledge of Smart Product-Service Systems (SPSS) is still under researched. Therefore, a literature review on S.PSSs was conducted with the aim of understanding the topic, then the two previously distinct domains of knowledge were cross-referenced, which finally contributed to the enrichment of knowledge with the synthesis of an apprach to responsible design S.PSSs for the practice of design. In the first step, a research on the database "Scopus" was performed with the keywords "Smart-Product Service Systems" and "Literature review". The literature review by Carrera-Rivera et al. (2022) was chosen as the most recent and therefore arguably the richest and most informed. The analysis of this paper led to the definition of two key constraints. First, temporal boundaries were defined between 2013 and 2022 with the former being the year when the notion of S.PSS was formalized; second, a clear set of keywords was defined: "Smart services", "Smart product-service systems", "IoT", "Internet of Things". At this point, design conferences and journal databases were selected, taking into account that a minimum of four is sufficient to perform a robust literature search (Romero et al., 2020). The reviewed databases consisted of a mixture between conferences, to capture the most recent notions, and journals, to intercept more structured knowledge (Table 2). The databases were manually consulted with a first selection based on the scanning of the abstracts according to the keywords identified, which led to the selection of 151 papers. These were read on a digital support and the most relevant information was transcribed in an Excel research

database, which acted as a knowledge management tool. During the analysis, 16 papers were found not coherent with the scope of the research, consequently they were eliminated. The strategy to analyse the second set of papers is coherent with the previous research as the articles were all read on a digital support to take notes in the margins and collect the most relevant insights which were later reported on the literature review database (see note 1). Hence, a concept-centric approach is adopted which identifies the main concepts, while highlighting their connections (Weber & Watson, 2002).

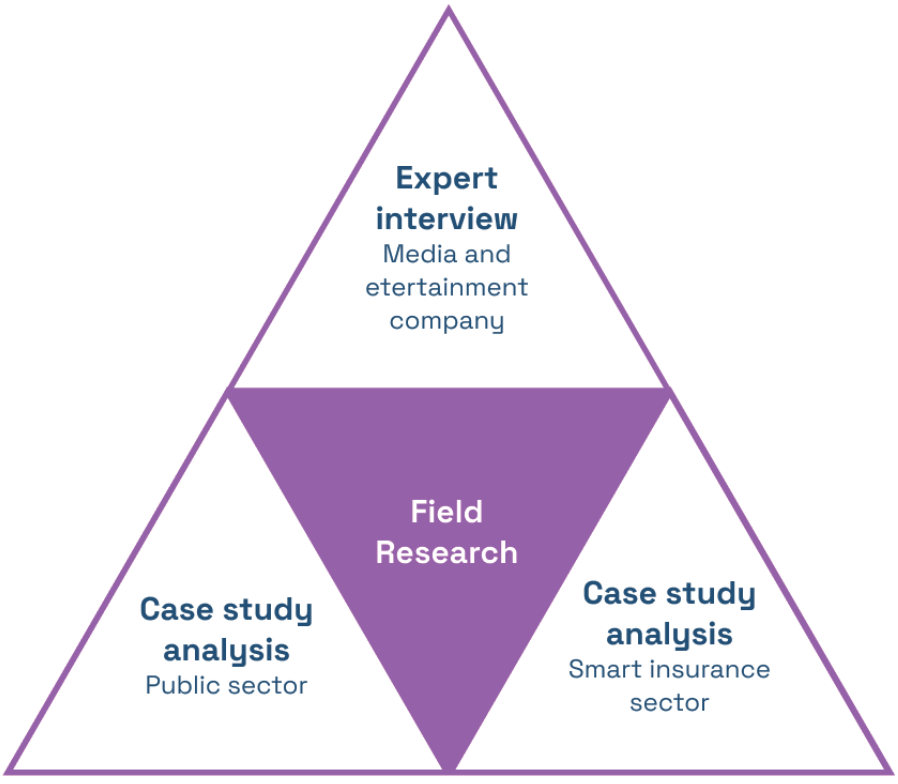
Table 2. Journals and conferences reviewed.

Reserach	Conferences	Journals
Primary	International Design Conference, Design Research Society Conference, International Association of Societies of Design Research	Design Issues, International Journal of Design, European Academy of Design, The Design Journal, Journal of Service Research, She Ji: The Journal of Design, Economics, and Innovation
Secondary	Conference on Industrial Product-Service Systems	Computers in Industry, Journal of Marketing, Journal of Marketing & Management, European Management Journal, Journal of the Academy of Marketing Science

3.3 CASE STUDY ANALYSIS

The literature review highlighted that scholars proposed a turn to practice suggesting to engage with the design complexity of practitioners rather than attempting to frame designer behaviours only or primarily through extant academic models or theories (Grey et al, 2018). Therefore, two case studies are analysed in order to cross-reference theoretical knowledge with emerging in-field information (Figure 2). The first case study illustrates the project that I followed during the compulsory internship for the M.Sc. program in Product-Service System Design at Politecnico di Milano. The project consists in the complete redesign of the information technology (IT) architecture of a major Italian public agency. The case study is particularly relevant for this dissertation as the literature review highlighted that solutions adopted at the back-end architectural level significantly constrain design possibilities at the front-end stage. On top of that, it is interesting to deduce useful guidelines for trust as the public sector should have the highest level of transparency concerning decision-making processes. The second cases study was chosen within the private sector in order to compare and contrast insights from the two different scenarios. It concerns a black box used by an Italian car insurance company where the front-end interaction patterns with users revealed significant impacts on their behaviour. In addition, it is interesting to deduce what are the decision-making drivers within the private sector. Finally, the findings of the literature review have been cross-referenced with the insights emerging from the case study analysis which informed the guidelines for responsible design of S.PSS, thus limiting manipulations and deceptive techniques impacting users' behaviour.

Figure 2. Case study map



4. THE RELATIONSHIP BETWEEN HUMANS AND MACHINES

The first chapter introduces the theoretical frameworks that describe the relationship between humans and technology. It has long been believed to be a mono-directional exchange with humans crafting tools to accomplish specific needs. However, recent years have brought technologies that are incumbent in most aspects of people's everyday activities, increasingly autonomous, and with higher levels of agency. As such, previous conceptualizations of the human-machine relationship are beginning to crumble while new frameworks are emerging, recognizing a relationship based on a multi-directional collaboration.

Human beings are merely one way of being in a mesh of strange strangeness (Timothy Morton).

4.1 A SERVICE ECOSYSTEM PERSPECTIVE TO MAKE SENSE ABOUT HUMAN-MACHINE INTERACTIONS

Service design is conventionally thought of as the act of conceiving, developing, and implementing services within a context. However, design has progressively broadened its original purpose. In fact, the design discipline moved from tweaking parts of the service system in isolation to an activity which works with the complexity of the system as a whole (Vink et al., 2021). More specifically, while the design of services configuration deals mainly with touchpoints and interfaces, the design for service approach is conceptualized as an engine for wider societal transformations, influencing socio-material configurations (Vink et al., 2021). Traditionally, the “social” and the “material” parts have been conceived as two separate entities. Academic research focused on the optimization of separate human and autonomous components (Miller, 2016), with much more attention being paid to increasing the capabilities of the latter (Kyle & John, 2016). Chapter 5.2 shows that Internet of Things (IoT) products have developed following a primarily functionality-dominant logic, which conversely led to low levels of adoption. In fact, Kyle & John (2016) note that the deep focus on the improvement of technical capabilities within autonomous agents left little to no consideration about how these capabilities will interact with human operators, which often led to poor coupling of human-machines teams. Thus, the question of participation becomes central within service development practice. In fact, recent research has stressed the need for an even broader participatory service design process that emphasizes the involvement of extended networks of both customers and providers (Vink et al., 2021). Furthermore, the design for service approach enlarges the question of participation, recognizing the agency of all actors who are able to intentionally influence how service ecosystems evolve through reconfiguring the institutional arrangements. Vink et al. (2021) advance four propositions for service ecosystems:

- service ecosystems do not have an equilibrium steady state but rather adapt to instabilities by enacting forms that are uncertain and unpredictable; therefore, due to the emergent and phenomenological nature of the desired forms of value cocreation, the outcomes of service ecosystem design are never fully controllable or predictable;
- service ecosystem occurs through the shaping of not only the physical enactments but also the inseparable, invisible institutional arrangements enabling and constraining value co-creation;
- actors are involved in ongoing institutional reproduction, and intentional shaping of institutional arrangements which leads to embedded feedback loops of reflexivity and reformation;
- service ecosystem aligns with emerging design literature that suggests that everyone designs, it is a collective endeavour by multiple actor constellations influenced by ongoing interactions.

Academics point out that the field simply has not solved certain challenges yet. In the first instance, the prosthesis approach is crumbling as it defines the scope of autonomous systems to either compensate for or overcome the limitations of a human user. It was synthesized within the Dartmouth Manifesto (1955) compiled by the group of scientists which will later formalize the field of Artificial Intelligence. They believed that machines could solve the kinds of problems that had previously been the domain of skilled humans, without considering if/how these machines would interact with people (Kyle & John, 2016). Miller (2016) points out that the issue with technological solutions does not lie in the possibilities of newer developments, but rather in the way that human beings reason and how they create and direct machines to act as proxies. In fact, computers are always programmed from a cultural perspective that is not universal, within any given cultural system there are not simply unanticipated challenges but also conflicts of values, and eventually systems created from cultural perspectives will very often operate in intercultural contexts (Miller, 2016). To sum it up, limits exist on both the human and the machine sides, with autonomous systems bounded as well (Kyle & John, 2016).

Many academics propose a collaboration-based paradigm between humans and technologies. In order to sustain the collaboration paradigm, Kyle & John (2016) propose the seminal example of the Artificial Intelligence DeepBlue which was able to defeat the chess Grand Master Garry Kasparov; however, Hydra – a supercomputer specifically trained to play chess – was eliminated before the semi-finals with three of the four semi-finalists consisting of Grand Master-led teams equipped with supercomputers. It should be acknowledged that this new relationship paradigm does not come without issues to consider. Nousala (2016) reinforces that within the collaboration paradigm ill-defined problems arise which rely upon an elusive political judgment for resolution. In fact, every interaction between humans and machines becomes negotiated which may cause conflict and even cause harm to achieve a measure of satisfaction (Miller, 2016). This approach is also referred to as “multistabilities”, which implies that technological artefacts can potentially evoke different forms of use and human relations; they may invite certain kinds of actions, enable some forms of involvement and engagement, while inhibiting or discouraging others (Pandey, 2018). In this scenario, establishing an responsible approach to shape a positive collaboration becomes critical to the success of human-machine(s) teams. It is even more important in the context of sociotechnical systems where multiple agents must collaborate to solve complex or wicked problems (Kyle & John, 2016). Generally, speculation on wicked problems relies on the assumption that there are solutions to this class of issues (Nousala, 2016) and much of the debate is about formalising theoretical frameworks in order to rationalise a phenomenon.

Collaboration with autonomous systems comes with no shortage of questions to be answered. Most importantly, a broadened public discussion about collaboration in sociotechnical systems (Nousala, 2016) is necessary. For instance, it is important to make gaps in machine learning and interpretation more transparent by presenting unintentional and erroneous transcriptions and responses (Pandey, 2018). In general, wider participation within the design process should come with deeper reflections on responsibility. In fact, the more actors participate in design

processes, the tighter the audit and scrutiny becomes as the public is primarily responsible for the outcomes. In essence, participation should elicit a wider reflection on the notion of public accountability of design. In fact, many academics raise the question of public accountability over black-box technologies advocating the need to shift from a human-in-the-loop to a society-in-the-loop paradigm. The former aims to embed an individual's judgement into AI systems, while the latter is a method for considering the general will of the public and embedding it into an "algorithmic social contract" (Liu & Pschetz, 2018).

The more-than-human-centred design approach tries to address some of the issues new and innovative technologies force society to confront. However, what are the origins of the more-than-human-centred approach? And most importantly, what are the characteristics of this new approach?

4.2 TOWARDS A MULTI-DIRECTIONAL HUMAN-MACHINE INTERACTION MODEL

The socio-technical ecosystem perspective showed an increased number and nature of actors involved within design processes. Nowadays, there are more fluid flows of interactions between people and processes, as well as between people and the systems of things mediating such processes; there are autonomous or semi-autonomous entities that increasingly do business with humans and with each other which results in societal effects that are either unintended or undesirable in democratic societies (Giaccardi 2020). A framework to rationalise this new phenomenon is needed indeed. More and more people express deep concerns and even fears based on increasing tech scandals and manifestos; meanwhile companies are increasingly concerned with how to anticipate unintended outcomes of the systems they design (Giaccardi 2020). As well, many academics criticize the Human-Centered-Design mantra as it reduces complexity by effectively shielding the user from seeing hidden networks of machines and machines-machines networks. This shielding gives rise to contradictions often in the form of depriving users of their privileges and affordances from devices or services that they encounter (Akmal & Coulton, 2020). Giaccardi (2020) further stresses that the radical rupture these technologies bring to design is often hidden by making them appear in familiar form; for instance, the smartwatch is not a watch anymore.

In this context, theoretical frameworks started enlarging the perspective from a Human-Centred-Design paradigm to a More-Than-Human-centred design approach. Industrial and technological sectors rest on the notion of Human-Centred-Design where the conceptualization of technology standing by for us accurately describes the relationship between a person and a tool (Liu & Pschetz, 2018, Giaccardi, 2020). Heidegger (1947) already instantiated the widely known example of the hammer passively waiting to be used. Nowadays, it is generally recognized that the understanding of smart consumer technology itself has

largely remained feature-centric, which too easily reduces the role of products to instrumentality (Pandey, 2018). For instance, Liu & Pschetz (2019) note that Asimov's Three Laws of Robotics (1950) are inherently human-centric as they seek ways to maintain the human-centred social order. Therefore, many academics argued the necessity of going beyond Human-Centred perspectives which do not account for the non-neutrality of machines and still views end-users as passive recipients (Akmal & Coulton, 2020).

The more-than-human-centred design approach is grounded in the discussion about post-phenomenology which retains classical phenomenology's focus on human experience; however, it critiques its alienation-centric view of technology as it opts instead to think in terms of mediation. For instance, algorithms do not merely remember the image descriptions from the training data but infer the relationship between the description and the objects in an image (Pandey, 2018). Post-phenomenology rejects correlationism which views things as only real insofar as they are perceived by human subjects (Coulton and Lidnley, 2019) as it fundamentally recognizes the non-neutrality of technology in mediating human-world relationships (Lindley et al., 2019). In essence, technology is not just material but a participant, so the point is not designing for these technologies but designing with them (Giaccardi, 2020). Implications of post-phenomenology theory are starting to be investigated in real scenarios. In fact, according to Lindley et al. (2019), people have started to engage with affective dimensions of digital network technologies including anxiety, exhaustion, overstimulation, overload, paranoia, unease, distrust, fear, and creepiness. In essence, more-than-human sees machines as active subjects (Liu & Pschetz, 2018) rather than passive objects.

However, how can the existence of more-than-human designs be defined? According to the post-phenomenology framework, existence of smart artefacts and their material composition could be seen both in terms of presence-absence (use) and absent-presence (networks). The duality implies a newly acquired importance of the material artefact which interacts with the users (presence) as well as the interactions between this object and its

network (absence). In essence, the material composition should also be considered as a hybrid of physically and remotely present materials (Pandey, 2018). The notion of networks implies that machines may have social organisations that are independent from humans which led Liu & Pschetz (2018) to split the notion of autonomy into two aspects:

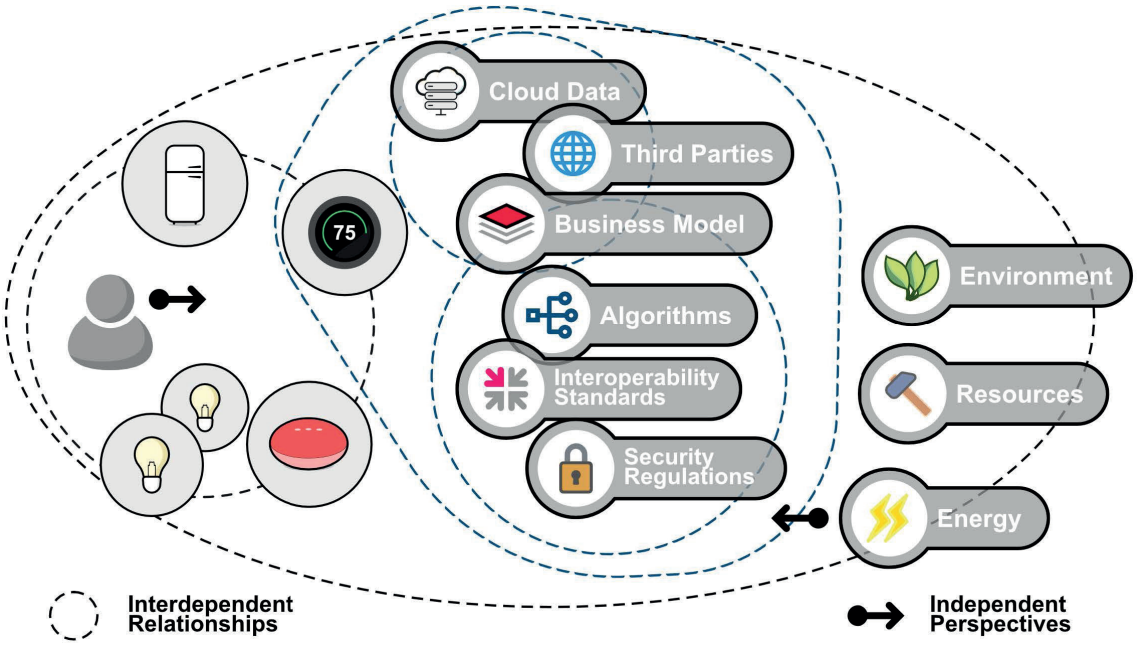
- Interactivity, which means the agent and its environment (including other agents) can act on each other;
- Adaptability, which means the agent's interaction can change the transition rules by which it changes its state.

In essence, objects around us have lived lives of their own (Akmal & Coulton, 2020), a complexity that the reductionist view of HCD simply cannot encompass. This position is also referred to as Ghost in the Machine by Lindley et al. (2019) which is consistent with the duality of presence-absence/ absent-presence illustrated previously. According to Akmal & Coulton (2020), the HCD mantra reduces complexity, thus effectively shielding the user from seeing hidden networks of machines and machines-machines networks. It gives rise to contradictions often in the form of depriving users of their privileges and affordances from devices or services that they encounter (Akmal & Coulton, 2020). However, a thing ought to relate to a number of other things and a more-than-human-centred design will have to be based on how to manage, present, and negotiate many different relationships in parallel, without a particular one being privileged over the others (Giaccardi, 2020).

Actor-network theory embraces the complexity instantiated by the more-than-human framework. In fact, it proposes the metaphor of "constellations" (Figure 3) where each device, actor, and service become a stakeholder within a network (Akmal & Coulton, 2020). This approach ultimately de-centres the human user. Actor-network theory takes the focus away from the human user and presents foci on the myriad things that entangle themselves within a networked system (Akmal & Coulton, 2020). However, things might also demonstrate hidden agendas, unclear agency, and inconsistent design choices that conspire

to undermine the needs of their users (Coulton and Lindley, 2019). Furthermore, actor-network theory cannot be conceived without an object-oriented-ontology (OOO) whose theoretical breakthrough consists of being a flat ontology, with humans and non-humans having equal footing, a position that is also referred to as parliament of things or democracy of objects (Akmal & Coulton, 2020).
The multi-directional exchange between people and human(s)-

Figure 3. Visualization of a possible constellation of IoT products (Coulton & Lindley 2019)



machine(s) introduces the notion of feedback loops, a possibility already encompassed by the socio-technical ecosystem perspective where these contribute to structuring the institutional arrangement within the network. Feedback loops also enable things to become co-ethnographers and co-designers by encouraging people to learn from each other, try different combinations and

develop shared norms of what might be considered normal and socially acceptable strategies (Giaccardi, 2019). Still, Giaccardi (2019) reports an experiment where domestic artefacts were hacked and transformed into connected things by makers themselves with the goal of opening up their design space to new sources of inspiration. Objects become Sensers who observe and make suggestions through streams of data visualizations that feed the design process of makers, inspiring them to unanticipated home improvements (Giaccardi, 2019). Thus, design enters an uncharted territory, becoming a probabilistic process that collapses distinctions between design and use, subject and object, and producer and produced (Giaccardi, 2020). It might be argued that probing becomes the fundamental attitude of design. Therefore, design ought to be predicated on what it might become as opposed to what it should be (Giaccardi, 2020).

A probing dominant logic has major implications on the issue of ethics. According to Giaccardi (2020), ethics is the basis of what is considered good, useful and even beautiful (Giaccardi, 2020). Furthermore, Liu & Pschetz (2018) note that as of today actor-network theory attracts no shortage of criticism for its lack of attention to moral issues. More specifically, moral agency is defined as one's ability to make moral judgments based on some notion of right and wrong and to be held accountable for those actions which shift the question from cognition to visible behaviour (Liu & Pschetz, 2018). Considering the service ecosystem perspective, the discourse about ethics ought to break through the boundaries of functionality towards encompassing the complexity of the multitude of possible interactions between humans and machines. In fact, Giaccardi (2020) highlights that the primary ethical-aesthetical dimension is related to what things are and how they come to present themselves,; it is not primarily about functionality in the local sense anymore, it is about the interactions between us and our things, and indeed between our things and other things without us being aware of the exchanges taking place. Thus, according to Giaccardi (2020), the relationship between human-machine(s) becomes a co-performance as things need to be designed so they can perform

next to people in ways that are sensitive and responsive to the human condition; in other words, in the interest of people and the environment with a threefold set of characteristics:

- openness, as things need to be designed so they become other things;
- variety, as things need to be designed so they become something more;
- configurability, as one thing can become more things by horizontally connecting to other products and services across broader ecosystems.

At this point, a deeper meaning of public accountability of technology can be outlined as not only developers but also technologies themselves might be held accountable for the outcome of the decisions they make and how data is shared and critiqued throughout the networks (Giaccardi, 2019).

In conclusion, the relationship between humans and machines highlights that the novel opportunities provided by network technologies come hand-in-hand with equally novel and cross-cutting challenges (Lindley et al., 2019). Especially because technologies are used to co-shape human-world relationships making practices and experiences possible, they play an active role in the way humans can be present in their world and vice versa (Pandey, 2018). Moreover, the representations and notifications presented to users are not the direct/raw captured data stream; rather, they contain interpretations and visualizations that are intended to help users make sense of the data (Pandey, 2018) And most importantly, the assumption that it is even possible to comprehend the perspective of some non-human object is still to be validated (Lindley et al., 2019).

Chapter four illustrated an overview of the most recent theoretical frameworks that attempt to rationalise the relationship between humans and machines. However, what are the new and innovative technologies that characterise the infrastructure of a more-than-human network? And most importantly, what are their limitations?

5. UNDERSTANDING THE TECHNOLOGICAL INFRASTRUCTURE UNDERLYING HUMAN-MACHINE INTERACTIONS

Having discussed the relationship between humans and technology in the previous chapter, it is now time to introduce the technical components that contribute to building that exchange. The technological infrastructure which modern society is built upon includes communication networks, mobile devices, computers, servers, and other technologies that support digital applications and services. New emerging technologies, such as artificial intelligence, blockchain, and the Internet of Things, are also transforming how people live and work. There is a wide consensus on the notion that new technologies have the potential to dramatically change, or at least influence, society.

However, in order to understand the impact that might be generated by these changes, it is imperative to have some degree of literacy about the underlying mechanisms that power these technologies. Hence, chapter fifth outlines the most innovative technologies that are increasingly powering objects and services that people access on a daily basis. The review has been conducted with a critical point of view as each sub-chapter also illustrates key open points and criticalities brought by the spread of these technologies.

5.1 AUTHONOMY THROUGH ARTIFICIAL INTELLIGENCE

After World War II (1939-1945), academics argued for the development of technology that would promote the application of science to the needs and desires of man (Pilling & Coulton, 2019). This position was later formalized within the Dartmouth Manifesto in 1955 by cognitive scientist John McCarthy and his colleagues who were establishing the field of Artificial Intelligence (AI) (Kyle & John, 2016).

Tracing the milestones within the journey of AI sheds light on the influence of politics, media and science. In fact, the development of AI is as interesting as it is complex, with phases of vivid interest from scientists, politicians, and the general public, subsequently followed by cycles of hibernation mostly promoted by dystopian scenarios envisioned by fiction literature and the media. Academic research produced the first Chat-bot in the 1960s: the chat-bot, Eliza, would interact with users imitating therapy sessions. Meanwhile, 1968 was the year when the movie “2001: A Space Odyssey” was released which depicted a quite complicated relationship between humans and technology projected in a futuristic scenario (Pilling & Coulton, 2019). However, the same decade also brought the first disillusionment with AI, as it appeared that AI was failing the ambitious promise of surpassing human intelligence. Consequently, funding was reduced except for military application solutions worth considering in order to gain a competitive advantage against the USSR while the Cold War was at its peak (Pilling & Coulton, 2019). The 1970s were a decade rich in stimuli from the media - the Star Wars saga, for instance - but the AI winter actually ended in the 1980s. In the 1980s, more simplistic and less ambitious AI systems than the speculative solutions proposed in previous decades, started to be implemented in services. Subsequently, the 1990s were characterized by a giant step by computer-kind with the defeat of chess champion Gary Kasparov by IBM’s Deep Blue. The peak of activities came in the 2010s when breakthrough discoveries in voice recognition brought AI right at the frontline interaction level

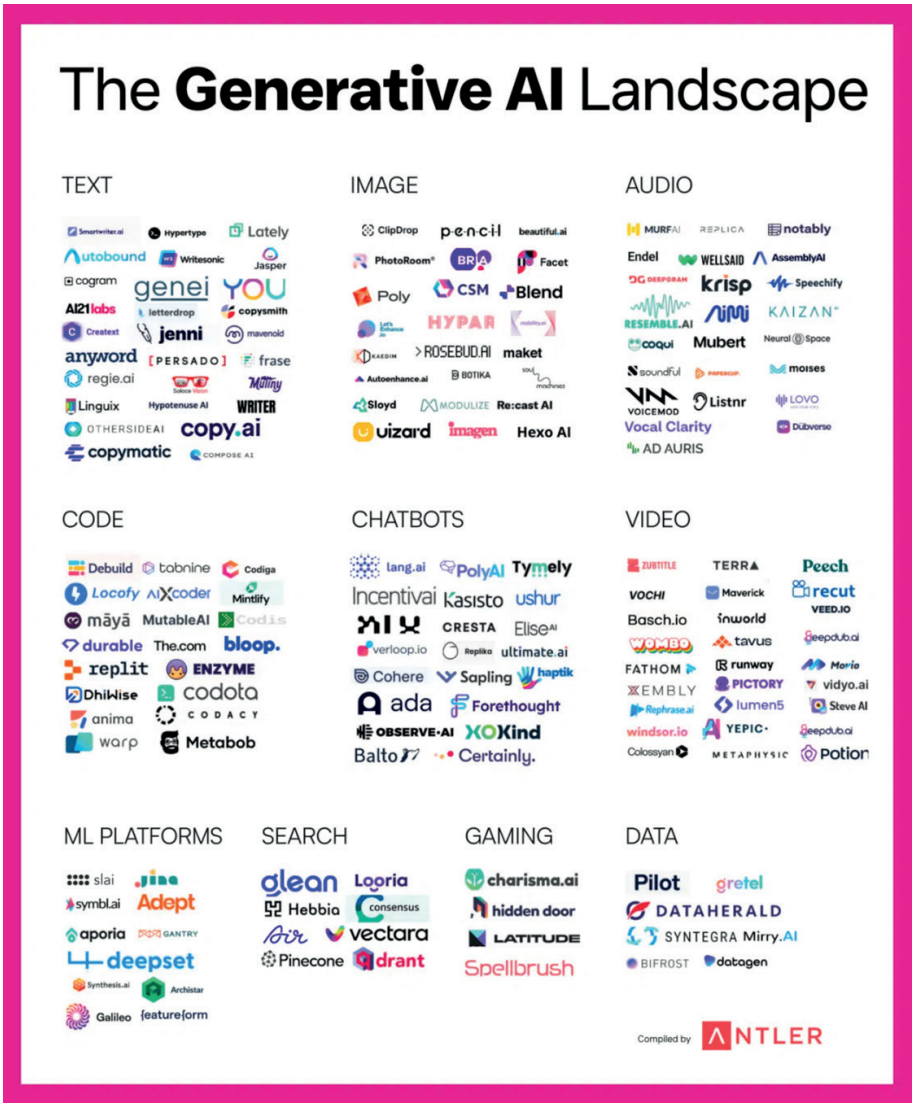
with end users due to chat-bots and conversational agents such as Siri, Alexa, Cortana, etc. (Pilling & Coulton, 2019).

The field of AI continues to evolve as it is not an emergent technology anymore. Having outlined the development of the field, it is now time to characterize the components of the AI technology, its promise, and some open points. According to Stoimenova & Price (2020), three types of AI are expected to emerge:

- narrow AI, which is expected to automatise routine tasks, it is bound to a specific field and is incapable of performing tasks outside a pre-programmed scope;
- general AI is defined as systems with the ability to match or exceed the intelligence of humans in virtually all domains of interest;
- finally, artificial super-intelligence agents – or simply artificial superintelligence - whose intelligence is expected to reach far beyond the collective capabilities of all renowned human experts in knowledge fields.

As of today, narrow AI is considered to be achieved (Stoimenova & Price 2020). In fact, the years 2021-2022 have seen massive releases of AI agents that are able to automatise effort-intensive and time-consuming repetitive tasks. Figure 4, although not comprehensive, provides quite a rich list of tools mostly concerning the design realm, including some open source offerings.

Figure 4. Recent releases of AI agents from https://justcreative.com/best-ai-tools/



Conversely, General AI is increasingly being deployed within the services that people access on a daily basis, for instance, recommendations systems by Netflix and Spotify (Verganti et al., 2020). Finally, as far as artificial super-intelligence is concerned, the opinions are generally split into two clusters: on the one hand, many prominent entrepreneurs, scientists, and philosophers, such as Bill Gates, Stephen Hawking, Elon Musk, and Sam Harris believe that this scenario leads to human extinction; on the other hand, others speculate an emergence of a post-human race which evolves by amplifying human cognitive capabilities (Stoimenova & Price 2020).

Artificial super-intelligence blurs the boundaries between the digital and the biological sphere. Identity becomes deeply enmeshed in a nonbiological matrix of machines, tools, codes, and semi-intelligent daily objects; these are becoming less like tools and more like part of an extended mental apparatus and such depth of knowledge initiates the transition from highly personalized experiences to personalized realities (Stoimenova & Price 2020). As Hollebeek (2021) puts it, Industry 4.0 – a synonym often used to characterise a bundle of new and innovative solutions – is characterized by a fusion of technologies that blurs the lines between the physical, digital, and biological spheres. According to Hollebeek and Huang & Rust (2021), AI can be characterized into three major categories:

- robotic process automation (RPA), whose linear algorithms are used to answer basic queries through sensor-based signals, also referred to as mechanical intelligence;
- machine learning (ML), whose algorithms auto-adapt or “learn” through trial-and-error without human intervention in order to understand, respond to, and pre-empt customer needs or behaviour, also referred to as analytical intelligence;
- deep learning (DL), whose algorithms incorporate artificial neural networks mimicking a biological nervous system, approximates human thought-processing and decision-making where each successive layer draws on the output from the previous layer as its input; also referred to as intuitive intelligence.

Therefore, it is possible to draw a parallel between narrow AI and RPA, general AI and ML, and artificial superintelligence and DL. However, it is widely recognized that the more elaborate Artificial Intelligence becomes, the less transparency it offers to its underlying decision-

making processes. Iaconesi (2017) points out that in algorithmic governance of processes, technological entities assume progressively higher degrees of agency and opacity. Transparency to a human operator mostly concerns the training methods used to build up algorithms. In fact, there are different approaches to train AI algorithms (Verganti et al., 2020):

- supervised learning, where the first step is to create (or acquire) a labelled data set,split the set between training and validation, and compare the algorithmic model's prediction of the outcome to the validated labelled outcomes in order to determine the validity of model's error between prediction and expert;
- unsupervised learning, whose primary application is to discover insights in data with few preconceptions or assumptions in order to find "natural" groupings in the data, without labels, and uncover structure that may not be obvious to the observer;
- reinforcement learning, which requires only a starting point and a performance function as the system is trained to start somewhere and probe the space around the starting point, using as a guide whether it has improved or worsened the performance of the algorithm.

It is important to note that the key trade-off in reinforcement learning is whether to spend more time exploring the contextual complexity beyond the current understanding or exploiting the model built so far to drive decisions and actions (Verganti et al. 2020). In afct, as the more time we spend exploring, the more we will be convinced we have the best way down, but if we spend too long exploring we will have less time to exploit the information and actually walk down (Verganti et al., 2020).

Opacity in decision-making could happen "by design" or "by default": in the former case, the constraints of the technology obfuscate processes, while in the latter policies concerning intellectual property shield public accountability. These conditions might sometimes work in pairs, which leads to the emergence of the notion of "black box technologies". Nowadays, the underlying operations relating to AI and the data collection and processing by these networked products and services are predominantly obfuscated (Pilling et al., 2022). The idea of black box technology seems to originate from the Second World War, where the term was used to refer to the gun sight carried on Flying Fortresses (a type of aircraft) which incorporated hidden components that corrected

for environmental variables: while the crew probably knew little of how the device worked, they certainly knew how to use it and were critically aware that it may be crucial to survival (Manohar & Briggs, 2018). Public accountability becomes crucial for the notion of black box technologies, especially when those technologies increasingly permeate services and are continuously reported to have shortcomings and biases. For instance, O'Neil (2017) notes that AI-aided sentencing in courtrooms has been repeatedly shown to infer stricter sentences based on racial biases. In essence, when technologists lack full understanding of how decisions are made from within these black boxes, the workings of the mathematic models and algorithms have to be made more transparent, comprehensible and accountable (Manohar & Biggs, 2018).

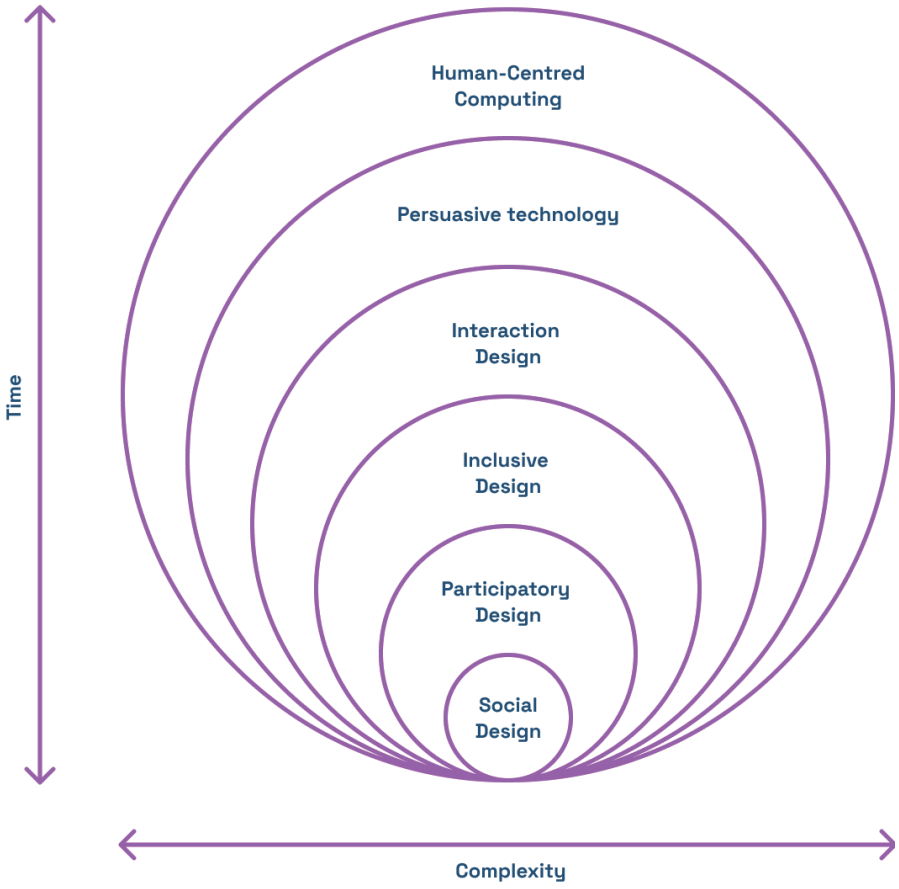
Moreover, many academics note that design is becoming more and more strategic within organizations. As well, designers are moving upstream in the design process (Verganti et al., 2020), collaborating more and more with data experts which urges design curricula to quickly embrace these changes and build design expertise concerning data. In fact, it is widely accepted that designers need to become experts in the technologies they use (Manohar & Biggs, 2018). One thing is clear: new technologies are putting designers in the view of policymakers (Manohar & Biggs, 2018), even though policies often evolve more slowly than technological development (Aurchenhammer, 2020). At this point one question becomes apparent, how should designers make sense of these new technologies? More specifically, which frameworks should designers apply to approach the topic of AI?

Human-Centred-Design has nowadays a long-standing history, having been first formalised by Don Norman in the 1980s. Recently. there have been attempts to apply the notion of Human-Centred-Design to AI which become more urgent considering O'Neil findings highlighted in the book *Weapons of Math Destruction*. Thus, creating the notion of Human-Centred Artificial Intelligence has been proposed.

Human-Centred Artificial Intelligence is based on the hypothesis that technology is interdependent of political, ideological, and cultural assumptions of a society that give rise to it (Aurchenhammer, 2020). This hypothesis appears to be even stronger considering the More-Than-Human framework previously illustrated. In fact, Auchenhammer (2020) suggests different strategies to design with new technologies (Figure 5):

- social design focuses on the designers' role in society and their responsibilities in the choices made that impact society (a dimension already emphasized by Papanek in his seminal 1973 book *Design for the Real World*). In essence, social design views the designer as the translator of societal needs into an AI system design;
- participatory design, which might overcome the isolated viewpoint of the designer focusing on the democratization of participation in systems design. However, it only represents the design space for the period of the project;
- inclusive design, which is an approach that includes and considers the needs and behaviours of diverse groups to accommodate in the designed artefact individual differences (physiological, psychological, and sociological);
- interaction design, which focuses on understanding and designing human-machine interactions by examining people's behaviour, actions, and cognitive processes occurring within the instances of exchange;
- persuasive technology, which is the approach that attempts to intentionally change human attitudes, behaviour, or both through the use of technology. Subsequent chapters detail the techniques and shortcomings within this design space;
- finally, human-centred computing where intelligence is viewed as an attribute of the combination of human-machine-context. Thus, collaboration becomes the new paradigm which is consistent with the More-Than-Human framework.

Figure 5. Designing for Artificial Intelligence strategies from Aurchenhammer, 2020



Although there is a wide range of approaches for the designers to choose from according to the context and the specific project, involving people in the design - by the admission of the very author - does not necessarily mean that they are "centred" (Aurchenhammer, 2020). The More-Than-Human framework further problematises the space by actually proposing to

decentre humans after all as other actors might deserve to be centred. Finally, it is worth noticing that AI is not objective nor neutral as bias transpires when AI reflects the implicit values of human actants who participate in the coding and the selection of data for the training of algorithms (Pilling & Coulton, 2019). Algorithms are presented and marketed as objective facts, although they could be more accurately described as opinions embedded in maths, working for the people and the powerful who build and implement them (O'Neill, 2016). In essence, AI is indeed a powerful opportunity provided that it is developed with proper governance. This is the reason that pushed the EU to start discussions on the so called "AI act"[3], recently approved, in order to offer development guidelines and regulate the space.

[3] https://artificialintelligenceact.eu/

It has been shown that AI is strictly linked to data. In fact, there would be no AI algorithms without huge amount of training datasets. Therefore, the question becomes: where do these datasets originate? How they are being manipulated?

5.2 THE INTERNET OF THINGS AS A NEW ARCHITECTURE OF DATA GENERATION

The opportunities and impact of AI become apparent when used within IoT systems. Although IoT was an emergent topic in research twenty years ago (Koskun et al., 2018), many academics have diagnosed low level of adoption by users in the real world, identifying as a cause in the excessive focus over technology-push rather than a market-pull innovation which considers the needs and skills of users (Peruzzini et al., 2014, Chuang et al., 2017, Pilling et al., 2019). In fact, many academics proposed studies that compare the functionalities of IoT artefacts with users' expectations. Consumers generally perceive IoT products as risky in terms of privacy and security (Roy et al., 2019). On the other hand, IoT has been a huge success in industrial endeavours (Funk et al., 2018) which unsurprisingly motivates how many of the benefits highlighted in research are mainly functionality oriented. These include benefits such as energy consumption reduction (Peruzzini, 2014), cost reduction, time-saving (Roy et al., 2019), safety improvement (Chuang et al., 2017), assisted living (Koskun et al., 2018) and many more. In fact, a significant number of IoT features are beneficial and attractive, but many functions are not desirable (Kim & Baek, 2014). In order to illustrate this duality, academics often propose the seminal example of the smart fridge. Although it could lead to food waste reduction by remembering the expiration date of the stored food, it also introduces friction during the interaction with end users as they have to manually scan all the food items. In essence, it could be argued the technological infrastructure is ready; however, there is a lack of support for user behaviours in terms of interaction and experience design.

In general, previous IoT studies focus on single atoms without adopting an integrated or systemic perspective. In fact, Peruzzini (2014) notes that products are developed separately which means that the simulation of a smart home environment (where many systems must be integrated) is poor from the very design phase. However, other academics stress the fact that the smart home

is no longer merely a prototype under evaluation in laboratories (Chuang et al., 2017). Therefore, IoT devices certainly promise valuable benefits, but they also come with some open points. First and foremost, IoT has been defined as a “materialized network society” (Lindley et al., 2019) which implies that every object needs to be situated such that its location is properly covered by the local network so that it does not intermittently disconnect and interrupt the monitored feed (Pandey, 2018). Put in other words, an IoT would not be able to function properly without being constantly connected to its constellation. Furthermore, artefacts are “always on” in terms of their sensing and connectedness. Otherwise, they wouldn’t be able to actuate meaningful behaviours because they lack contextual information from end users (Funk et al., 2018). This is the reason why often user expectations and technical features collide, as the question about data governance and how the data will be managed is still open. Peruzzini et al. (2014) outline the key data categories for IoT in:

- product identity number, which refers to all information provided by the manufacturing company able to identify a specific device and its care or maintenance actions;
- continuous monitoring data, which includes information characterizing the continuous monitoring of the device when it is turned on;
- control parameters, which refer to functional parameters that characterize the operational parameters of the specific device. Th ey are continuously analysed and compared with a set of target parameters (e.g. speed, rates, temperatures, etc.);
- state parameters, which are data about the status of home devices and are used to monitor a particular scenario or to carry out device remote control;
- general data, which comprehends data generated by external entities and defines the use scenario;
- derived data, which concerns data derived from post-processing elaboration and statistics analysis carried out by auxiliary systems;
- graphical user interface data, which comprehends data generated by users as direct or remote settings during instances of interaction.

Strictly from a business perspective, IoT's value proposition for companies consists in leveraging on a vast amount of data which simply could not have been harvested before. However, a clear value proposition for users still ought to be defined (Chuang et al., 2017). In fact, Chuang et al. (2017) through a series of workshops found that users generally have more affective expectations concerning IoT technologies which include:
house as a supportive friend, as people often feel helpless and desire to receive warming caring or greetings;
room atmosphere creator as a pleasant setting of the environment could help to improve users' productivity and engagement;
theme songs for every moment which could be classified under the previous point;

- coordinator and reminder, as in a scenario where multiple people live in the same home, the algorithm could help to synchronize the inhabitants' schedules, remind them to do specific tasks, and coordinate with each other;
- life memory collector as some users struggled with keeping or throwing away the memories that have been piling up through times;
- routine builder for young generations, as parents encountered similar frustrations in educating their kids on building their daily routine, especially bedtime and morning rituals.

Generally speaking, a more experiential value proposition ought to incorporate needs, goals, and desires of prospective users (Coskun et al., 2018). However, it is important to acknowledge that users' expectation is a highly volatile construct, as they may differ between contexts, locations, and times. In fact, Coskun et al. (2018), within another series of workshops, found that users tend to prefer IoT products with the ability to control remotely, autonomy, the ability to cooperate, and the ability to provide guidance and multi-functionality; they wanted the appliances to take over repetitive chores, not pleasurable activities and rituals (es. cooking). A peculiar aspect was a group of users that expressed the need for various levels of guidance which could be translated into design guidelines for increasing competence (Coskun et al., 2018).

In conclusion, the IoT comes with opportunities, concerns, and open issues, especially considering the data lakes that are being produced at an increased pace. It is a foundation of this dissertation that data is the key value at stake, therefore a key question could be formalized as: could there be a more equitable datascape? In particular, how could the very users take back ownership of their data?

5.3 BLOCKCHAIN AS A NEW DATA STRUCTURE TO ACHIEVE DATA INTEROPERABILITY BETWEEN SYSTEMS

There are plenty of cases where the actors who were designated to treat and protect users' data have failed to deliver on their promises. This is the reason for the profound excitement around the diffusion and development of a new set of technologies known as Blockchain. As of today, there is much inflation around the name "Blockchain," mostly because it is often associated with the highly speculative and volatile cryptocurrency "Bitcoin" (Figure 6).

Figure 6. The volatility of Bitcoin (€) through time from Google Finance.

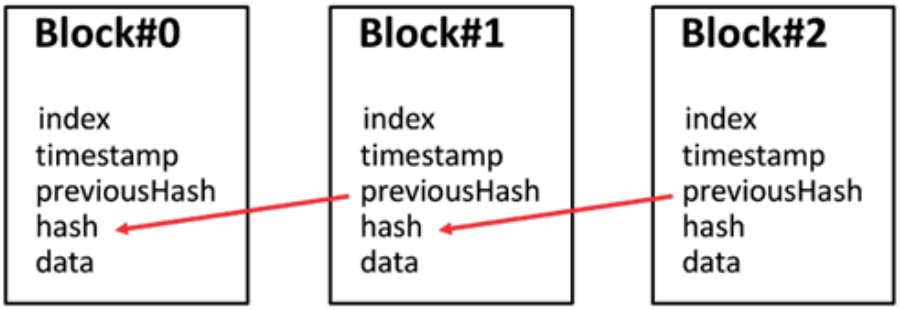
Blockchain is everything but cryptocurrency and its benefits go well beyond finance. Blockchain is actually a bundle of different technologies (Fuchs, 2019):

- authentication: methods to prove that you are who you say you are;
- encryption: methods designed to limit access to data by making it unreadable unless identity is authenticated and permissions are verified;
- digital signatures: digital stamp to establish proof that someone did something;
- hashing: an algorithm that converts a data file into a unique string of characters.

These building blocks together bring a disruption at the technological and social infrastructure level. On the one hand, a new data structure is made possible where the users retain ownership over their data; on the other hand, the very notion of trust could be reframed. Before Blockchain , "counterparty risk"

transactions have been formalized, where there is risk of one party failing to deliver on the agreements (Chiap et al., 2019). This specific risk led to the proliferation of intermediaries and third parties whose scope is to guarantee trust within the transaction. Understandably, every actor needs to be fairly compensated which leads to a proliferation of fees and an increase in the cost of goods or services. Furthermore, since information circulates between multiple stakeholders, the possibility of data breaches significantly increases. Trust now can be guaranteed by the system itself whose rules are agreed upon by the very participants (Chiap et al., 2019).

Figure 7. Relationship between different blocks



More specifically, according to Chiap et al. (2019), Blockchain is a digital ledger composed of a distributed network of machines that store data in chains of registries (Figure 7). The infrastructure organized as such may create congestions when a considerable number of transactions are requested within a short time frame. As the congestion gets more severe, the prices of the transactions increase. Furthermore, the computing power necessary to fulfil the mathematical rules of the system is very energy-intensive which makes the process potentially unsustainable.

Significant research, both private and public, is underway in order to optimize calculus requirements and to make the process more sustainable. For instance, Ethereum (a widely known Blockchain system) recently shifted to a proof-of-stake hashing mechanism, which optimizes the number of machines that are necessary to authenticate the transaction. In addition, Alps (an Italian start-up) set up their mining pools within a mountain dam in order to use electricity coming from sustainable sources. Both examples are actually clues that interest concerning this new technology is on the rise. In fact, while industry first treated Blockchain as a

hostile technology as it may significantly disrupt well-established processes across all sectors, more recently there has been huge interest in understanding how to establish collaborations between start-ups and established businesses to leverage the opportunities opened by this emerging technology. Innovations span across different sectors: from financial services with Ripple collaborating with banks in order to optimize foreign money exchanges; to grocery with Carrefour collaborating with IBM in order to enhance the traceability of products. The number of case studies is increasing on a daily basis.
Despite the rising interest in industry, academic research is not falling behind. In fact, Manohar & Biggs (2018) report in detail the design phase of "Tapestry," a browser-based service that aims to enable people, businesses and digital services to connect more safely online through the exploitation of the complex digital footprint left behind by individuals' everyday digital interactions. The service helps someone establish the authenticity and trustworthiness of the interactor or organisation an individual is about to disclose personal information to; moreover, it does not aim to make people's trust-related decisions for them but rather communicate whether a digital pseudonym matches the person or company claiming to be behind it. Because of the encryption mechanisms, any change made to information within a blockchain is recorded, therefore any modification is traced which makes any effort to change data structures unnecessary. In fact, a block of information is encrypted using a hashing function which converts the input data into a finite number of bits; any change would necessarily modify the hash of the block thus making clear that some operation has happened over that piece of information, moreover the very transaction will be saved in another block, therefore, having a proof of the changes (Chiap et al., 2019).

However, what this definition conceals is a radical transformation brought by blockchain as it provides a fundamentally new data structure for WEB 3.0 (Fuchs, 2019). The development of the World Wide Web is characterized by four key moments according to its interaction with humans. In fact, users were only able to search and read information with WEB 1.0, thus having a

mono-directional exchange; then in 2004 WEB 2.0 was officially defined by Dale Dougherty, vice-president of O'Reilly Media, who noted the emergence of platforms which provided more instances of interaction with users; subsequently, John Markoff of the New York Times suggested the emergence of WEB 3.0, or the semantic web, whose main characteristic is to make the world readable by machines (Aghaei et al., 2012; Choudhury, 2014). The enthusiasm does not stop with WEB 3.0, as there is already speculation for the next version of WEB 4.0, defined as a symbiotic web where the interactions will be directly between the human mind and intelligent machines (Aghaei et al., 2012; Choudhury, 2014).

In essence, blockchain enables a nearly frictionless exchange of value, much like the internet has enabled a nearly frictionless exchange of information (Fuchs, 2019). However, even blockchain, as with every innovation followed by high hopes and marvellous promises, comes with open issues to be investigated and agreed upon with a public consensus. This agreement is especially important because blockchain tends towards quantification with all relational, emotional, and expressive interpersonal exchanges becoming transactions, a phenomenon also referred to as "economification" (Manohar & Biggs, 2018). Quantification goes hand in hand with datafication, a phenomenon by which many aspects of the world and people's lives are transformed into data (Kozyreva et al., 2020).

5.4 OPEN POINTS: BETWEEN SUSTAINABLY AND DATAFICATION

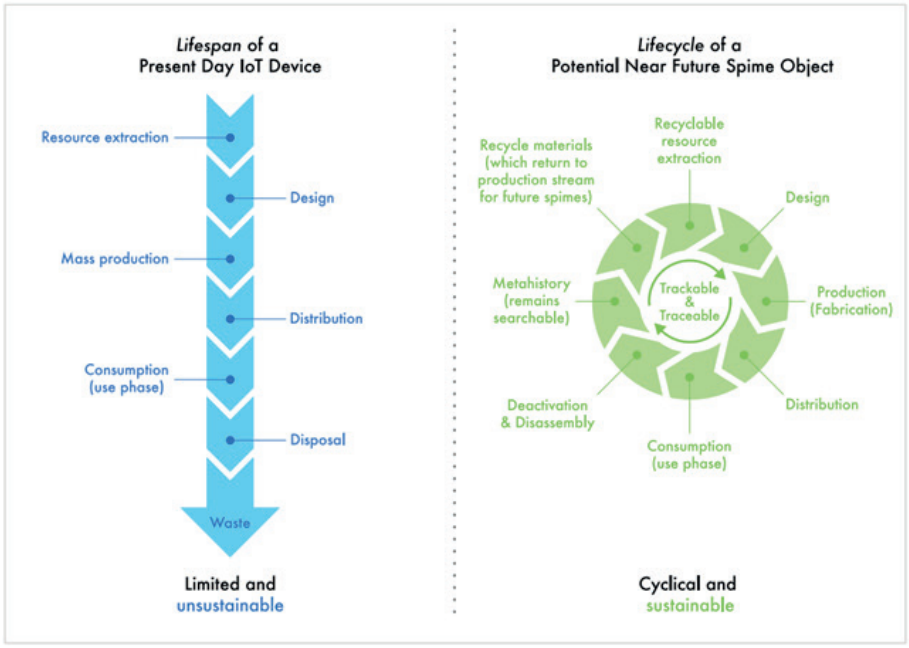
This chapter illustrates the major technological trends that are influencing society at the present time and their impacts on the "knowability," "readability," accessibility, and usability of the world (Iaconesi, 2017). Arguably, technological drivers always come with promises and expectations as well as criticalities, with the notion that data becoming a commodity and foundation of value taken as a fundamental premise of this dissertation. In addition, nowadays the physical world is quickly catching up as new devices continuously mine streams of data. However, Kunneman et al. (2022) find that data science generally remains inaccessible to most designers. In a scenario where designers have a low level of literacy concerning data, how exactly are they supposed to create value for users? How could they balance the needs of the customers and the needs of the business? Evidently, this may lead design solutions to backfire with designers acting in the interest of businesses rather than of users.

Users, knowing or unknowingly, directly or indirectly, give consent for their data to be collected and consequently sold to the highest bidder (Iaconesi, 2017). This phenomenon is often motivated because of growing competition, which increasingly forces organizations to seek new sources of competitive advantage (Kunneman et al., 2022). However, it effectively produces an asymmetry in the distribution of power, rights, freedoms and opportunities which often manifests through a lack of openness, transparency and access (Iaconesi, 2017, Jakobs et al., 2022). It is psychologically impossible for human beings to understand which and how much data is captured about them; on top of that, ecosystems are closed and proprietary ecosystems, rarely open source, which largely limits public accountability (Iaconesi, 2017). Kozyreva et al . (2020) further stress this point, highlighting that such algorithms are both complex and non-transparent. More specifically, the opacity of machine-learning algorithms concerns their autonomous and self-learning character which produces an output with a given input, but the exact processes that generate

these outputs are hard to interpret. This is the reason why some describe these algorithms as “black boxes.”

The burden must not bear exclusively on one specific party. However, the very discipline of design is reframing its practices, having always been in a constant state of flux. As Guy & Kimbel (2019) puts it, design always redesigns itself with the definition of a shared vocabulary being the most basic element for approaching a given topic. Therefore, many pieces of research focus directly on creating a jargon to characterise these IoT constellations. Stead et al. (2019) speculate about spimes, which are material instantiations of an immaterial system. Again, the duality of presence-absence absence/absent-presence recurs with the definition of spimes. It is important to notice that spimes would be designed so they can be managed sustainably throughout their entire lifecycle (Figure 8), from their initial production to having their components recycled and reused at the end of their life (Stead et al., 2019). The notion of spimes has been crafted to directly tackle the fact that little discourse recognises the intrinsically unsustainable nature of IoT devices which are typically covered by a façade of innovation (Stead et al., 2019). Therefore, there is a need for a comprehensive framework to design spimes throughout their life cycle. This framework would have to offer upstream guidelines to design responsibly as well as operative processes to design new products. However, often IoT product design culture displays a penchant for superfluous

Figure 8. Design of the life-cycle of a possible spime compared to a product (Stead et al., 2019)



‘gizmo’ style devices which a considerable number of times solve problems that do not really exist: a misleading approach also referred to as solutionism (Stead et al., 2019) or technological determinism (Vitali et al., 2017). In general, solutionism could be defined as the application of a techno-optimistic perspective to the production and marketing of products that try to solve problems that simply do not exist (Lidley et al., 2019). Even businesses are aware that solutionism is a poor source of value. In fact, Wu & Pillan (2017) note that the CEO of Cup Time highlighted that drinking water data is worthless. Cup Time is a smart water cup working with a smartphone to record drinking habits and to remind the user to stay hydrated and healthy,

The notion of spimes is just one of the core questions of smart technology. In fact, other concerns fall under a more social sustainability perspective. Smart technology challenges designers in the wider sense to be concerned with transparency over data transfer and management, which goes beyond individual devices (Jakobs et al., 2022). As shown in previous chapters, the atomic perspective should be abandoned favouring instead the ecosystem perspective. For instance, entries that people see when browsing search engines, social media websites and other online services are completely determined by algorithmic processes which have the effect of typically excluding all the rest, closing people in "bubbles" while systematically and unknowingly exposing them to experiments (Iaconesi, 2017). The effects of information bubbles could well undermine the ability of a society to function, as people tend to show diminished sensitivity to and acceptance of diversity, rising levels of cognitive biases, diminished tolerance, and social separation (Ianconesi, 2017). Kunneman et al. (2022) note that further opportunities are expected to emerge from the interaction between designers and data scientists, leading to new dimensions of information. However, the success of the collaboration mostly depends on three parameters:

- technical, concerning the quality of the dataset;
- organizational, as capabilities beyond the original team are likely to emerge within and across the collaboration;
- economical, as determining business value presents a challenge since on many occasions value creation depends on individual projects.

In fact, the combination of quantitative with qualitative methods could produce different conclusions and alternative perspectives as data science techniques 'think' and 'learn' in inherently different ways than those designers are trained in (Kunneman et al., 2022). The promise embedded in this collaboration consists of enhancing the transparency of systems powered by new technologies and securing trust and confidence among all stakeholders under the privacy-by-design paradigm (Jakobs et al., 2022). Equally important, Jakobs et al. (2022) argue that each data point must be collected strictly for the purposes of supporting the functionalities of the service that is being delivered. Data-rich environments provide companies with a variety of customer data that if properly analysed could enhance their innovation activities. This process also has the positive benefit to allow end-users further upstream into the design process (Sayar & Er, 2019). In essence, data is reconceptualized as not only outputs of customers' use of products, but also as agents to organize and manage the product design process with the other actors (Sayar & Er, 2019).

To conclude, it must be acknowledged that not only are there foundational developments on the technological infrastructure side, but also that the front-line interaction patterns with users are changing. In fact, it is widely accepted that new technologies are more and more intertwined with services, and services are more and more intertwined with people's everyday activities. Therefore, it is now time to illustrate how this phenomenon came to be.

6. SERVICES AS INSTANCES OF INTERACTION BETWEEN HUMANS AND MACHINES

Chapter four shows that services are increasingly part of people's everyday life. People access services to pursue a specific goal, use services as a means to reach a determined outcome, and experience services to fulfil a specific need. This chapter describes a phenomenon commonly referred to as servitization. It implies both a profound shift in the relationship between business and customers as well as a radical transformation within and across organizations. A considerable number of companies transformed with servitization in order to gain competitive advantage; however, some companies have not been able to adapt to increased competitive pressure and the complexity of continuously shifting customer needs. Therefore, understanding services is key to appreciating the dynamic interplay between the actors that build up ecosystems.

6.1 UNDERSTANDING THE DEVELOPMENT OF SERVITIZATION AS A PHENOMENON

After World War II (1939-1945), academics argued for the A considerable number of words have been spent looking for a definition of services. It should be acknowledged that people's everyday lives are increasingly mediated by services; this phenomenon is commonly referred to as servitization. Servitization is a major socio-economical change influencing society as a whole. Academics generally accept it as an ongoing process first formalised around the 1980s by marketing scholars. They advocated the need for "breaking free" from a pure product-centric marketing strategy, thus going beyond the classic marketing mix (Shostack, 1977). In fact, generally speaking, services are conceived in terms of what products are not (Taylor, 2013). In their seminal paper, Vargo & Lush (2004) note that increasingly, marketing has shifted much of its dominant logic away from the exchange of tangible goods (manufactured things) toward the exchange of intangibles, specialized skills, knowledge, and processes (doing things for and with), encompassing a more comprehensive and inclusive dominant logic, one that integrates goods with services. Vargo & Lush (2004) trace the origin of SD-Logic back to 1840 when F. Bastiat (Economists, 1801-1850) criticized the political economists' view that value was tied only to tangible goods, speculating that the foundations of economics were people who have "wants" and seek "satisfactions".

More recently, the dedicated literature on service design has advanced the concept, highlighting a shift of focus within the very phenomenon of servitization. In fact, SD-Logic moved from an emphasis on the "design of services" to the "design for service." The principal difference between the two notions is that the design of services conceptualization views service as an intangible market offering, denoted by the term services (plural); whereas design for service views service as the fundamental basis of exchange, denoted by the term service (singular) which has become increasingly aligned with the early work on SD-Logic (Vink et al., 2021). Even though the difference in terms

singular and plural might seem subtle, it implies changes in the relationship between the actors involved in the service delivery. A diffused optimism characterizes the discussion around SD-Logic, Vargo & Lush (2008) suggest that it could provide the foundation for a revised theory of the firm (and other resource-integrating activities), a theory of service systems and a revised theory of economics and society (Vargo & Lush, 2008). Servitization and digitalization must not be understood as two separate phenomena, they often interfere and overlap with each other. In fact, digital technologies have transformative effects on product design practices, since manufacturing firms are moving towards service provision (Sayar & Er, 2019) and changing their organizational structure.

It is generally accepted that in today's scenario enterprises are faced with increasing competitive pressure and shifting customer needs, which make it difficult for them to gain a competitive advantage over competitors (Vandermerwe & Rada, 1988; Paliyenko et al., 2022). Moreover, in the digital era, a manufacturer's capability to handle data increasingly determines the success of product design (Sayar & Er, 2019). Rabe et al. (2019) provide a seminal example of these changing customer needs, suggesting a shift in the roots of the notion of ownership: nowadays, customers just want to access and use products. This is consistent with the literature on SD-Logic as according to Vargo & Lush (2004), before 1960 marketing's role was merely viewed as a transfer of ownership of goods. As a consequence, manufacturing companies are currently pushing the transformation from product manufacturers to service providers (Rabe et al., 2018) in order to lead a continuously shifting competitive landscape.

More in detail, services are market offerings made tangible by material touchpoints; therefore, products and services as well as customers and end-users are integrated in the same development process (Paliyenko et al., 2022). These actors are bundled into a solution which is inseparable in terms of components (Rabe et al., 2018). The duality between materiality and immateriality was already noted by Shostack (1977), who highlights that the

service itself is intangible but there are certain very real things that belong in any description of the total entity. More recently, Sayar & Er (2019) further stress that services are complex offerings that comprise products, services, and data, and improve business performance through analysis, optimization, prediction, and integration. It is only natural that the datascape dimension acquires significant importance. In essence, the literature on service design recognized the power of data, consistent with what previous chapters showed. Ultimately, the product is designed as part of the service, rather than designed separately and added on to the service (Sayar & Er, 2019).

Despite servitization being a roaring trend, an opposite tendency is already emerging, that is reverse servitization. In fact, many organizations are struggling to adjust their organizational structures, acquire relevant knowledge and form specialized development teams (Iriarte et al., 2019). On top of that, Taylor (2013) notes that producers want to become service providers not because doing so results in a win-win situation for everybody, but they want to do it because they can stay in business, even though their previous field of operation has shifted under them. Changing the organizational structure from manufacturer to service provider implies that service firms are moving further down the distribution chain (Vandermerwe & Rada, 1988) as they are much closer to the end consumers, which might ultimately be uneasy for some organizations. In fact, Iriarte et al. (2019) further detail the reason for enterprises to opt-in to reverse servitization:

- organizational, in terms of structures, culture, skills and capabilities;
- financial, in terms of identifying new risks and defining new business models;
- customer relationship, in terms of new interaction models;
- supply chain, in terms of mutating relationship dynamics;
- market, in terms of new regulations, new competitors, and new needs.

On a different but significant note, SDL is also criticized as it does not accommodate or pay sufficient attention to marketing

ethics intended as both the idea of offering only what is good for society and the marketing of ideas that get people to do good things (Vargo & Lush, 2008). More in detail, Bahrami & Aryana (2019) express the need for social marketing (Bahrami & Aryana, 2019).

Although services are intangible marked offerings, they have been shown to have huge impacts on the environment they are provided in, as well as on the people that participate in the experience. The key question then becomes: how do services influence and impact the materiality of the world in which they are delivered? But most importantly, what exactly is the impact of smart technologies on service delivery?

6.2 FROM THE NOTION OF SERVISCAPE TO THE SMART-SERVICESCAPE

Although academics have long recognized that it is difficult to find pure products and pure services (Shostack, 1977), they also argue that it is difficult to measure the quality of the service itself. Arguably, customer satisfaction might be the only metric to determine the quality of the personal encounter (Solomon et al., 1985) which ultimately led academics to frame the notion of service encounters. Service encounter is defined as a purposeful, goal-oriented, dyadic interaction with the parties assumed to enact certain behaviours (Solomon et al., 1985). The notion of service encounter has been taken forward by Bitner (1990, 1992), who framed the concept of servicescape. Bitner recognized that the qualities of the environment in which the encounter occurs very much influence the behaviour of the actors involved. Thus, there is – already at the design stage – a concrete possibility to influence the behaviours of people involved in the designed interaction. Although every service is built up by scripted behaviours, every service encounter goes through adaptation patterns (Chapman, 2016) a process whereby actors involved in the encounter mutually adapt to each other (Shostack, 1977). Adaptation patterns have also been referred to by the term domestication (Pilling et al., 2019). Bitner (1002) notes that the influence of the environment over human behaviour has long had a wide consensus as it has been first investigated by environmental psychology, which is a dedicated branch within the psychology discipline that targets the relationship between people and their surroundings. The servicescape may elicit different responses across an array of dimensions (Bitner, 1990):

- cognitive responses influencing people's beliefs about the place, people and products;
- emotional responses that in turn influence behaviour;
- physiological responses with the example of noise causing physical discomfort.

These notions are surprisingly aligned with the affordances

found by Bruno & Caina (2019) in digital services; the authors argue that the service encounter acts upon three levels:

- the cognitive level represents the way in which humans learn and process information;
- the individual level represents the human being interacting with the world;
- the social level intended as being part of a community.

The first conclusion is that the notions used to study the quality of services in physical settings can also be used to investigate digital encounters. On the other hand, it also implies giving users a progressively more important role in the interaction. While the next paragraph specifically details the dimension of user participation, the service-ecosystem perspective shows that people are not the most prominent actors within the servicescape anymore. Digital technologies are becoming more incumbent on services, which leads to a shift of servicescapes towards smart servicescapes. Smart represents the socio-economic and technological improvements driven by rapid developments in information, communication and connected technologies (Roy et al., 2019).

Not only the context but also the conceptualisation of consumers is shifting towards the notion of smart consumers. Smart consumers are commonly framed as active users who voluntarily extend efforts to directly help others in the smart servicescape (Roy et al., 2019). The interaction patterns may very well be extended within and across a More-than-Human network. Smart consumers voluntarily participate in the experience in order to create value across the service ecosystem and can be recognized by three characteristics outlined by Roy et al. (2019): informed, connected and aware. These characteristics make make them able to possess :

- increased control and consciousness of their decision-making;
- greater service customisation and personalisation;
- Increaded empowerment;

Enhanced willingness to participate in value co-production and co-creation processes.

However, Bruno & Canina (2019) note a fourth characteristic that ought to be considered for smart consumers, which is creativity: the ability to discover something new, to adapt the available knowledge purposefully and solve problems originally, flexibly and effectively. This involves the development of a less-than-linear process of information collection, selection, reconfiguration, and identification of the relationships, generating new results (Bruno & Canina, 2019). Arguably, the most sophisticated technology already has a less-than-linear problem-solving process which often is intelligible for human operators. Furthermore, as already noted by Solomon et al. (1985), the fusion of the actors involved in the service encounter is greater than the sum of its parts. This proposal is incredibly similar to the definition of systems. In fact, systems theory defines a system as a group of interacting, interdependent parts that form a complex whole whose properties are greater than the sum of its parts (Romero et al., 2020). The smart experience co-creation is a type one reflective higher (second) order construct which consists of reflective first order and reflective second order factors (Roy et al., 2019). This interaction is so deep that neuroscientists are beginning to see structural changes in human brains correlated with the increased pervasiveness of digital technologies (Bruno & Canina, 2019).

Nevertheless, there are also downsides to the increased connectedness between humans and machines. In fact, digitally natives do have not the ability to maintain the same focus and attention as previous generations when reading text written on physical touchpoints (Bruno & Canina, 2019). In essence, the stronger the collaboration between humans and machines, the deeper the changes generated within the very structures that enable human life. Some academics propose that human beings are co-evolving with technology (Bruno & Canina, 2019). This notion is perfectly aligned with More-than-human theories, which suggest thinking in terms of designing with technologies.

However, what does a deeper collaboration with customers imply? How can consumers be involved in the design stage? How can they participate during the service delivery?

6.3 CO-CREATION AND CO-PRODUCTION AS THE DEFINING CHARACTERISTICS OF THE SMART- SERVICESCAPE

It is generally believed that servitization is largely driven by customers. Within a product-dominant logic, tangible outputs and discrete transactions were central; however, in a service-dominant view intangibility, exchange processes, and relationships are the focal point (Vargo & Lush, 2004). At the very beginning, academics noted that business's focus was on customers' needs and satisfying these needs mainly through core business activities; later the emphasis shifted to establishing and maintaining a relationship between corporations and their customer base (Vandermerwe & Rana, 1988). Thus, not only are users' contribution central in the service delivery phase, but also, they are more and more involved upstream in the design process. In fact, in the traditional goods-based manufacturing perspective, the producer and consumer are usually viewed as ideally separated in order to enable maximum efficiency; however, in SDL the customer becomes primarily an operant resource or a co-producer (Vargo & Lush, 2008). Operand resources are defined as resources on which an operation or act is performed to produce an effect, and operant resources are employed to act on operand resources (Vargo & Lush, 2004).

According to Vargo & Lush (2008), service systems represent any value co-creation configuration of people, technology, and value propositions connecting internal and external service systems, and shared information. Co-production is only the first step within a participatory paradigm. In fact, SDL shifted from a logic based on co-production to an approach based on co-creation of value, which captures participation in the development of the core offering itself (Vargo & Lush, 2004). Co-creation refers to a mutually beneficial interaction and collaboration among at least two participants that may result in value creation for those participants (Roy et al., 2019). In essence, value becomes negotiated and phenomenologically determined (Vargo & Lush, 2008). The participatory approach is

consistent with the ecosystem perspective: initially, value was focused on any exchange between two parties while nowadays it needs to be understood that the venue of value creation are the configurations of economic and social actors within interacting constellations who exchange across and through networks (Vargo & Lush, 2008).

Participation is directly related to democratizing design processes and enlarging the discourse around a specific issue at stake. In fact, design practices are being appropriated by non-designers (Pierri, 2017), meaning the shift to a more participatory design approach does not consist primarily of designers and developers engaging in use, but people (collectives) engaging designers in their practice (Reddy & Linde, 2016). Strictly from a design standpoint, it means de-centralising the role and the agency of designers in the design process towards diffused design capabilities, thus allowing non-designers to reclaim the space of problem framing, issues formation, sense making and creativity (Pierri, 2017). In fact, the smart citizen is defined as an inherently creative individual bruno & Caina, 2017). Therefore, the core competencies of both businesses and designers are not physical assets anymore but intangible processes: more specifically, bundles of skills and technologies (Vargo & Lush, 2004). Vandermerwe & Rana already noted the importance of knowledge sharing within an SDL in order to craft instances of participation – intended in terms of "know-how", and "know-why", "know-what" in 1988.

Knowledge has become a source of competitive advantage for companies which arguably is both a blessing and a curse. Although servitization comes with many promises and benefits, it also raises questions about unintended values and consequences. A considerable number of academics raise concerns about the amount of knowledge about users that a business is able to capitalize on. The correlation is linear: the more knowledge businesses acquire, the more risks for users' information to be exploited. Thus, knowledge about users is turned against them with new business models are based on appropriating and retaining user attention as engagement in the service delivered

has become a primary driver of competitive advantage (Chianella, 2021). As new informational environments evolved parallel to the refinement of Internet companies' business models, the goals and incentives of design shifted as well. Human collective attention became a profitable market resource for which different actors compete and fierce competition for human attention has led to the growing fragmentation of collective attention (Kozyreva et al., 2020). In essence, relevance becomes an invaluable competitive advantage and attention a precious currency (Iaconesi, 2017). These business models primarily frame users as a means of providing data both for improving the Natural Language Processing element of a service, but also to infer behavioural patterns of the user which can be used for profiling purposes which allow a more granular and targeted advertising (Pilling et al., 2022).

The fragmentation of collective attention has produced wider unintended social consequences. The widespread crisis of attention has triggered the emergence of new technical forms of communication which inherently isolate individuals beyond the community, thus the management of the attention of individuals allows control of their experience (Ayazova, 2017). Lindley et al. (2019) propose the notion of "siren servers" referring to how the likes of Amazon, Facebook, and Google seductively enchant vast numbers of users into their datascapes, while systematically eroding privacy and autonomy. Furthermore, the notion of addiction has recently evolved into a spectrum of terms no longer only associated with drug use. Psychiatrists in the 1990s classifyied some behaviours as forms of "behavioural addiction," provided that the outcome was rewarding enough to generate craving (Chianella, 2021). To conclude, now that algorithms are able to learn the schedules and habits of individual users with the possibility to generate addiction with finer granularity and at greater scale (Chianella, 2021). The fact that new addictive experiences are designed in the moment (Chianella, 2021, Verganti et al, 2021) against users' interests highlights that the mechanisms of co-production ad co-creation have a significant possibility of backfiring.

The academic discussion has primarily investigated technological and market drivers as two detached instances. However, services and pieces of technology are more and more bundled within networks and constellations. These bundles are commonly referred to as Smart Product-Service Systems (S.PSS). Thus, what are the characteristics of these bundles of services and technologies? What benefits do they bring? Which criticalities should public discourse focus on?

7. INTRODUCING, DEFINING AND DISCUSSING SMART PRODUCT-SERVICE SYSTEMS

Smart product-service systems (S.PSS) are an emerging class of innovative solutions that combine physical products with digital services. They generally promise a seamless user experience and greater value for customers. Smart product-service systems leverage on the phenomena introduced in the previous chapters. On the one hand, the advances in technology open new solution spaces; on the other hand, the shifts in new and innovative business models incentivize the creation of new market offerings. This chapter explores the concept of smart PSS in more detail, examines their characteristics and dives into the different design processes that bring them to market. Finally, the chapter examines the benefits and challenges associated with smart PSS adoption along with best practices for designing and implementing successful smart PSS solutions

7.1 CHARACTERISTICS OF SMART PRODUCT-SERVICE SYSTEMS

From a high-level point of view, it could be argued that digital products ceased to be completely mapped onto the physical object and come to be distributed in both time and space (Taylor, 2013). The combination of Cyber-Physical Systems (Rabe et al., 2019) is expected to be a game changer in the entire life cycle of products, from production and distribution touse and disposal of goods (Petrelli, 2017). Moreover, Cyber-Physical Systems (CPS) are causing significant changes across different business models. Smart solutions are more and more pervasive in business-to-business (B2B) models, such as back-end processes that enable service delivery, and in business-to-consumer (B2C) models, changing front-line interaction patterns (Roy et al., 2019). Industry 4.0 is a notion that emerges from the combination of both business models which allows companies to optimise strategies, develop new products, shorten development periods, achieve resource efficiency, and provide more personalised products (Romero et al., 2020). Hence, the quantity of benefits is significant. However, it is important to notice that greater personalisation has been repeatedly shown to have negative consequences on user experience, as the more choices users are presented with the more cognitive load is required from them to process all the information. This cognitive overload ultimately leads to dissatisfaction about any decision taken or, even worse, the complete inability to make a choice (Solomon 1985; Nematzadeh & Sosa-Tzec 2014; Schwartz, 2016).

Furthermore, the paradigm is moving from the development and application of isolated computer-aided actors to more digital, networked, and intelligent methods and agents (Romero et al., 2020). Consequently, S.PSSs have emerged as part of Industry 4.0. They comprise embedded sensors, integrated actuators, software, and electronic components that enable the communication with external entities and objects (Paliyenko et

al., 2022). In essence, not only the back-end processes but also the interaction level (front-end) is profoundly changing.

More formally, S.PSSs have been represented by several scholars as a digital ecosystem characterized by high complexity that integrates stakeholders, devices, and platforms. Therefore, according to Carrera-Rivera et al. (2022), the design of S.PSS requires being able to capture the needs of multiple stakeholders in a collaborative process to create value (co-creation). Co-creation and co-production are already critical components of the service-dominant logic. However, much of the user's participation occurs through the data they generate and machines are able to capture. Now, user participation is now possible through analytical capabilities that were not simply present before. The generated data can be used to extend existing services and offer additional smart solutions; because of this evolution, the core concepts of standard PSS must be extended towards smart products and services which can be combined creating a new domain referred to as "smart PSS" (Paliyenko et al., 2022). The concept of smartness encompasses a different array of characteristics. In fact, the S.PSSs are typically described as a specific type of system able to learn, perceive, self-organise, be aware of the context and its environment, and communicate with and inform other entities (Paliyenko et al., 2022).

Significant academic research has focused on defining the characteristics of S.PSSs. For instance, Roy et al. (2019) put forward the 5Cs framework: connection, collection, computation, communications, and co-creation. Meanwhile Kim & Baek (2014) describe 7 dimensions of product smartness: autonomy, adaptability, reactivity, multi-functionality, ability to cooperate, humanlike interaction and personality. Nevertheless, the most recent piece of research describes eight characteristics. In fact, Romero et al. (2020) infer the following characteristics of Smart Product-Service Systems:

- communication capability, as the elements of the system must be able to interact to exchange data;
- embedded knowledge, as human experience and expertise must be captured by the system as well as information about the environment;

- learning capability, as knowledge of the system can be modified through the application of diverse methods and algorithms;
- reasoning capability, as smart systems must be able to reason using their knowledge to make decisions;
- perception capability, as the configuration implies the presence of an environment that smart systems interact with;
- control capability, as the system must be aware and incontrol of and able to change its internal state relative to the position they occupy within a given environment;
- self-organisation, as the actions performed by the smart system are not limited to the environment, hence the system is able to modify and manage its structure while keeping its original objective;
- context-awareness, as the context comprises information that characterises the current state of an environment.

Therefore, technologies potentially allow constant monitoring, adjustment and redefinition of products and their relationships to other actors and artefacts in a network (Sayar & Er, 2019). Some academics specifically use the term “intelligence” when referring to SPSS. Romero et al. (2020) note that intelligence represents the combination of the following smart capabilities: learning, reasoning, and embedded knowledge. Coherent with the principles of the ecosystem perspective, the characteristic that elicits significant interest is context awareness. Carrera-Rivera et al. (2022) define context awareness as the idea that devices or systems can react based on their environment; furthermore, they point out that it includes:

- context acquisition, as data points need to be acquired from different sources (i.e. sensors, cps, databases, etc);
- context modelling, as the collected data needs to be represented in a meaningful way;
- context reasoning, as data should be processed to provide useful information and insights (context);
- context dissemination, which is a phase that distributes context to consumers. It is important to notice that users might be end-users or other applications as well considering the insights from the More-than-Human framework;

- context monitoring, as there may be changes in the context at some point.

S.PSSs rely heavily on data to function properly and time is a crucial variable concerning every aspect of their life cycle. In fact, a considerable amount of time is needed to build a dataset with a proper structure and optimal quality. Therefore, it is important to recognize that the first phases of the interaction will be characterized by a lack of data which might lead to decreased functionalities of the S.PSS (Carrera-Rivera et al., 2022). Thus far the thesis highlighted that the quality of data could be a significant limitation, or at least a friction, in the adoption processes of S.PSSs.

Smart Product-Service Systems have been studied for some years now as the term first appeared in 2017 (Carrera-Rivera et al., 2022). Consequently, much attention has been dedicated to the definition of the term “smartness.” Therefore, the key question becomes: which is exactly the meaning of smartness?

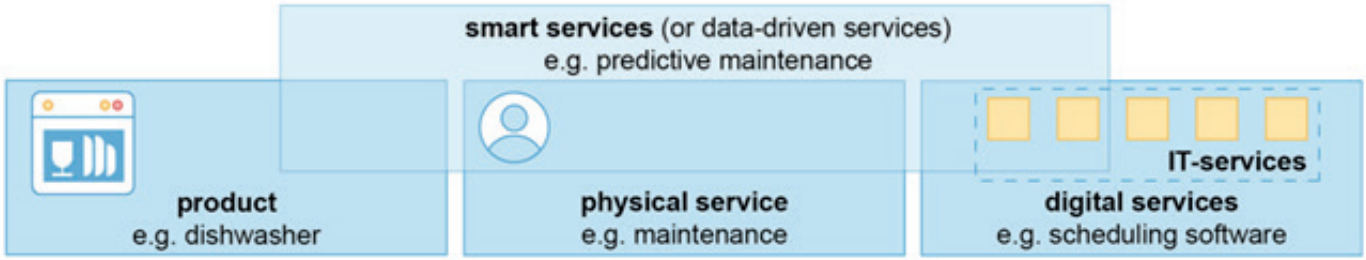
7.2 UNDERSTANDING THE NOTION OF SMARTNESS

Kim & Baek (2014) note that smartness is a concept initiated by smartphones. However, the notion was lateradvanced to cover a variety of factors that include not just information and communications technology, but also sustainability, resilience, innovation, and business (Vink et al., 2021). The business model perspective is significantly important within the notion of smartness. In fact, Carrera-Rivera et al. (2022) note that S.PSSs still share the core business foundations of the traditional PSS, which can be classified into three main categories: Product-oriented, Result-oriented, and Use-oriented.

Interestingly enough, a significant number of academics highlight that the meaning of smartness is situated. Romero et al. (2020) write that smartness is a concept created by society, as it is a cultural practice rather than an inherent biological property of an individual; this directly criticises the tendency of different schools of thought to overlook the knowledge that comes from personal experiences. Conversely, other authors present smartness as a relationship between an individual and their community. Or, authors have proposed smartness to be the development and use of knowledge, skills and behaviours in order to obtain benefits for the individual and its community by resisting the educational hegemony and relate smartness to the balance between knowledge and wisdom. Therefore, Rabe et al. (2018) built a framework to define the components of an S.PSS (Figure 9):

- products are physical goods and the result of a production process, they generate benefits fulfilling defined functions where production and consumption take place at different points in time;
- physical services are intangible goods that are primarily provided by a person in the physical environment in a direct contact with the customer where supply and consumption take place simultaneously which means that storage is

Figure 9. Components of Smart Products-Service Systems from Paliyenko et al. 2022

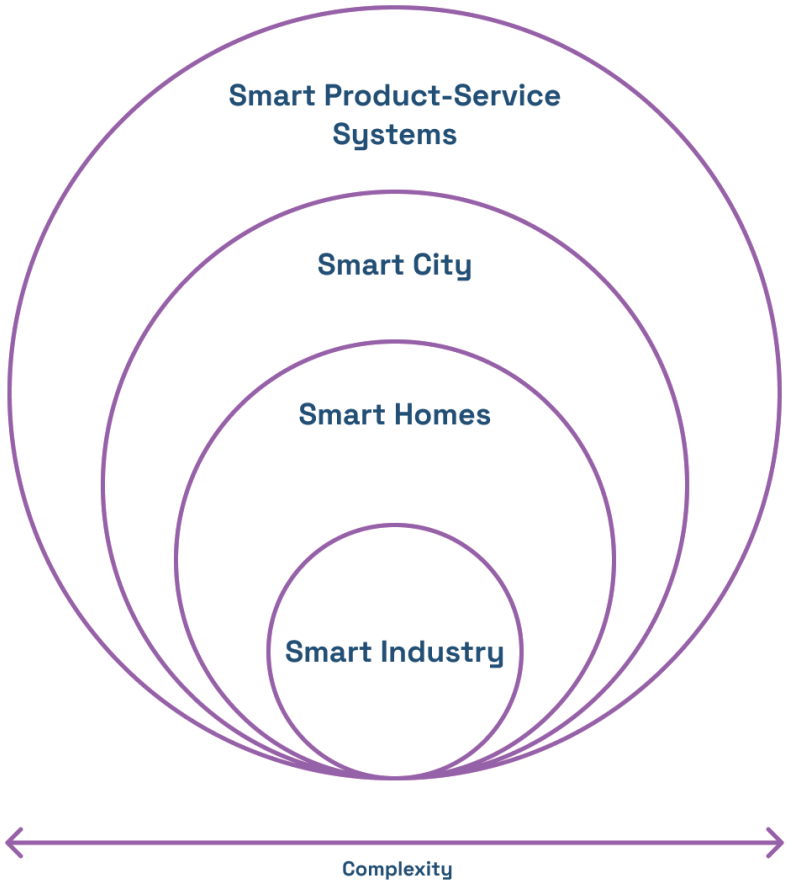


not possible (the adjective "physical" refers to the place of provision and not to the nature of the service, which is non-physical);
- digital services are provided in a digital environment and thus not primarily by people but by IT systems (Rabe et al., 2018).

The schema just presented studies S.PSSs singularly through an atomic point of view which does not embrace a more holistic (ecosystem) perspective. In fact, Romero et al. (2020) push readers to consider that smartness is reached through the cooperation of several factors such as policies, economy, governance, education, and individuals; furthermore, they identify some domains in which the notion of smartness is applied nowadays (Figure 10):

- smart city, which is based on the idea of creating an urban space characterised by sustainable economic growth and high quality of life of its inhabitants. The core element of smart cities is the interconnection between all possible elements of the city;
- smart home, which is based on the implementation of a communication network that allows to connect and remote control or monitor devices and services;
- smart industry (or Industry 4.0), which is based on the idea of smart factories as flexible cyber-physical production plants whose functioning is based on the use of big data to provide personalised services or products to customers;
- smart service systems are systems composed of people, information, organisations, and technologies that interact towards the achievement of common objectives.

Figure 10. The landscape of Smart-Product-Service Systems from Romer et al., 2020



Vitali et al. (2017) argue that a product today is really smart when its interface and functions are connected to actual user needs and habits. Put in other words, long-term success come from providing actual value and a positive user experience, thus rejecting the idea of solutionism and technological determinism (Maier & Harr, 2020). Moreover, communication is more than ever continuous and global among people and objects; the boundaries between tangible and intangible, hardware and software, private and public blur and dissolve. Peruzzini et al. (2014) advance the notion of smartness by advocating for the emergence of advanced systems which are characterized by the interoperability of data. The interoperability of data enables the connection between different constellations of S.PSSs. There is a wide consensus among academics that interoperability is the next issue to be tackled. Romero et al. (2020) highlight that the most important issues for achieving smart manufacturing is the interoperability and development of technologies. Furthermore, Carrera-Rivera et al. (2022) highlight that the key challenge for S.PSSs are that data are heterogeneous, with different data formats and multi-sourced. Indeed, this is going to be the next challenge to be solved with a technocratic approach which will possibly impact users' experience allowing an even greater datafication and economification of people's everyday lives.

In conclusion, S.PSSs offer many benefits while carrying open questions. It is only possible to address those key challenges by investigating the S.PSSs while they are actually being developed. So, what is the S.PSSs development process? Which are the assumptions that govern the development of a new S.PSS?

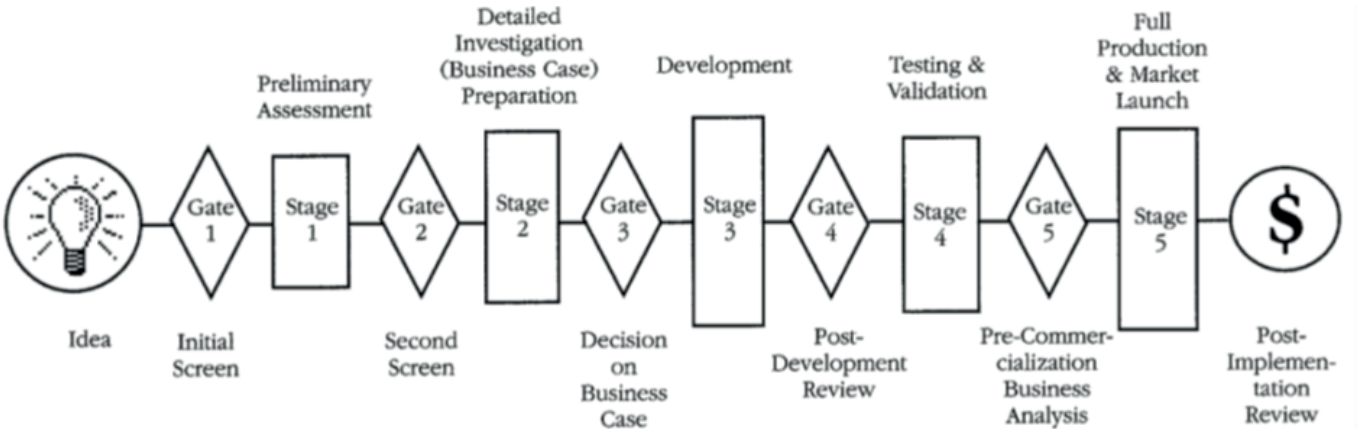
7.3 NEW PRODUCT DEVELOPMENT: A PROCESS TO BRING SMART PRODUCT-SERVICE SYSTEMS TO THE MARKET

Enterprises generally rely on manuals and norms which provide guidelines and best practices to develop new products. However, significant research highlighted a substantial lack of an established new development process specifically dedicated to S.PSSs (Lee et al., 2020; Paliyenko et al., 2022). A product development process is a transformation of a market opportunity and a set of assumptions about technology into a product available for sale (Lee et. al, 2020). Norming the product development process is deeply connected to business strategy. For example, companies could either implement a get-ahead strategy to use innovation reputation to differentiate from their competitors; in contrast, they could implement a catch-up strategy that allows companies to remain efficient, survive, grow, and even overtake leader's position (Lee et al., 2018).

According to Lee et al. (2018), traditionally NPD process models have been characterized as stepwise approaches, such as the stage-gate system which consists of a linear process with intermediate validation phases (Figure 11). The stage-gate process has been found to be too prescriptive and mechanistic, failing to consider activity overlaps that would naturally naturally during standard operations (Lee et al., 2018).

The shortcomings of the stage-gate model pushed academia to focus research on the innovation of product development processes, thus proposing sequential models such as the "simultaneous approach" or "rugby approach," which essentially are parallel processing models (Figure 12). Parallel processes increase the speed of developments but also enable new philosophies of design. One example is market-led design, which

Figure 11. Representation of the stage-gate process from Lee et al. 2018



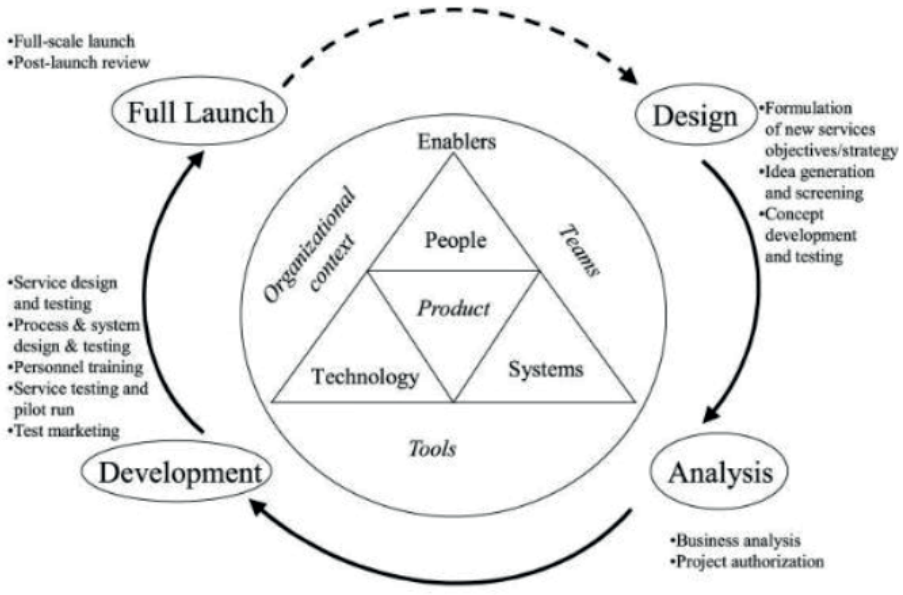
allows the implementation of flexible manufacturing in order to respond to the flow of new information on customer demand and preferences so that products are more tailored, adaptable and desirable to the customers (Lee et al., 2020). However, it has been recognized that these models suffer from three of the same major weaknesses as linear NPD models do:

- they are time-consuming and often overly bureaucratic processes;
- each stage does not describe the way firms should integrate different development teams;
- these models do not help to define what must be produced during each stage (Lee et al., 2018).

These issues may lead to friction in the adoption of NPDs. Furthermore, it is acknowledged that the design of S.PSS typically follows a traditional approach, wherein the single device is considered the final product which limits the design of bigger, interconnected and more complex interactive systems since the traditional product design approach usually focuses on the properties and functionality of a single artefact (Ghargar et al., 2018).

Nowadays, as the nature of products is shifting towards becoming digital platforms, flexibility appears to be the most important requirement of a new development process. Flexibility should be implemented as either the ability to make changes to the product while being developed or in the processes that govern its development (Lee et al., 2018). Thus, an NPD is characterized by short cycles which subsequently increase the definition level concerning the problem (Figure 13). Iteration cycles effectively build up a less-than-linear process where the problem as well as the solutions spaces are continuously emerging within short cycles of discovery (Lee et al., 2018). In essence, a probing attitude appears to be

Figure 12. Illustration of a sequential model for product development from Lee et al. 2018

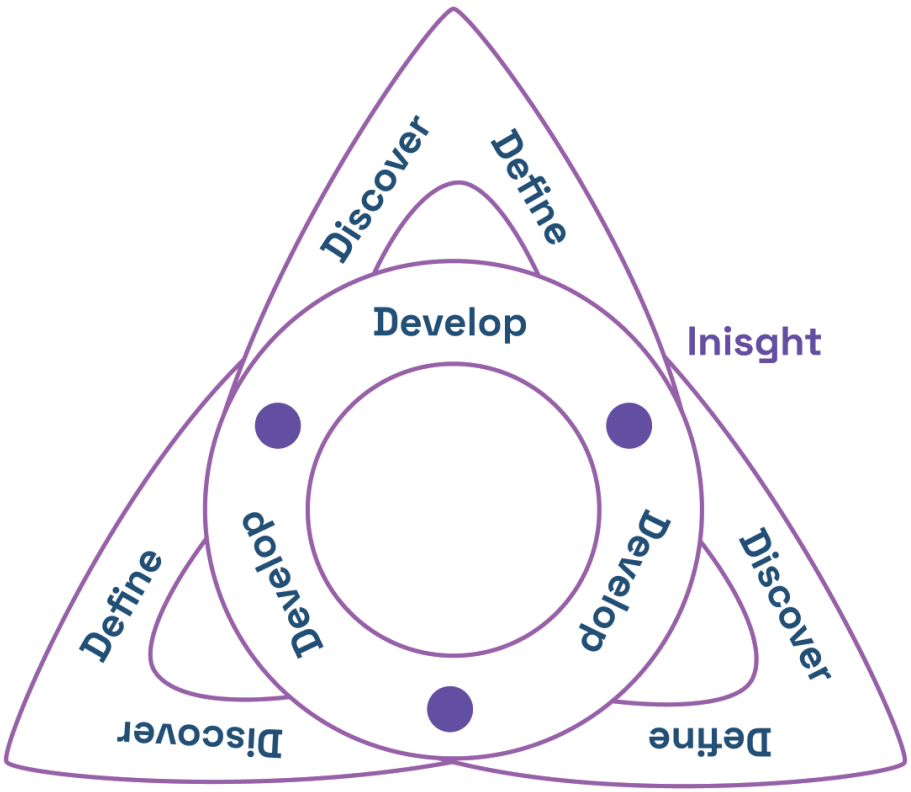


emerging. In fact, it could be argued that from an analysis-execution approach, the methodologies shifted towards a discovery-probing approach where short cycles improve communication and coordination activities between development teams and across organizations, improve a product's speed to market and consequently team's delivery time, and expedite responses to changing customer requirements (Lee et al., 2020). This model also de-centres innovation as it pushes intelligence toward the edge of the organisation's enlarging network (Lee et al., 2018). In essence, the peripheries of networks have a newly acquired importance. Counterintuitively, as innovation is de-centred, the peripheries of the networks become central

Nevertheless, no process models – not even the iterative one which is more recent – outline any specification about which data must be used and, most importantly, at which stage. In essence, no new product development process outlines data management strategies. The missing link is evident as even researchers when reporting about an e-textile to treat hand chronic arthritis fail to design exactly these policies into a system that deals with health data (Gonku-Berk & Topcouglou, 2017). In essence, including data within a new development process becomes a requirement considering the increasing importance of the datascape within S.PSS. It is perhaps over-optimistic to ask a model to reach such a level of detail as any model is by definition generalist. However, any model must surely include guidelines for the governance of data generated, used and analysed throughout the lifecycle of S.PSS.

On a more positive note, Smart Product-Service Systems deepen the notion of participation - at least on a theoretical level. In fact, the development process has been defined as a closed-loop design because it is not limited to the design stage and can be extended to all phases of the

Figure 13. New iterative product development process from Lee et al. 2018



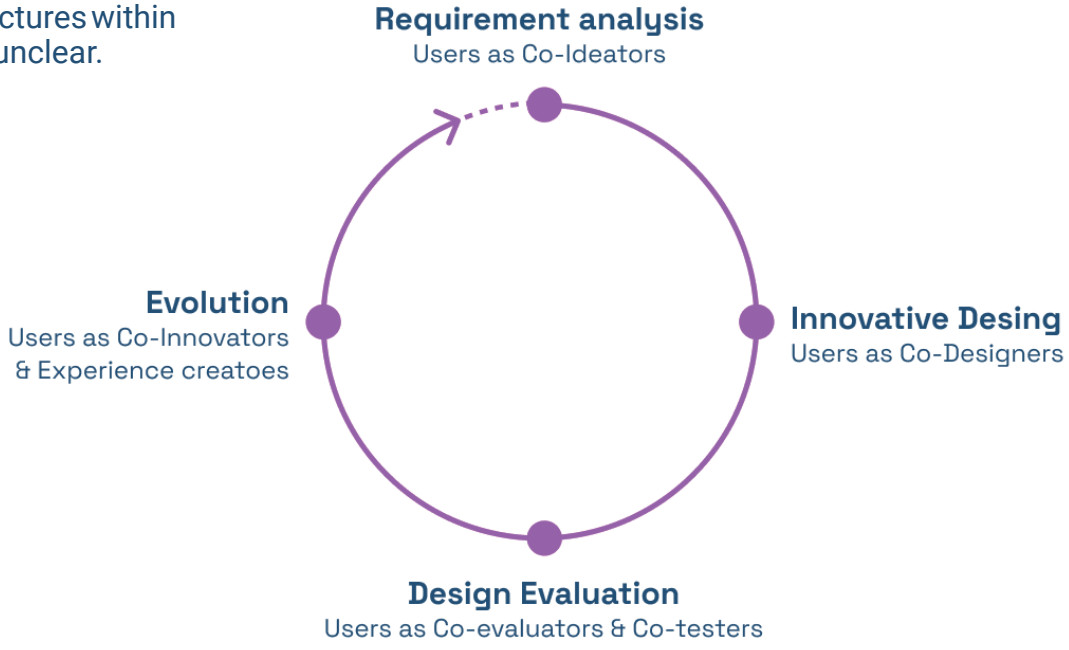
product lifecycle with a more holistic approach encompassing a life-long evolutionary approach (Carrera-Rivera et al., 2022). In fact, according to Carrera-Rivera et al. (2022), users are involved throughout the life cycle of the S.PSS (figure 1):

- during the requirements analysis phase, user requirements need to be identified thus customers may have the role of co-ideators;
- during the innovative design phase, it is possible to analyse at a later stage the fulfilment of requirements and customer needs through prototyping;
- during the design evaluation, customers could participate as co-evaluators, thus gaining useful insights on sustainability aspects, value proposition and customer value.
- during the evolution phase, users can take the role of co-innovators leading to iterative product adjustments.

It is expected that new product development processes will better focus on the values and experiences of the individual as opposed to optimising the production process (Petrelli, 2017). Therefore, S.PSSs are expected to break free from the functionality-oriented paradigm, embracing a more experienced-based approach.

In conclusion, it is important to notice that even though S.PSSs might have the same underlying infrastructure, each design is unique in terms of configuration as it delivers a different experience to every user (Petrelli, 2017). Despite the emergent literature on new product development processes, the benefits for users and their impacts on organizational structures within companies is still unclear.

Figure 14. Closed loop design in Smart Product-Service-Systems from Carrera-Rivera et al., 2022.



Therefore, what are the benefits for users which would promote a more experience-based paradigm? Moreover, what is the impact on established processes within companies? Are companies willing to adopt these processes?

7.4 EXPECTED BENEFITS OF SMART PRODUCT-SERVICE SYSTEMS AND ORGANIZATIONAL DIFFICULTIES IN NEW PRODUCT DEVELOPMENT PROCESS

It is important to highlight that the methodologies illustrated in the previous paragraph still suffer from some limitations, such as: what data should be captured, at what point in the loop and for what purpose. Moreover, there is also a gap in how to build in-house capabilities, skills and competencies that can leverage upon the vast amount of today's harvestable data. Finally, it has to be clarified how to manage strategic alliances with networks of users, machines, data and algorithms. Some dimensions – for instance, the alliances within networks - have already been highlighted by Vandermerwe & Rana in 1988. According to Lee et al. (2020), it is notoriously complex to build strategic alliances with device manufacturers, software developers, or service providers: on the one hand, bigger value constellation means there are likely to be more opportunities in value creation; on the other hand, the more partners getting involved increases the risk of data leakage and complicates managing the interests of a distributed and diverse set of stakeholders.

Even though research on new development processes could certainly provide useful insights to companies, there are other organizational variables at stake. In fact, Paliyenko et al. (2022) conducted research on German SMEs (Small and Medium Enterprises) and found that some have not even established an additional development process, while others are currently struggling to adjust their organizational structures in order to acquire the relevant knowledge and form specialized development teams. Also, it is important to notice that current employees are required to follow a turbulent change management roadmap. In fact, they might change their role and skills while still being fully engaged in their day-to-day business and their existing workload (Paliyineko et al., 2022). This piece of research could very well be the starting point for additional investigations into NPDs in order

to embed milestones and guidelines to facilitate the adoption of new and innovative models within already established and stratified organizational structures.

On a more encouraging note, although research highlighted difficulties in the adoption of NPDs, S.PSSs come with many expected benefits. Generally, it could be argued that the fundamental promise of Smart Product-Service Systems consists in promoting positive behaviours in users. As shown in Table 3, there is a wide range of possible applications of an S.PSS which could promote sustainable behaviour, with the term sustainability intended in a broader and holistic sense.

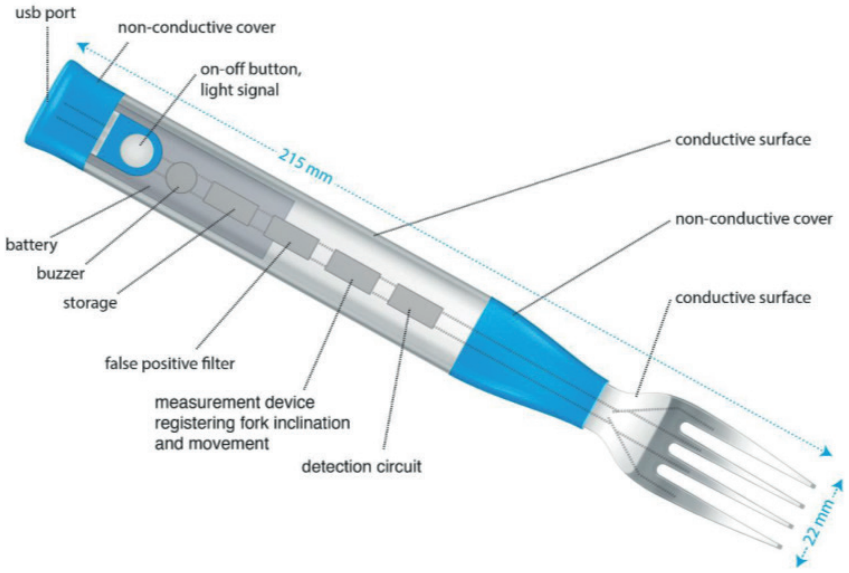
Hermsen (2018) argues that so far designers often relied on self-monitoring data. However, it is evident that constant self-tracking, even for a limited about of time, is considerably effort-intensive from a user perspective. Additionally, self-tracking is definitely not objective. Conversely, feedback could bring habitual behaviour and its context to conscious awareness, thus shifting the paradigm from a reflection-on-action (focused on past events) to a reflection-in-action (focused on present events) and disrupting habitual behaviour (Hermsen, 2018). Therefore, feedback has the potential to direct users toward a target behaviour, a dimension that is commonly referred to as persuasive technology. Persuasive technology acts on balancing System 1 and System 2 thinking modes, whose specific strategies for behavioural change are analysed in detail within the following chapters. Feedback could also be targeted to achieve a specific goal over a period of time. In fact, behavioural research found that when a discrepancy between goal and performance is noted – given enough motivation, opportunity, and the right abilities –

Table 3. Applications of SPSS promoting positive behaviours from Ferraro et al., 2017.

Context of Persuasive Technologies	Examples
Commerce—Buying and Branding	To buy a certain product
Education, Learning, and Training	To engage in activities that promote learning
Safety	To drive more safely
Environmental Conservation	To reuse shopping bags
Occupational Productivity	To set and achieve goals at work
Preventative Health Care	To quit smoking
Fitness	To exercise with optimal intensity
Disease Management	To manage diabetes better
Personal Finance	To create and adhere to a personal budget
Community Involvement/Activism	To be a volunteer
Personal Relationships	To keep in touch with their aging parents
Personal Management	To avoid procrastination

people will attempt to reduce this discrepancy (Hermsen, 2018). According to the notion of participation, data could be tracked within a collaborative process, provided that users give informed consent. Furthermore, according to Hermsen (2018), tracking user behaviour through a social, collaborative process will find more uses for designs that encourage relatedness; conversely, tracking could otherwise be aimed at achieving autonomy and self-determination. Hermsen (2018) reports on an experiment where the relationship between the human and the tool is directed towards the enhancement of autonomy. The experiment was performed both in a laboratory and real-life conditions and a vibrotactile feedback from a smart-fork (Figure 15) persistently decelerated people's eating speed, which led to health benefits in the digestion process.

Figure 15. smart-fork providing vibrotactile feedback when eating patterns are accellerated from Hermsen, 2018.



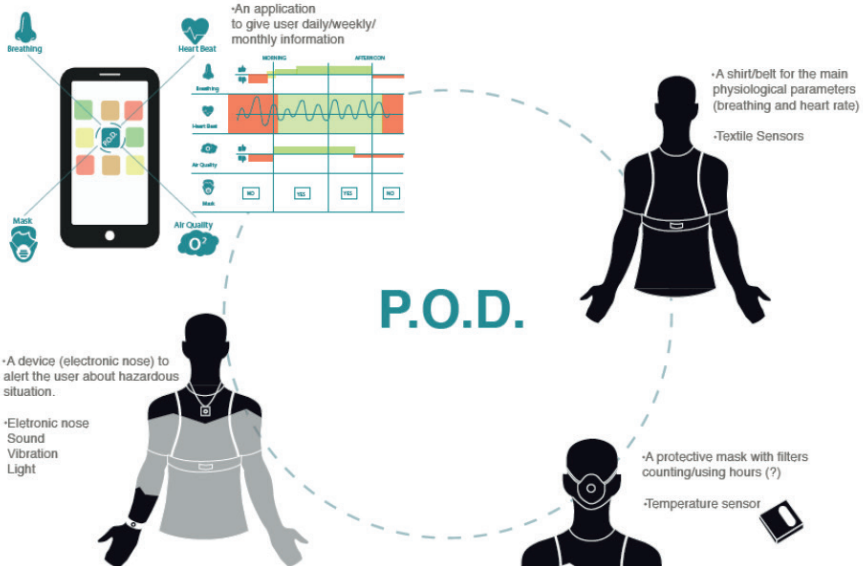
The experiment is useful to prove that the relationship between humans and technology is indeed not neutral. Additionally, it shows promising effects concerning the collaboration paradigm, as human health benefited from uncovering eating patterns. However, the experiment does not yet provide evidence for the lasting effects of behavioural modification, as people might get accustomed to feedback (Hermese, 2018) which would shift back the relationship to a System 1 type interaction. In addition, worryingly enough, the design phase did not raise questions about the data governance model in terms of the limits of data harvested and the processes to measure human behaviour (Hermsen, 2018).

Another interesting research stream suggests that Smart Product-Service Systems could also promote sustainable behaviour, consistent with the notion of spimes. Van der Berge et al. (2022) note that CO2 emissions effectively lead to social and health-related issues. On top of that, an estimated 20 percent of direct household emissions in the USA could be saved through behaviour change (Lockton et al., 2014). Therefore, it means that one-fifth of the emission associated with the life cycle of a product could be saved during the use phase alone. In fact, repair-by-design is an emergent strategy aimed at specifically optimising the use phase of a product which might contribute to the reduction of household emissions. However, research shows that consumers often have low ability (e.g., time, skills, tools, knowledge) and motivation (e.g., financial, pleasure) to repair artefacts, though both are demonstrated as being necessary to initiate repair activities (Van der Berge et al. 2022). More specifically, two user studies have been conducted by Van der Berge et al. (2022): the first study investigates whether a fault indication on a malfunctioning product stimulates consumers to repair a vacuum cleaner and a washing machine; the second study was conducted to validate findings of the previous test. The results show that consumers seem quite willing to repair their products provided that the service provider offered guidance during the repair experience in order to enhance self-control and ultimately self-efficacy (Van der Berge et al. 2022).

It is important to recognize that in detailing the user journey, designers are effectively scripting users' behaviours into the designed solutions, (Lockton et al., 2014) prescribing what could be done and what could not be done. Scripting behaviours opens a prolific area of debate concerning overlaps between the knowledge domains of persuasive technology and ethics in design. Persuasive technologies are defined as computer-based tools designed for the purpose of changing people's attitudes and behaviours (Ferraro et al., 2017). The notion of scripting was already formulated by Solomon (1985), who defined it as a coherent sequence of events expected by the individual, involving themeither as a participant or as an observer.

Interestingly enough, back in the 1980s scholars researched how to leverage persuasive technology to stimulate responsible behaviours in employees, therefore enhancing work-health conditions. Nowadays, researchers leverage on wearable technology to improve work-health conditions. Ferraro et al. (2017) note that wearable technology has primarily focused on diet and physical activity; however, they designed, prototyped, and tested a wearable system with preventative and protective purposes for monitoring the workers' health status, the surrounding environment, and the potential risk sources. Firstly, they conducted a market benchmark in order to understand the market offering and in parallel conducted interviews with workers of a coating plant. The main insight was that wearing the protective mask in the workplace is based on personal perception, such as when they smell a bad odour or see and feel the environment overspray (Ferraro et al., 2017). Therefore, they provide a solution called POD (Figire 16), which enables employees to breath higher quality air (safety), feel comfortable, be aware of the environment's air quality, and finally be more attentive to personal health (Ferraro, 2017).

Figure 16. System architecture from Ferraro et al. 2017



As illustrated before, feedback is a powerful strategy to induce cues that effectively modify people's behaviour. POD's behavioural shift is aimed at a positive change as it promotes work-health conditions within a frequently toxic environment; however, persuasion might very well turn into manipulation without proper governance of the projects and most importantly without a set of guidelines that could inform the design process.

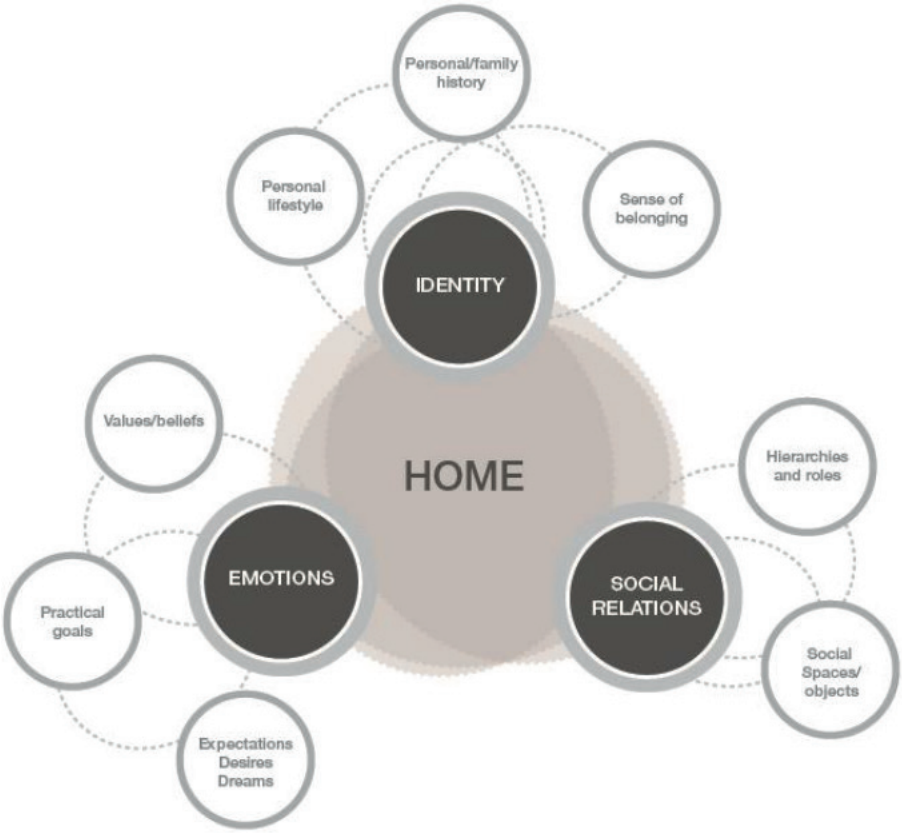
Finally, Smart Product-Service systems are believed to have

the capability to enhance the hedonic dimension of well-being, thus creating pleasurable and desirable living contexts in smart homes environments (Colombo & Pillan, 2017). This is coherent with the much-needed shift from a functionality-oriented to a more experience-based paradigm. In fact, Colombo and Pillan (2017) note that most smart solutions are developed for functional and technical performances, leaving aside all the soft aspects (meanings, values, emotions) of real life in our homes. Therefore, they suggest that for new products to be more attentive of the users' affective dimension, design should not only focus on the fulfilment of practical needs (e.g. having a more monitored and secure home) but should analyse and consider the emotional and symbolic implications of each new solution that is introduced in the domestic landscape (Colombo & Pillan, 2017). In an ethnography study, the authors note other symbolic dimensions (figure 17), such as:

- social and emotional factors, as every activity is complex and, in order to be suitably interpreted, it should be framed with respect to different facets of what they call experience;
- symbolic values, as every single task is often interpreted, in a conscious or unconscious way, as symbolic and affective;
- rituals, as they play quite an important role for people of each age, education, and social status. Rituals govern a number of activities which include "preparing to go to bed", "doing laundry" and "managing clothes";

self-reflection, as they noted a

Figure 17. Synthesis of ethnography studies conducted by Colombo & Pillan, 2017.



diffused and common need, the exigency of “being in control” on the environment.

In conclusion, the previous chapters illustrate the shift of focus from the optimization of technology itself to the way in which technology affects the social world. In fact, the socio-technical viewpoint implies a two-way relationship where technology affects the social and the social shapes the technological, neither the technology nor the user can be seen as stand-alone subjects anymore (Reddy & Linde, 2016).

The next chapters will dive deeper into the effects on human behaviours and cognition within these multi-directional instances of exchange. More specifically: how can technology change users’ behaviours? What are the strategies to operationalize the behavioural change? And finally, where is the line between persuasion and manipulation?

8. EFFECTS OF SMART PRODUCT-SERVICE SYSTEM ON USERS' BEHAVIOURS

The previous chapters briefly touched upon persuasive technologies and the role they have in influencing people's behaviours. Design and behavioural change are two powerful forces that have the potential to shape society in profound ways. Designers have long been at the forefront of creating products, services, and experiences that influence our behaviour, whether consciously or unconsciously. Meanwhile, behavioural change experts have developed strategies and interventions to help people adopt new habits and make lasting changes in their lives. In recent years, there has been a growing recognition of the interplay between design and behaviour change and the potential for these two forces to work together in creating positive social and environmental impact. By designing products, services, and experiences that are intentionally crafted to encourage desired behaviours, designers can leverage their skills and expertise to drive meaningful change in society. At the same time, behavioural change experts can work alongside designers to provide insights into human psychology and behaviour, helping designers to better understand how their designs can influence behaviour. By combining these two areas of expertise, designers and behavioural change experts can create solutions that are not only visually appealing and functional but also effective in driving positive behaviour change.

8.1 EXPECTED POSITIVE BEHAVIOUR CHANGES IN USERS

The position of technological neutrality maintains that a given technology has no systematic effects on society because technologies are merely tools people use for their own ends; however, a second position of technological determinism maintains that technologies are understood as simply and directly causing particular societal outcomes (Pilling et al., 2019). It should be noted that the latter is coherent with the More-Than-Human framework outlined in the first chapters. In addition, the activity of designing has in recent years been understood as a purposeful act to achieve functional and behavioural properties in the artefact (McMahon, 2021). In fact, in human civilization history, products appear as solutions to people's needs while humans formed their own behaviours and habits in parallel, depending on the availability of tools and environmental constraints. A habit is commonly defined as routine of behaviour that is repeated regularly (Wu & Pillan, 2017).

Furthermore, especially within services, the dimension of behaviour has been largely investigated. Services have been framed as a dyadic interaction characterized by a social behaviour consisting of joint activity where a major task for the interacting persons is the mutual coordination of appropriate behaviour (Solomon et al., 1985). Therefore, the service interaction transforms the attitudes of agents involved in the exchange. Tang et al. (2016) specify that service interaction is a learning process wherein customers acquire the knowledge, skills, attitudes, and motivations necessary to effectively fulfill their role expectations in a service program. Thus, it is evident that the expected roles have been previously scripted within the service delivery program upstream at the design phase. More specifically, Roy et al. (2019) suggest that several dimensions of the environment act as stimuli (S) that act as a combined influence on consumers' internal states (O), which eventually influence consumers' behavioural responses (R). Therefore, role clarity is a major driver of service success. In fact, people are often defined by the service roles

they play, with a lack of role clarity being a major source of job tension, dissatisfaction, and reduced innovativeness at work (Solomon, 1985). In essence, the dyadic interaction is a radically transformative force as it could promote uplifting changes within the agents involved. Transformative Service Research (TSR) is the theoretical framework that rationalises the dimension of uplifting behavioural changes within a service dominant logic.

Consumers interact with the service providers to seek solutions, obtain benefits, and address their needs or wants; thus, they can satisfy physical, mental, social, or financial well-being (Tang et al., 2016). TSR is service research approach that focuses on creating empowering changes and improvements in the well-being of both individuals and communities (Anderson & Ostrom, 2015; Tang et al., 2016). Anderson & Ostrom (2015) identify three themes in transformative service research:

- first, the focus on well-being issues in services which has arisen as a consequence of harm caused by services;
- second, a shift of focus from the classic dyadic paradigm consumer-provider towards a collective level which is coherent with the service ecosystem perspective;
- third, the impact of the upstream involvement of co-creation on customers and employees.

Even though every change provided by S.PSS has been so far possibly subversive, the changes were usually acceptable to users since they were usually presented as an addition to the existing useful features (Tang et al., 2016). In fact, the “abruptness” and “friction” associated with the changes depend on several factors: the familiarity of users with technologies, motivation toward the functions, context of use, quality of the communication presenting the product, and finally, the social environment (Wu & Pillan, 2017). In essence, the service organization can significantly improve its customers’ personal well-being by influencing consumers’ social cognitions as well as their goal-pursuit processes (Tang et al., 2016).

It is suggested that human behaviour is largely purposeful and

goal-driven process, which is typically characterized by two stages: goal setting and goal striving. These two stages imply that in order to achieve long-term benefits, consumers need to control unplanned and spontaneous short-term impulses (Tang et al., 2016). The case study of the smart fork sustains the argument of balancing the trade-off between the short-term and the long-term time frames in order to obtain sustained benefits, as everyday micro-interactions impact the overall health benefits provided by the dyadic interaction. In addition, when setting goals or establishing goal intentions, consumers implement an appraisal process to evaluate information relevant to the pursued goal, including their own capabilities, environmental situations, and anticipated outcomes and processes (Tang et al., 2016). Therefore, according to Wu & Pillan (2017), the first step within a design process for setting uplifting goals consists of the preliminary evaluation of the consequences of the design choices on user behaviours. However, research shows that the cognitive load of the goal-pursuing process is different according to the stage the users are involved in. In fact, newcomers and customers who are close to the end of a program are more vulnerable to failures in the goal obtainment: the former suffers from lack of self-regulation capabilities while the latter are fragile because the course of the program might have depleted their mental resources by constant self-regulation (Tang et al., 2016).

In essence, during the goal-setting stage, the role of the service organization is to help consumers form positive appraisals of environmental information so they can set a challenging but attainable goal. Conversely, in the goal-striving stage, the role of the service organization is to help consumers convert goal intention into actual goal-achievement, as without proper organizational support the link between goal intention and goal achievement is likely to break, thus hindering well-being enhancement (Tang et al., 2016). Even though the service delivery stage has been shown to be a learning process, these results indicate that simply learning about the role expectations and knowledge required by the service program is not sufficient to change consumers' expectations of their experience and the outcome of the goal-striving process. It is the actual physical and

emotional support provided by the service provider that alleviates consumers' stress and helps them form positive outlooks of the goal process (Tang et al., 2016). In essence, a deeper notion of collaboration is needed where benefits are shared between all the actors that participate in the service delivery.

Although transformative service research is a useful theoretical argument for supporting the need of a deeper collaboration paradigm, it does not provide guidelines, methods, and strategies to successfully put in practice what it promises. Therefore, how can service providers operationalize transformative service research? Which are the strategies that enable service organizations to actually change people's behaviour?

8.2 NUDGING AND BOOSTING, TECHNIQUES TO OPERATIONALIZE BEHAVIOUR CHANGE.

The notion of nudging was popularized by behavioural economist Richard H. Thaler and law scholar Cass R. Sunstein who suggest that public policymakers and other choice architects influence decision-making processes in a manner that promotes behaviour in the general interest of society as well as in the interest of the decision maker (Huang & Bush, 2014). Nudging relies on the insight that it is possible to change people's behaviour via their environment (Kozyreva et al. 2020). This notion has also been utilized to frame the concept of servicescape, which is based on the foundational insights of environmental psychology, a discipline that studies the relationship between humans and the environment.

Nudging could also be positioned within a more general framework, commonly referred to as libertarian paternalism (Huang & Bush, 2014). Libertarian paternalism is a negative rationalization of cognitive flaws in human decision-making. It sees users as inherently flawed decision-makers with the majority of consumers not well equipped to make choices for themselves. In fact, research in cognition has largely shown the two distinct systems that characterize human thought. On the one hand, there is the 'reflective system' (system 1) which is deliberate, analytical and self-conscious; on the other hand, the 'automatic system' (system 2) which is rapid, intuitive, and with shortcuts (heuristics) that lead people to the most efficient choice (Maier & Harr, 2020). Incredibly, 95% of one's cognitive activity takes place in a non-conscious manner (Maier 6 Harr, 2020). Unfortunately, it is widely accepted that these shortcuts often backfire, leading to biases and shortcomings over the decision-making process.

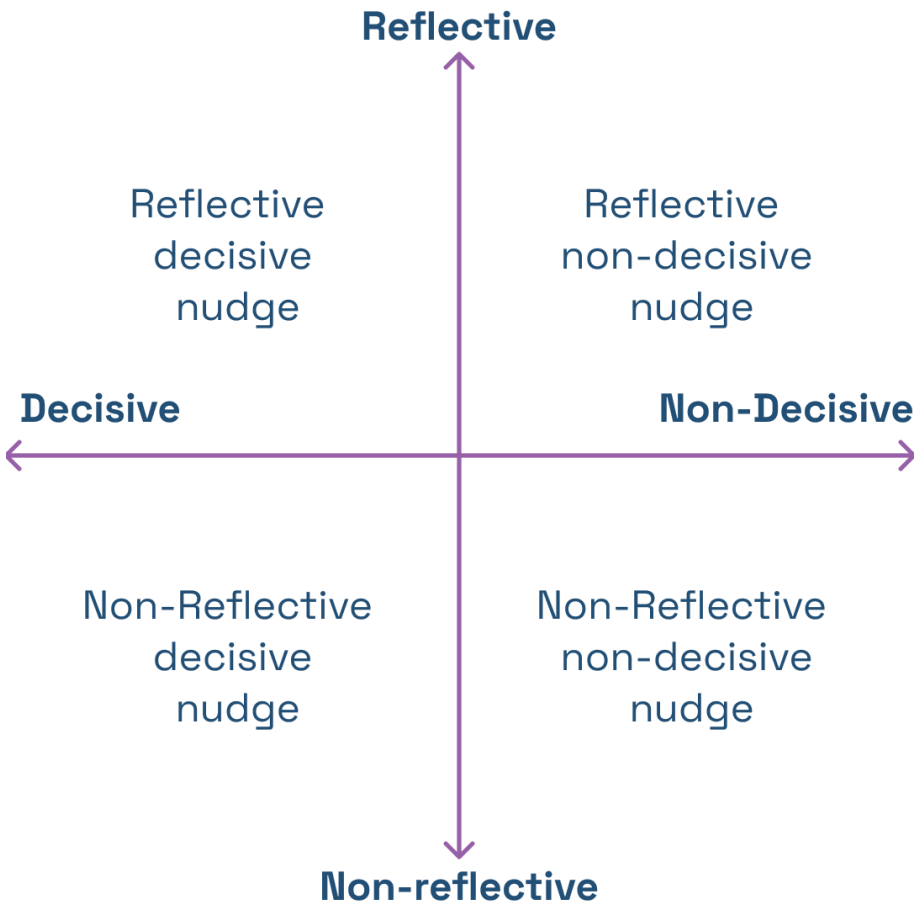
It is important to point out that nudging suggests a preferred behaviour leaving the option to users to reverse their decision-making process. Huang & Bush (2014) formally define the notion of nudging as any aspect of the choice architecture that alters

people's behaviour in a predictable way, without forbidding any options or significantly changing their economic incentives. According to Kozyreva et al. (2020), the citizen in a specific situation should be able to reconstruct either the intention or the means by which behavioural change is pursued (Huang & Bush, 2014). Importantly, nudges do not eliminate available options and are easily reversible, yet they substitute autonomous choice with preselected rational decisions to overcome people's cognitive biases and inadequate decision-making competencies. Even though nominal autonomy might be preserved, effective autonomy may be reduced (Kozyreva et al. 2020). This opens deep discussions concerning ethics in design.

In fact, design literature has long recognized that designers could craft more mindful interactions through the addition of nudges or design friction (Chianella, 2021). Kozyreva et al. (2020) specifically refer to educative nudges, or system 2 nudges, which constitute a category explicitly respectful of human autonomy as it boosts decision-making strategies. However, nudging could also backfire. According to Huang & Bush (2014), what makes nudging unique in a design context is that it may both enable designers to highlight certain overall user-preferred decisions opportunities, but it also enables the designer to affect decisions of users or those who inhabit designed environments by bypassing their reasoning processes. Therefore, Huang & Bush (2014) built out a framework (Figure 18) to distinguish ethical and non-ethical nudges:

- A reflective-decisive (RD) nudge aims to influence reflective thinking by influencing the automatic system (System 1 thinking). The nudging features of the

Figure 18. SA framwork for ethical nudges from Huang & Bush, 2014



product are decisive for choosing the particular product.
- A reflective-non-decisive (RND) nudge aims to influence reflective thinking by influencing the automatic system (System 1 thinking). The nudging features of the product are not decisive for choosing the particular product.
- A reflective-decisive (NRD) nudge aims to influence the behaviour maintained by automatic thinking without involving reflective thinking (System 2 thinking) during the use process. The nudging features of the product are decisive for choosing the particular product.
- A non-reflective non-decisive (NRND) nudge aims to influence the behaviour maintained by automatic thinking without involving reflective thinking (System 2 thinking) during the use process. The nudging features of the product are not decisive for choosing the particular product.

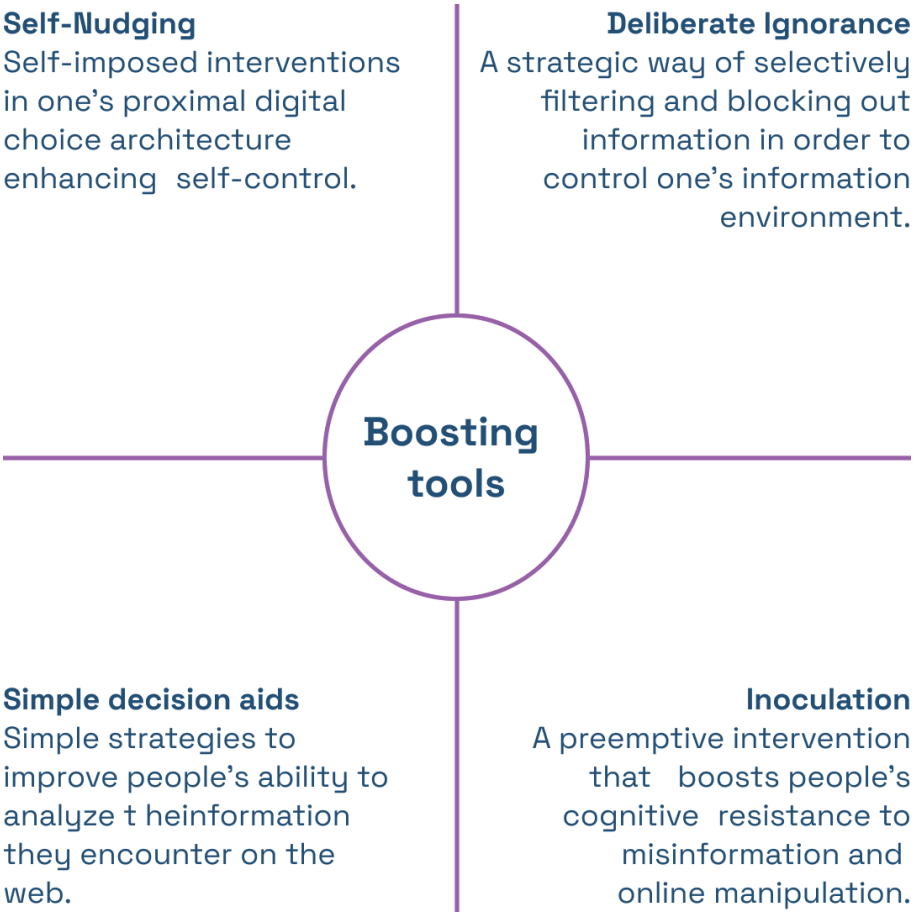
In conclusion, non-reflective nudges could be considered unethical as they limit users' agency without users being aware of the nudgeleveraging the system 1 thinking. Along the same line, reflective nudges could be considered more ethical as they elicit system 2 thinking. Thus, reflective nudges are what Kozyreva et al. (2020) refer to as educative nudges, as they boost users' decision-making. In essence, nudges reduce a user's agency within a specific situation as the decision-making is delegated to an entity that is considered by a considerable number of actors as rational.

However, as it is widely recognized that scripting behaviours is one of the factors that contribute to service success, one might wonder: what is the responsibility of designers? Kozyreva et al. (2020) specifically refer to the notion of commercial nudging when interfaces are designed primarily to maximize financial return for the platforms, capture and sustain users' attention, monetize user data, and predict and influence future behaviour. This commercial-oriented approach to users' engagement often leads to deceptive techniques, detailed in following chapters, that nag users into making choices, namely concerning purchases and data privacy that they would not do otherwise.

A more promising approach to behaviour change is boosting. Boosting is rooted in a different view of human psychology, since it views people not as cognitive actors full of biases who are unable to make good decisions on their own, but rather as admittedly bounded decision makers who have the ability to learn and to rely on simple cognitive strategies adaptable to uncertain environments (Kozyreva et al. 2020). Therefore, the main objective becomes empowering people to make better decisions for themselves while fostering and extending human agency and autonomy. Figure 19 outlines in more detail the four strategies through which boosting may occur (Kozyreva et al. 2020):

- Self-nudging, for people to foster self-control and motivation. However, this does not mean the responsibility for important features of the digital choice architecture would be shifted from companies or regulators to user;
- Deliberate ignorance, to shield oneself from biases in an era of polluted information as a tool for information management where epistemic abstinence becomes more rational than epistemic indulgence (ex. a technique often used in orchestra auditions);
- Inoculation, also known as pre-bunking, targets people's ability to recognize misleading or manipulative strategies before they encounter them face-to-face or online. It can immunize people against certain strains of false and misleading information. It is pre-emptive as it aims to expose people to misleading or manipulative strategies and to neutralize their disruptive potential before people actually encounter them in the world.
- Simple decision aids

Figure 19. Strategies for boosting from Kozyreva et al., 2020.



> for digital-information literacy complements educational programs by providing people of all ages with simple strategies and decision aids for evaluating information encountered online. The goal is to foster good habits that are as simple and automatic as washing one's hands or scanning the crosswalk before making a turn.

Lockton already recognized the dimension of deliberate ignorance prematurely in 2012 when highlighting the negative effect that filter bubbles might have on users, when the experience of cognitive dissonance is deliberately avoided. In conclusion, both nudging and boosting act on a specific characteristic of autonomous agents, which is agency. Even though the two approaches act on agency with specular strategies (limiting vs. enhancing agency), they imply the underlying existence of third super-parties rational entities which effectively acts as a reference point to determine what is acceptable and what is not.

However, it should be clarified: under what circumstances this entity is considered rational? What are the criteria that label this entity as rational? Whose point of view was used to elaborate the criteria? In essence, which point of view should be adopted when embedding nudges in designed outcomes? Therefore, a problem of representation is intrinsic to the nudging design phase as the overall design space (both problem and solution spaces) is often framed according to specific point of views – which then exclude other perspectives – in order to rationalise the complexity of the process so that ultimately decisions can be made. often defined by the service roles

8.3 THE NOTION OF FRAMES: ADOPTING A POINT OF VIEW WHEN IMPLEMENTING BEHAVIOURAL CHANGE

It is generally recognized that the scope of design activity has enlarged through time: as Guy & Kimbell (2018) put it, design is constantly re-designing itself. In fact, some scholars frame contemporary design strategies as way of making society (Sloane, 2019). This view is coherent with the great power that the notion of nudging gives to choice architects. Fox et al. (2020) position the proposal of reframing the practice of design within the reflexive turn movement of the 1980s that spread across several fields, including anthropology and sociology. The reflexive turn movement challenged the view that the researcher's own experiences and emotions are invalid forms of knowledge production, arguing for the existence of a mutual constitution between the analytic tools of researchers and those of their sites of study (Fox et al., 2020). In essence, as Narayan et al. (2020) illustrate, design is power.

The enlargement of the scope of design activities was accompanied by a growing awareness of the challenges that designers face. According to Guy & Kimbell (2018), designers are now tackling social issues. Therefore, a reframing of the notion of design appeared necessary. According to Prendiville (2022), designers have been described as material-semiotic storytellers as they possess a set of practices and capabilities to interpret socio-technical systems. Furthermore, design practices normalize past and present values into the future (Prendiville, 2022). This puts great responsibility on designers' shoulders, as emergent values could be normalised and spread through design artefacts which ultimately influence the structures that people use to interpret the everyday.

At the same time, framing has become a foundational concept in design theory. Framing is defined as a deliberate strategy involving an approach to meaning-making and sense-making intended to make complex social situations understandable

in order to develop actions; in essence, it is the creation of a (novel) standpoint from which a problematic situation can be tackled (Prendiville, 2022). Designers, therefore, must develop critical skills for interpreting new phenomena they are exposed to. Sloane (2019) stresses this position even further, arguing that design is never neutral and that criticality in design necessitates reflexivity. Frames are inherently political as they condition, foreclose, direct, or open up social processes and outcomes and in doing so suppress or reveal dissensus (Prendiville, 2022). As previous chapters showed, tools and materials themselves are far from neutral as well. Instead, they are shaped according to the values and politics of their designers and the societies in which they are embedded; furthermore, they come to embody those values and politics (Poirer, 2017). In essence, design is far from being a passive practice and the tools that designer use and produce are far from being neutral agents.

Thus, inequalities become a central issue that designers should address. However, few if any design professionals explicitly claim to engage with inequalities with the task being a big, if not impossible, task to ask from designers alone. In fact, neoliberal times are characterised by rising form of inequalities (Guy & Kimbell, 2018). Countless studies demonstrate that not only economic but also legal, property, educational, racial/ethnic, health and well-being inequalities are the result of financialist neoliberal models (Guy & Kimbell, 2018). The financialist neoliberal modes are a risk that have been previously highlighted in the chapter on blockchain as this new technology pushed towards datafication, which implies an economification of every aspect of an individual existence. Put more generally, the domination of rentier capitalism within neoliberal modes of production and consumption is, by necessity, dependent on inequalities. Since the 1980s, the exponential growth of economic inequalities has been exacerbated by the steady retreat of the ‘safety net’ of the state as a device for addressing inequality issues, thus introducing instead more localized settings of cities, communities and citizens experimentalism in policy and implementation (Guy & Kimbell, 2018).

In essence, even though the scope of design increasingly enlarged through time, it is impossible to ask designers alone to change the world. The point is that the relationship between design and inequalities is fluid, it can move between demonstrations of power and elitism that sustain unequal power relations and decided efforts to challenge them (Sloan, 2019). Therefore, it is important to recognize that frames carry the values of the frame's creator (Prendiville et al., 2022). Fox et al. (2020) propose the notion of positionality, refering to personal history, cultural status (e.g., gender, nationality, and racial identity), and the power differential aspects of our identities that mark relational positions rather than essential qualities. Prendiville (2022) identifies different types of frames, such as:

- narrative frames which are time device to articulate designers' engagement in a process in a continuous process of re-framing in dialogue with relevant actors;
- meaning frames which are the process through which designers create shared understandings directed to build consensus between project beneficiaries;
- individuals' frames of reference which create cognitive biases understood to relate to larger discursive forces and knowledge systems in society (i.e., institutional frames). Within the framing effect (central to understanding the link between perception, moral values, and actions) people assess situations through a process of internal comparison to a legitimate point of reference or baseline;
- master frames, which are enduring collective actions that re-emerge in different forms through cycles of action by which different social groups strive for legitimacy claims by un-institutionalized actors, also referred to as new forms of political agency or activism;
- counter-frames, which oppose earlier effective frames and arise competitively between opponents involved in political debates;
- institutional frames, which are taken for granted realities that structure expectations and script behaviours;
- ill-defined frames, which claim that relying on empathy as the point of departure effectively privatizes its frame of

> reference, such as, for example, rendering the problems of systemic racism as solvable by walking a mile in a person's shoes. Implicit within this critique is an argument against the uncritical subjectivist approaches that currently underpin design frame theory, whereby frames reproduce biases related to identity, gender, race, citizenship, and beliefs.

Specifically, Poirer (2017) recognizes that many base components of digital infrastructure that humanists must leverage to build digital systems (e.g., databases and algorithms) have themselves been built with cultural assumptions that differ drastically from those of humanistic inquiry. This is consistent with the risk highlighted in chapter 5.4 that focused on the underlying infrastructure of Smart Product-Service Systems. Recognizing the mediating effect of frames means acknowledging the importance of a self-reflective approach to design that might advance a mutual (and thus equitable) relationship between designer and user which always happens within a fragile encounter whereby choice architects constrain users towards desired behaviours (Fox et al., 2019). In essence, the notion of frames recognizes that the contact between humans and the real world is happening through a system of representations which are mainly the result of developers' work; these frames mediate the individuals' experience of their environment (Ayazova, 2017).

However, it should be noted that design throughout time has addressed the question of representation by crafting a creative process that bring designers and consumers together. Previous chapters showed an array of strategies that enable bringing users upstream in the design process, as highlighted by Aurchenhammer (2020). In this scenario, the user is physically and intellectually involved in the industrial process and thus becomes capable of shaping their own reality (Ayazova, 2017).

As the scope of design has been framed, it is now time to frame the role of designer within this newly acquired set of responsibilities. More specifically, the question of nudging and representation are directly intertwined with ethics of design process. What is the ethics of the design process? What is the designer's agency? And most importantly, what are designer's responsibilities?

8.4 ETHICS WITHIN THE DESIGN PROCESS

As presented in the previous chapter, design is a growing strategic force of social change which implies a primary social responsibility for practitioners engaging in increasingly complex problems. The social question within design was already highlighted by Papanek (1984), who stated that architecture and design are the social arts par excellence. It is reasonable to say that designers should acquire new competencies to tackle increasingly systemic issues. In fact, the infrastructures available to designers – the existing tools and materials that designers employ when building new systems – sometimes do not align with the commitments of specific communities (Poirer, 2017). The misalignment between existing tools and required competencies urgently raises questions about ethics within the design process.

Designers will inevitably influence the context of people and society for better or worse (Eggink et al., 2022). Chivukula & Grey (2020) organized a workshop in order to test the infrastructure available to designers: design students were provided with current wireframes of Alexa's mobile application (including the home page, settings, and permissions pages). Then, participants were asked to iterate on these wireframes or completely change the user interactions in order to address the design brief, which was explicitly manipulative. Even though the study aimed to explicitly force design artefacts towards malicious design intent, it seems pretty unreasonable that designers would ever be faced with such an explicitly manipulative project brief. It is more interesting to study the cases in which designed solutions without any malintent actually backfire; this type of study could lead to the development of backcasting checkpoints to keep the design project on track.

Ethics is often addressed as a way of dealing with complexity, setting the boundaries of what is a good thing to do and what not. However, Eggink et al. (2022) argue that it can be more constructive than merely drawing a red line. They propose the notion of experiential ethics in order to purposely address

complex and controversial ethical issues by making the inherent dilemmas of technological development clear and visible within and throughout the design process. Building upon notions of problem framing, Chivukula & Grey (2020) propose the concept of co-evolution acting as a set of evolutionary processes whereby problem spaces continuously interact with potentially related solution spaces. Co-evolution justifies the notion of experiential ethics as dilemmas are tackled within the unravelling of the design process with a reflection-in-action approach. In essence, dilemmas or problem spaces are situated within a specific place and time.

Poirer (2017) highlights that through reflection on their own practice, designers can configure materials to challenge the assumptions about the role design plays in society. It should be acknowledged that both the notion of experiential ethics and the reflection-in-action approach are consistent with Sloane's (2019) idea that design constantly redesigns itself. The emergence of different courses of action is commonly referred to as devious design as it could be a practice where designers not only "make do" with the infrastructure available, but also leverage that infrastructure in ways that challenge its underlying logics (Poirer, 2017). In essence, values emerge from the creative process itself, which allow Eggink et al. (2022) to frame creativity as ethics.

Consequently, there have been many approaches that stimulate designers to actively engage with the values that are incorporated in a particular technology, for instance, Value Sensitive Design (Egginks et al., 2022). Value Sensitive Design is defined as a theoretically grounded approach to the design of technology that accounts for human values in a principled and comprehensive manner throughout the design process (Friedman et al., 2002). Friedman et al (2002) identified five dimensions for a Value Sensitive interaction with technology:

- disclosure, which refers to providing accurate information about the benefits and harms that might reasonably arise from the action under consideration;
-

- comprehension, which refers to the individual's accurate interpretation of what is being disclosed;
- voluntariness, which refers to ensuring that the action is not controlled or coerced and that an individual could reasonably decline participation should they wish to;
- competence, which refers to the possession of mental, emotional and physical capabilities needed to give informed consent;
- agreement, which refers to a clear opportunity to accept or decline to participate.

Although many of these methods have been shown to be effective in a research context as a generative tool to understand the ethical implications of design, none have been rigorously tested in professional practice and even fewer have been disseminated to practitioners (Grey et al., 2018). Therefore, scholars proposed a turn to practice, engaging with the design complexity of practitioners rather than attempting to frame designer behaviours only or primarily through extant academic models or theories (Grey et al, 2018).

In fact, the professional ethics literature in design and technology contexts has been dominated by work in engineering ethics; furthermore, there is a substantial lack of integration into educational programs which makes it possible for designers to favour stakeholder's value rather than user value (Chivukula et al., 2018; Chivukula & Grey, 2020). Therefore, the need for an ethical approach to inform the design process is evident, as designers risk favouring stakeholder's value rather than user's value, thus failing to comply with the Human-Centred-Design approach. Designers have been referred to as every-day-ethicists because ethics becomes embedded in the everyday activities of practitioners through their actions, as they constantly negotiate values in their daily activities (Chivukula et al., 2018, Grey et al., 2018). Chivukula & McKay (2019) also found evidence that much of the conversation about ethical phenomena and complexity takes place on social media - a phenomenon which they specifically call "asshole design". Asshole design is a tag used on social media where everyday people report shortcomings

of design artefacts in the real world. Although it might seem trivial, it actually may have great consequences on business, as UX failures might push customers to competitors which in turn erodes the first company's bottom line profits.

Furthermore, the question about what (and whose) values should be considered remains open, the very question of representation already highlighted in this chapter. More specifically, the question is not only about a pre-determined set of human values (e.g., B. Friedman & Kahn, 2003), but also to discovering values that may have relevance for specific groups (Chivukula & Grey, 2020). In fact, the first approach is not consistent with the notion of experiential ethics while the latter enlargens the participation, as the needs and values of different communities could be embedded in the design process.

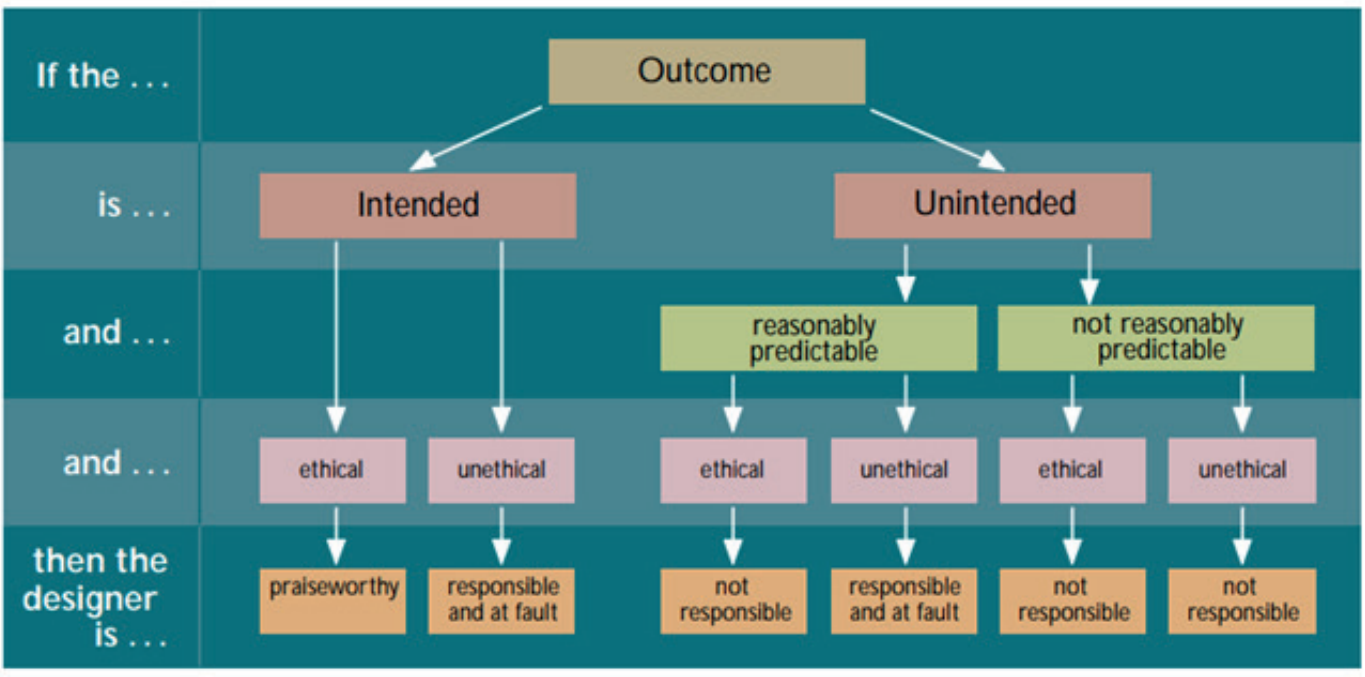
Participation is even more important in the context of persuasive technology which purposefully aims at modifying human behaviours. According to Berdichevsky & Neuenschwander (1999), technologies have always influenced our lives and how we lead them, but only recently have technologies emerged that are actively persuasive in their own right, such as artefacts created primarily to change people's attitudes and behaviours. This type of technology is also referred to as captology (Lockton, 2012). Furthermore, Berdichevsky & Neuenschwander (1999) built a flow chart to determine the ethics of an act of persuasion (Figure 20). It is important to notice that persuasion distributes responsibilities between the agents involved in the act, namely the persuader and the persuaded; therefore, ethical scrutiny has to focus on the methods of persuasion with a set of principles to make sure that persuasion does not trespass the boundary turning into manipulation (Berdichevsky & Neuenschwander, 1999). Introduce what this list is:

- the intended outcome of any persuasive technology should never be one that would be deemed unethical if the persuasion were undertaken without the technology or if the outcome occurred independently of persuasion;
- the motivations behind the creation of a persuasive technology

should never be such that they would be deemed unethical if they led to more traditional persuasion;
- the creators of a persuasive technology must consider, contend with, and assume responsibility for all reasonably predictable outcomes of its use;
- the creators of a persuasive technology must ensure that it regards the privacy of users with at least as much respect as they regard their own privacy;
- persuasive technologies relaying personal information about a user to a third party must be closely scrutinized for privacy concerns;
- the creators of a persuasive technology should disclose their motivations, methods, and intended outcomes, except when such disclosure would significantly undermine an otherwise ethical goal;
- persuasive technologies must not misinform in order to achieve their persuasive end;
- **the golden principle: the creators of a persuasive technology should never seek to persuade a person or persons of something they themselves would not consent to be persuaded to do.**

Much of the behavioural change induced by technology have been studied within the discipline of Human-Computer-Interaction (HCI). Lockton (2012) notes that the convergence of the digital and the physical world influences our behaviour significantly

Figure 20. Flowchart ramifying the levels of ethical responsibility associated with predictable and unpredictable intended and unintended consequences from Berdichevsky & Neuenschwander, 1999.



framing the notion of “code is law”. It implies acknowledging that while law is a substantial regulator of human behaviours offline, online it is code that predominantly structures what people can and cannot do (Lockton, 2012). Table 4 illustrates seven tools of persuasive technology (Lockton, 2012; Maier & Harr, 2020). On top of that, it is important to notice that there are often two dimensions to behavioural change: on the one hand, activation of a target behaviour; on the other hand, preventing it to happen (Fogg, 2009).

Table 4. Seven persuasive technology tools from Lockton 2012.

Tool	Description & design implications
Reduction	Simplifying a procedure: reducing the number of steps needed to complete a task, in order to encourage people to do it. As well as increasing likelihood that a task will be performed correctly, also potentially increases people’s belief in their own abilities, leading to a more positive attitude towards the behaviour. See also Maeda’s (2006) and Colborne’s (2010) treatments of intentional simplicity in interaction design.
Tunnelling	Tunnelling refers to leading users through a predetermined sequence of actions or events, step by step (Fogg, 2003, p.34). This is often initiated by people who want to change their own behaviour, e.g. hiring a personal trainer to direct them through a programme. There are parallels with commitment and consistency biases (Cialdini, 2007); in design terms, the most obvious implications are the use of `wizards’ to lead users through a process, and making use of opportunities to deliver messages to audiences who are already `captive’ in some way.
Tailoring	Computers are able to tailor and segment the messages, interfaces and options available to users at dierent times, in dierent circumstances, and for dierent people, making it more likely that the messages delivered will be perceived as personally relevant. Often combined with tunnelling as part of wizard-type systems to oer users directly relevant information and options
Suggestion	The key to offering suggestions, in Fogg’s treatment, is finding the opportune moment to do so. Suggestion technologies often build on people’s existing motivations. The suggestion technology simply serves to cue a relevant behaviour, essentially saying ‘Now would be a good time to do X’ (Fogg, 2003, p.41). In design terms, achieving kairos requires an understanding of the situations that users are in, perhaps with monitoring of behaviour or other variables which help determine when (and where and how) would be a good opportunity to offer a suggestion
Self-monitoring	This is essentially about giving users the opportunity and capability to receive feedback on their own behaviour, and how it is aecting progress towards a goal. Fogg emphasises using technology to eliminate the tedium of tracking, making it easy for people to keep track of aspects of behaviour which would otherwise require substantial eorts to monitor. In recent years, the `quantied self’ movement (e.g. Wolf, 2009) has made increasing use of sensors and data analysis to enable self-monitoring, and there are numerous design opportunities in this eld.
Surveillance	See section 3.2 of Lockton, 2012
[Operant] Conditioning	See Lockton (2011b)

Digital infrastructures allow, restrict, and control user behaviours; this is the essence of persuasive technologies. Digital rights management refers to measures designed to control and restrict user behaviour which essentially aims at reinforcing business models (Lockton, 2012). Therefore, stakeholders' value is often favoured rather than user's value. Generally, there is a growing concern about design practices that prioritize business goals over the welfare of users (Moser et al., 2019). On top of that, technology is more and more pervasive and autonomous which enables automatic surveillance stronger than ever before with digital innovators being able to leverage the extensive research done concerning behavioural change. More specifically, Fogg (2009) found that behaviour is generally controlled by three factors: motivation, ability, and triggers (Table 5).

Table 5. Motivation, ability and triggers identified by Fogg (2009).

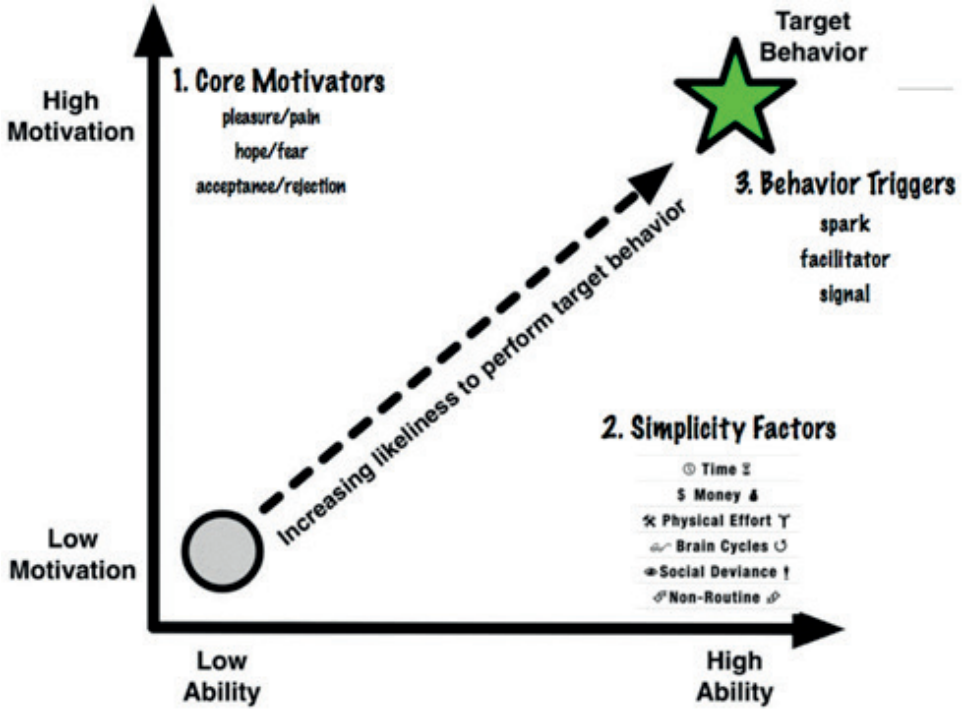
Motivation	Ability	Triggers
Pleasure/ Pain whose result is immediate	Time	Spark as trigger in tandem with motivation
Hope/ Fear which is characterized by anticipation of an outcome	Money	Facilitator as a trigger: motivation but lack ability
Social acceptance/ Rejection as people stive social acceptance but even more strive to avoid being socially rejected	Physical effort	Signal as trigger: both ability and motivation
	Brain cycles	
	Social deviance	
	Non-routine	

The fundamental notion that could be captured from the Fogg Behavioural model (Figure 21) is that in order for a person to perform a specific behaviour he or she must be (i) sufficiently motivated, (ii) have the ability to perform the behaviour, and (iii) be triggered to perform the behaviour (2009).

In essence, Taylor (2013) suggests that design for use has become the design of use, not because designers are considered the ultimate arbiters of good or bad, but rather because the focus of research has moved from the nature of objects to the behaviours of people. In conclusion, the designer is increasingly expected to have a range of competencies that relate to understanding the behaviours of consumers and their cognitive processes (Taylor, 2013). Thus, designers have a newly acquired responsibility over the full life cycle of a problem-solution space. However, here has been little substantial development of the importance of values and ethics within the field of design and, in particular, within design curriculums (Forlano, 2016)

At this point, both the technological and the behavioural dimensions have been discussed in previous chapters. The most relevant impacts on the discipline of design have been laid out. However, it is still unclear: what is the role of designers? And more importantly, what are the practices that designers use in order to craft solutions that influence human behaviour?

Figure 21. Fogg Behavioural Model from Fogg, 2009.



9. UNDERSTANDING HOW DESIGNERS BRING SMART PRODUCT-SERVICE SYSTEMS TO THE USERS

Designers bring solutions to the users - or at least they are one of the stakeholders that contribute to the process of delivering product and services to them. This chapter highlights the increasingly strategic role that designers are acquiring within organizations. It will then focus on the infrastructure of design, more specifically the practices and patterns that designers use to bring new and innovative solutions to end users. However, the patterns influencing users' behaviours often cross the boundary between persuasion and manipulation, hence becoming dark patterns. Ultimately, the goal is to provide readers with a comprehensive understanding of the powerful intersection between design and behavioural change, and how this intersection is creating impact on the world people experience.

9.1 DESIGNER AS AN EVOLVING ROLE

In different historical periods, the discipline of design has been given different categorisations. It started with homo faber and the maker of things in the Neolithic Age; the second mutation presented the idea of humans as the machine creator in the Industrial Revolution Age. A third transfiguration is occuring now, and it could be characterised as the Age of the Homo Gubernator in the age of cybernetics and high technology (Ferrari, 2017). However, it should be recognized that Homo Gubernator is not quite coherent with the latest frameworks that characterize the relationship between humans and technology as agency becomes a fluid concept with machienes being more and more authonomous. Nevertheless, the designer becomes the one who gives form to what could be described as the agent/product interface (Taylor, 2013). Especially the Third Industrial Revolution has been distinguished by the predominance of electronics and information technologies while the Fourth Industrial Revolution is speculated to be a fusion of technologies that blur the lines between the physical, digital, and biological spheres (Ferrari, 2017). As a consequence, the present shifting scenario impacts the role of designers within organizations. Ferrari (2017) notes the emergence of a different kind of designer, not primarily concerned with the process of form-giving, but with the understanding of complex systems. In fact, it is clear that as the scope of design enlargens, a new set of problem spaces and competencies is required.

The shifting role of designers is discussed also in relation to the major technological improvements happening nowadays. In fact, designers are increasingly required to not just find and solve problems, but also frame what is commonly referred to as a problem definition (Taylor, 2013). This is first and foremost an ethical question concerning the notions of frames and positionality, as by defining the problem space some perspectives will be purposefully ignored. Verganti et al. (2020) suggest that creative problem-solving is often conducted by algorithms. Therefore, the activity of human design increasingly becomes an activity of sense-making: precisely, understanding

which problems should or could be addressed. In fact, according to Taylor (2013), the economy of scale shifted to an economy of scope. Introducing the economy of scope goes to the very root of the definition of design as a discipline; more specifically the definition forces to address the querelle between Mihaly Csikszentmihalyi (Psychologist, 1934 – 2001) and Herbert Simon (Economist, 1916 – 2001). Csikszentmihalyi clearly distinguished problem finding and problem solving as two distinct phases in a problem-solving process, while Simon did not believe in the dichotomy of the problem space (Verganti et al., 2020).

Fox et al. (2019) propose the notion of design activism, which they define as a counternarrative aimed at generating and balancing positive social, institutional, environmental and/or economic change. However, designers must work as activists and something else at the same time, contending with concerns like function, cost, and usability (Fox et al., 2019). In fact, many researchers and practitioners state that design and business success go hand in hand. For instance, Ayazova (2017) highlights that the main goal of designers is first and foremost to ensure the economic success of the companies they work for. This is consistent with the phenomenon formalised by many scholars which highlights that design is more and more strategic within organizations. In fact, if design was not able to prove return on investments, it would be hard to justify any role at all within companies.

Nowadays, design should collaborate with new and innovative solutions introduced by the AI-powered web of data (Aghaei et al., 2012; Fuchs et al., 2010). Online content can be added, removed, or changed in seconds: digital architectures can rapidly adapt to new demands and challenges (Kozyreva et al., 2020). Verganti et al. (2020) build upon this point as the software embedded in the products themselves enable information to flow the other way, from the firm to the user, with a specific solution for a specific person being crafted in real-time with the user experience continuously improved. Hence, it consists in a two-way interaction that constantly evolves in real-time as the user experiences the digital solutions (Verganti et al., 2020). However,

constant improvement of users' experience is consistent with new digital business models that capitalise on users' attention and engagement. As designers play an active role in deploying these business models, they become ethically involved.

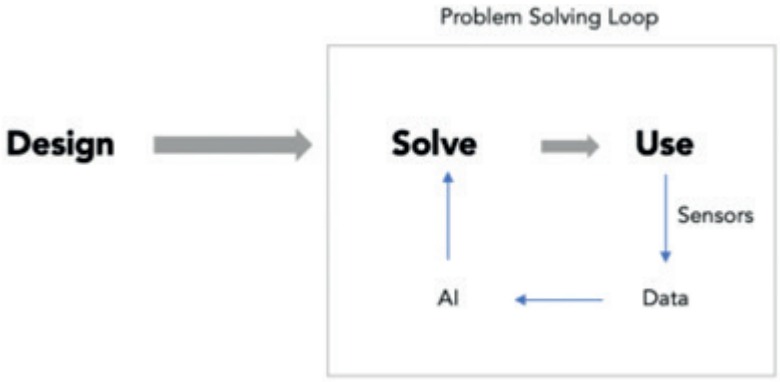
The AI web of data impacts the design and delivery of design solutions. As illustrated in Figure 22, products (goods and services) are generally designed for segments of users. They are subsequently manufactured at scale and finally delivered for "use"; after a product is released, the context evolves (the market changes or new technological opportunities emerge) so organizations must capture new insights from customers (Verganti et al., 2020). In essence, the operating model entails significant effort and investment to redesign a product as innovation is postponed until the marginal value of a new product supersedes the cost of its design (Verganti et al. 2020).

Figure 22. High-level representation of a waterfall design process from Verganti et al., 2020

However, AI offers the opportunity to revolutionize the traditional design process. As illustrated in figure 23, innovation moves upstream, from manufacturing to design, because of digital automation (Verganti et al., 2020). Digital automation implies that certain decisions during the design process are delegated to S.PSSs ,which are able to sense the environment (context-awareness) and consequently act to modify the scenario (learning capabilities). Specific solutions (i.e., what an individual user actually interacts with) are designed by an AI engine in what is commonly referred to as a "problem-solving loop." Loops collect real-time data (insights) from customer interactions or from the ecosystem in which the firm lies; this data can immediately inform the AI embedded in the product which has problem-

solving capabilities (Verganti et al., 2020) significant effort and investment to redesign a product as innovation is postponed until the marginal value of a new product supersedes the cost of its design (Verganti et al. 2020).

Figure 23. High-lever representation of an AI-informed design process from Verganti et al., 2020



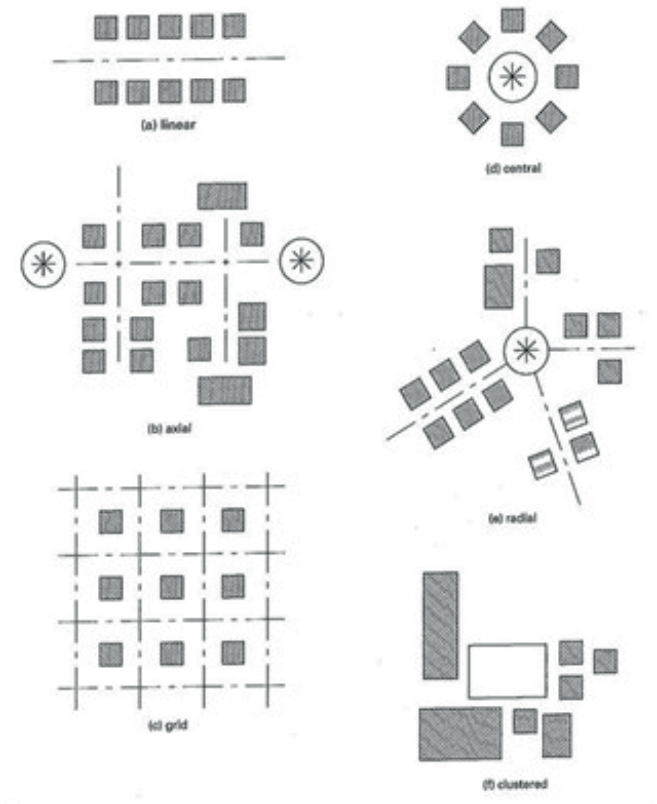
However, whilst design literature may make it seem as though designers are entirely free to choose how a product, building or artefact will be shaped, it has already been established that cultural assumptions, legal mandates, and other social forces exert considerable influence on technological innovation (Pilling et al., 2019). On top of that, these limitation filters into the algorithms that power digital solutions, which effectively makes machines bounded by ___ as well. In the late 1990s, Nicholas Negroponte talked glowingly about how "digital agents" would emerge as the dominant form of human-computer interaction (Taylor, 2013). Human actors have, to an extent, effectively contracted out their agency to the structures upon which they depend. In fact, one concerning issue is that decision-making is being delegated to a variety of algorithmic tools without clear oversight, regulation, or understanding of the mechanisms underlying the resulting decisions (Kozyreva et al., 2020). Networks are often private by law. According to Ayvazova (2017), private networks might represent a treason of humanistic and ethical values. Also, Verganti et al. (2020) further stress the point that an important implication is the question of accountability in innovation, especially concerning the amplification of biases.

Although innovative technologies are often described as disruptive, designers and developers frequently rely on established building blocks to build complex solutions. These are commonly referred to as design patterns and they have been successfully used to speed up the development process of complex solutions. However, what is the origin of design patterns? Why have they proven to be successful?

9.2 DESIGN PATTERNS

Humans design artefacts; we realize (make, construct, or otherwise implement) them; we consume, use, or operate them; we maintain them; we dispose of them or of the products of their consumption or use. All of these terms are action terms – verbs – whose overall ensemble of design activities make up a process (McMahon, 2021). Even though Verganti et al. (2020) note that what humans do in the context of AI is not to design solutions (these are generated by the AI engine) but to design problem-solving loop. Hence, problems keep occurring over and over again and are typically addressed with a set of recurring solutions in order to accumulate knowledge of a specific situation over time. This mechanism leads to the creation of design patterns, which were first formalized in the architecture field by Christopher Alexander (Architect, 1936 – 2022) in 1977, who proposed a set of archetypical designs for building cities (Figure 24) which were intentionally crafted to be reused by other architects. The question of representation is evident from the beginning as Alexander crafted design patterns choosing a specific perspective, namely the design conceptualization typical of the school of architecture. This bias could be the very reason why design patterns have been repeatedly shown to backfire transforming in anti-patterns or in the worst-case dark patterns.

Figure 24. Examples of urban design patterns from Alexander, 1977.



However, McMahon (2021) notes that design patterns could be effectively positioned at the intersection between the field of design and the discipline of engineering as he shows that since the 1980s, English universities were encouraged to have design as a thread running through their engineering curriculums.

More formally, the idea of a pattern is to capture an instance of a problem and a corresponding solution, abstract it from a specific use case and shape it in a more generic way, so that it can be applied and reused in various matching scenarios (Bosh et al., 2016). McMahon (2021) notes the wide acceptance of design patterns within the field of design engineering, highlighting two established practices:

- adaptive design, in which known and established solution principles are used, and in which it may be necessary to undertake original designs of individual assemblies or components;
- variant design, in which arrangements are set within limits set by previously defined product structures.

In essence, design patterns allow designers – in the wider sense – to build on what they know, thus favouring the accumulation, systematization and recycling of knowledge in a scenario that shifted from the idea of the lone designer and inventor to teams that are today often globally distributed (McMahon, 2021). In fact, the central concern in many fields is the balance – namely the choice of how much effort to allocate – between the application of existing solution principles and the search for new solution principles. As previously highlighted, this is the well-established trade-off between exploration and exploitation. Design patterns are connected to the notion of standard engineering for the generation of a new artifact by putting together methods and elements under principles that are known and accepted (McMahon, 2021).

The design process is inherently iterative and often experimental; in fact, probing has been shown to be the new attitude. Moreover, the process needs judgement, organization, and collaboration

with many actors or agents that undertake different activities; therefore, there are several benefits for using design patterns (McMahon, 2021):

- the design characteristics are chosen according to constraints imposed by manufacturing possibilities, codes and standards, material capabilities, ergonomics, and so on. As well, they are chosen with the aim of maximizing the performance of the output artifact;
- the design effort very often goes into scaling an artifact in some ways – making it larger, smaller, more powerful, more efficient, etcetera – in that it often involves work to remove some constraint, thus allowing a modification to the effective design space;
- in the latter part of the last century, there was an enormous effort in the design of many mechanical artifacts for design for assembly in view of the increasing costs of labour (and thus assembly costs). The lower costs of automation nowadays favour design for energy efficiency, repair, recycling, and remanufacturing in order to minimize the environmental impact of such artifacts;
- replacement of the existing means of achieving some function or subfunction in the design by some new approach;
- adding elements to an established design pattern, for example, to mitigate some issue such as a harmful emission or to offer enhanced user experience or improved control of the artefact.

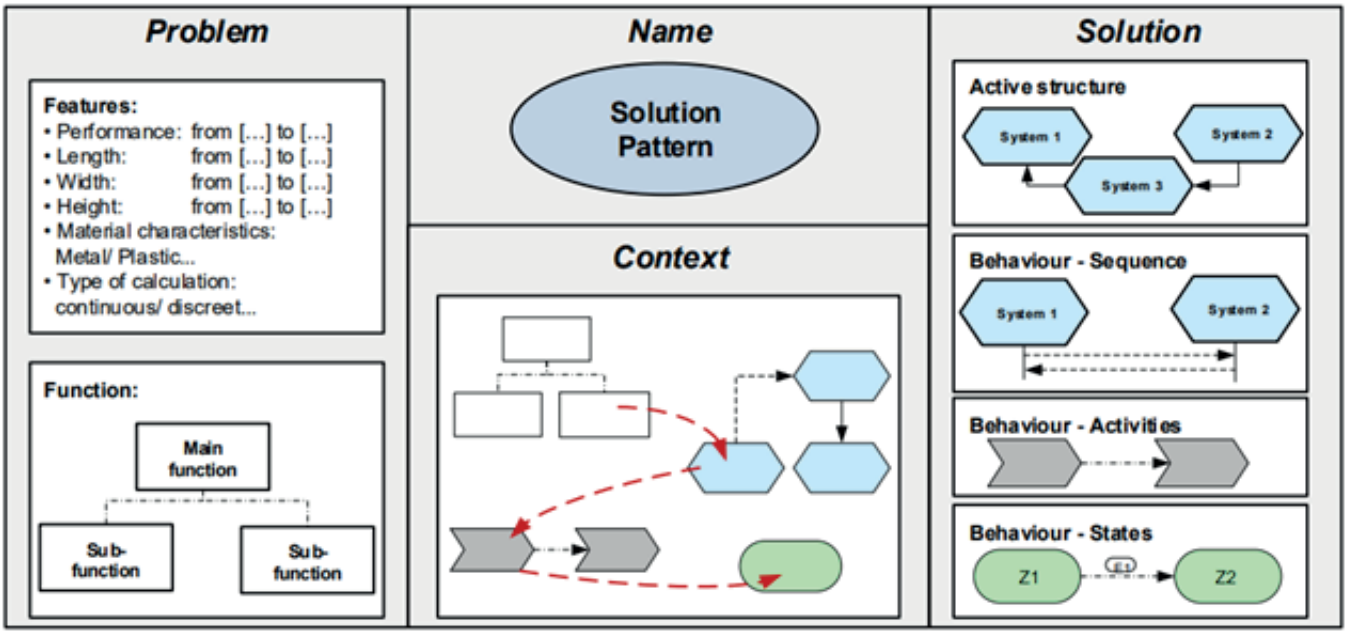
In order for an organization to effectively and proactively use design patterns, suitable knowledge management is essential. Carrera Rivera et al. (2022) propose a framework composed of three layers: the bottom layer includes the identification of physical resources and data resources; the knowledge management layer uses domain ontologies to model the product's components, services, and context; the top layer is the requirement elicitation which consists of formalising under what context system component(s) should or will do in the process. This is the reason why Anaker et al. (2020) position design patterns within the field of system engineering whose scope consists of achieving

a uniform and holistic understanding of the system among all stakeholders. The reuse of existing artefacts, and thus the reuse of once successfully applied solutions, plays an increasingly important role. Therefore, suitable knowledge management is a fundamental part of each enterprise as a basis for creativity and innovation. Anaker et al. (2020) propose the following benefits of design patterns:

- transferability across disciplinary boundaries;
- improvement of communication through explicit knowledge representation;
- long-term documentation of solution knowledge;
- reduced complexity by breaking down extensive problems;
- increased efficiency through targeted reuse;
- promotion of creativity.

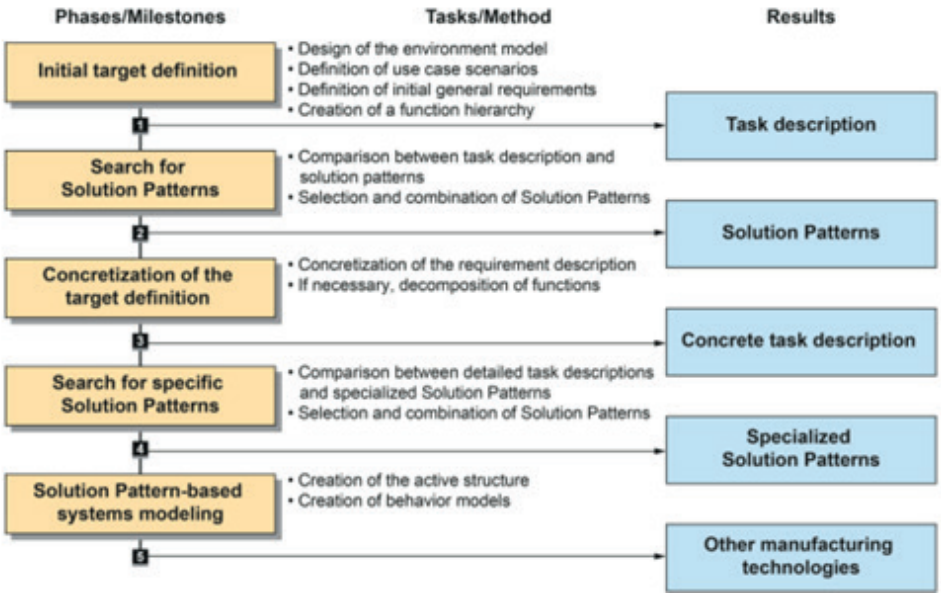
Moreover, design patterns could close the discrepancies between models or prototypes and real-world scenarios, as the solutions they encompass have been repeatedly used. In fact, McMahon (2021) highlights that for designers the key is to understand the behaviour of the artefact in its environment. Therefore, in order to make design patterns effective, Anaker et al. (2020) propose a structure composed of four categories: name, problem, solution, and context (Figure 25).

Figure 25. Uniform structuring of solution knowledge from Anaker et al., 2020



The conceptualization of design patterns is not only limited to a specific perspective, but also builds up a value system that is often biased toward positive perceptions of technology. In fact, what both design and system engineering fail to address is the situatedness of the design activity, meaning that the design situation – the context – is shifting constantly: namely, there are changes in scientific understanding, technological capability, markets, societal needs, attitudes and so on. Understanding the implications of such changes is a key design challenge (McMahon, 2021). However, in the procedure for modelling a solution pattern (Figure 26) there is no space for a review phase which iteratively checks the validity of a previously identified solution. Moreover, as a specific design pattern grows in usage, it also becomes increasingly difficult for alternative designs to challenge the incumbent pattern in the market, which leads to a lock-in effect for a particular design pattern (McMahon, 2021). In essence, the risk implicit within design patterns is perpetuating and amplifying biases embedded in the solution.

Figure 26. Procedure model for a Solution Pattern based systems design from Anaker et al, 2020.



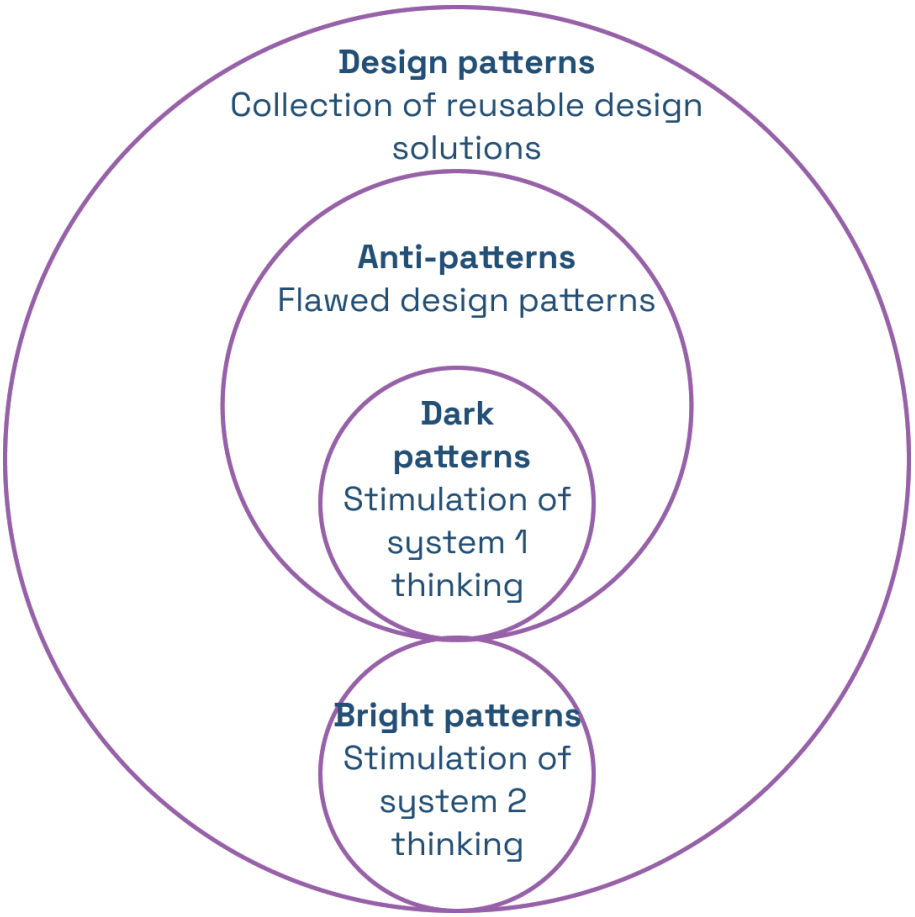
Previous chapters introduced open issues about the infrastructure of S.PSSs, which specifically highlighted a worrying risk of amplifying shortcomings and biases. In order to rationalise shortcomings in design patterns, academics began to frame the notion of anti-patterns. Anti-patterns document a solution approach that should be avoided because it has been proven to be a bad practice, hence they play a fundamental role in raising awareness of malicious solutions and advocating against their usage (Bosh et al., 2016). Anti-patterns target solutions that may seem obvious to the system developer at first glance, but include several less obvious negative implications and consequences; on even established patterns could become obsolete and therefore downgraded to anti-patterns due to new considerations (Bosh et al., 2016). In essence, anti-patterns are non-solutions (Greenberg et al., 2014) that address the question of unintended values in the design process.

Nodder (2013) pursued a massive review of anti-patterns in his seminal book "Evil by Design," where he described strategies and techniques used by companies in digital environments to build choice architectures that steered users to the company's preferred behaviours. Nodder illustrates psychology principles that inform designers who influence users' choices. Furthermore, the scope of the book was not to build a taxonomy ready to be used for evil intent, but rather building a taxonomy highlighting that from knowledge come responsibilities. Therefore, nowadays the necessary vocabulary to specifically identify each technique is laid out, which is the basis for creating strategies to counteract anti-patterns, also referred to as light patterns or bright patterns.

Although HCI researchers and practitioners commonly believe that their discipline promotes sustainability, health, accessibility and digital well-being (Widdicks et al., 2020), the notion of anti-patterns actually highlights that designed artefacts can lead to malicious outcomes. Figure 27 summarizes the knowledge landscape of design patterns. Furthermore, Widdicks et al. (2020) note that, in general, the differentiation between anti-patterns and dark patterns arises from the designers' intent with two possible outcomes:

- backfiring, which is defined as the design and uptake of a system that leads to an anti-pattern which conflicts with or does not meet = the system's design purpose(s);
- favouring, which is defined as the design and uptake of a system that leads to an anti-pattern which may or may not have been intended but that aligns with the system's design purposes(s).

Figure 27. Perimeter of the Design Pattern domain of knowledge.



Widdick et al. (2020) provide an example for both outcomes: on the one hand, MultiPoint which allowed multiple mice per computer so that many children could simultaneously use educational software: it backfired in rural India where infrastructure is poor and public teachers are under-trained; on the other hand, slot machines are the seminal example of favouring business preferred behaviours as they push users in iterating a target behaviour with malicious consequences in terms of financial wellbeing of people.

Anti-pattens led to the emergence of the repentant-designer figure who rightly or wrongly blame themselves for the consequences of their designs: an example is the creator of infinite scroll Aza Raskin who now recognizes the downsides of his innovation (Widdicks et al., 2020). Indeed,

anti-patterns raise the question of culpability which is closely intertwined with the notion of intent However, intent is not always clear to determine as sometimes the designed artefacts could just be the outcome of a poor design choice which leads to the notion of shady-patterns defined as patters that were problematic for users but probably not due to an evil intent on the part of the designer and developers (Widdick et al., 2020). What complicates even more culpability is determining what exactly is in the users' best interest (Widicks et all., 2020). Again, the question of representation is more vivid than ever within the domain of design patterns. In fact, attributing the problems to corporate decision making and poor end-user awareness alone does not do justice to the role that design plays (Nelissen & Funk, 2022). Conversely, designers are just one piece of the service delivery process. Therefore, culpability and responsibility should not be attributed solely to the designers/ developers but to all the stakeholders that participated in the project. In essence, culpability become co-shared between the agents involved in the service design and delivery phase of a S.PSS. Furthermore, it should be highlighted that a co-shared culpability model is consistent with the ethical persuasion suggested by Berdichevsky & Neuenschwander (1999 which distributed responsibility between all the actors involved in a persuasive act.

Understandably, business favour solutions that contribute to their growth by definition. However, what characterizes business model within the digital landscape is the profound interest of users' engagement which leads to the generation of massive amounts of databases for businesses to leverage upon, ultimately leading to the increase of bottom-line revenues. At this point it is time to define what is user engagement? And most importantly how has it come to be such a crucial metric of success?

9.3 DOWNSIDES OF USER ENGAGEMENT AS THE PRIMARY METRIC OF SMART PRODUCT-SERVICE SYSTEMS

Previous chapters illustrated the business model shifts due to service-dominant logic. New business models are one component that has favoured the dissemination of anti-patterns and dark patterns. In fact, if the business logic runs that the value for the producer can no longer come from making an artefact and selling it for more than the production cost, then the value must come from expansion and monetization of the provisioning phase of the life-course of a commodity (Taylor, 2013). In essence, businesses are more interested in capitalizing upon the overall lifecycle of an S.PSS solution. However, it is crucial for companies to capture and retain users' attention in order to monetize the full life cycle of the service delivery. This is how engagement metrics have become a primary source of business success.

User engagement is defined as the emotional, cognitive, and behavioural connection that exists at any point in time, and possibly over time, between a user and a resource; it does not entail only how a single interaction unfolds, but it details how and why people develop a relationship with technology and integrate it into their lives (Attifield et al., 2011). Attifield et al. (2011) define 8 dimensions of user engagement:

- focused attention, which involves the exclusion of other things. It is closely related to the notion of flow, which refers to a mental state in which a person Is fully immersed in what they are doing;
- positive affect, which refers to the affective dimensions of the encounter, taking into account the emotions elicited by the user;
- aesthetics, which refers to the sensory and visual appeal of the encounter;
- novelty, which refers to a state of surprise, which consists of unfamiliar and unexpected experiences;

- endurability, which refers to an experience which is enjoyable, useful, engaging and that customers are willing to repeat;
- richness, which captures the growth potential of an activity by assessing the variety andcomplexity of thoughts;
- reputation, trust and expectation. which rely on often implicit contracts between the actors involved in the encounter;
- user context, which refers to the users' motivation, incentives and benefits that affect the experience more than the traditional paradigm of usability.

Arguably, successful technologies are not just used but are engaged with as users invest time, attention, and emotion into the technology encounter (Attifield et al., 2011). The definition is consistent with the fact that the idea of user engagement emerged as interaction with technologies became more pervasive and complex. In fact, in the 1980s, the dominant logic was a single person sitting in front of a workstation with the computer left behind at the end of the day; in parallel, the conceptualization of the user has also changed from a source of errors to a partner in social interaction (Attifield et al., 2011).

Despite research focused on the benefits of user engagement, there still is a residual risk that solutions to capture and retain user engagement backfire and lead to malicious outcomes. In fact, Stoimenova & Kleinsmann (2020) note that an incongruence might arise between the purpose (what is intended/anticipated effects) of the solution and the value it delivers. This perspective builds upon the notion of unintended values, which depends on discrepancies that might arise when different frames collide (e.g., designers vs. users, business vs. designers, business vs. users). Unintended values are even more worrying as AI-powered agents gain autonomy and act in more complex domains. Ultimately, it may become progressively harder to anticipate the impact and implications of the array of possible unintended values (Stoimentova & Kleinsmann, 2020).

In fact, the interface is a space where people encounter the complexity of interconnected information online. The interface has a decisive role in how people perceive the information

presented; in other words, there is no internet without ubiquitous choice architectures that constrain, enable, and steer user behaviour (Kozyreva et al., 2020). Although both persuasion and manipulation could be questionable practices, it could be argued that manipulation is just a dceptive strategy. More specifically, coercion is a type of influence that does not convince its targets but rather compels them by eliminating all options except for one (e.g., take-it-or-leave-it choices). Manipulation is a hidden influence that attempts to interfere with people's decision-making processes and steer them towards the manipulator's ends; it neither persuades people nor deprives them of their options, instead it exploits their vulnerabilities and cognitive shortcomings (Kozyreva et al., 2020). The very nature of online platforms affords quick design of choice architecture; it might take years to build the infrastructure transforming a city to bike-friendly, but adjusting default settings on online webpages or introducing friction into an information sharing process can take less than a day (Kozyreva et al., 2020).

Therefore, Stoimentova & Kleinsmann (2020) argue the need for framing criteria for such design practices that: (i) addresses the incongruence between purpose and (unintended) values, (ii) proactively anticipates potential future values and (iii) makes a clear distinction between the way a system behaves and the way it is being used. Significant research in the field of design suggests that prototyping is often employed to surface unanticipated outcomes, as it is conceptualized as a performative process that produces specific subjectivities and bodies during the interplay between various actors (Reddy & Linde, 2016). Furthermore, prototypes summon the past and foreshadow particular futures (Forlano, 2016). Therefore, it could be argued that prototyping is not only an evaluative (analysis) means, but also a generative (synthesis) one (Stoimentova & Kleinsmann, 2020). However, Pilling et al. (2019) suggest that the generative prototypying method is reliant on receiving sufficiently provocative responses from participants. Furthermore, prototyping cannot provide general guidelines in order to design with positive intent, as it is a situated performative act.

There is a growing interest in research around persuasive technologies with built in design patterns that are subjected to backfires, bias and shorcomings. Specifically, some design patterns are commonly used to steer user behaviour to preferred choice architectures in order to capture economically-valuable data. These patterns are commonly referred to as dark patterns. However, what is the definition of a dark pattern? What impact do they have? And most importantly, what is the state of the art of academic research on dark patterns?

9.4 FROM USER PERSUASION TO MANIPULATION: INTRODUCING DARK PATTERNS

Nowadays, there is a complex interplay between users, organisations, algorithms, and national, international and global regulations and agreements; specifically, data and information flows within user experiences in the physical and online domains cause grey areas to emerge at levels that are legal, cultural, psychological, ethical and philosophical (Iaconesi, 2017). Moreover, the Internet is no longer an unconstrained and independent cyberspace but, notwithstanding appearances, a highly controlled environment. Access is regulated by algorithms and design choices made by corporations in pursuit of profits and with little transparency or public oversight (Kozyreva et al., 2020). Ultimately, the Internet is characterised by choice architectures. As new technologies become more pervasive, companies deal with increasing personal data, and many sources highlight that they are handling it poorly, with every new data scandal eroding trust in technology (Nelissen & Funk, 2022). In essence, the scenario depicted up to this point could be characterized by huge benefits with unclear, unintended consequences. The specific case in which companies combine behavioural manipulation with data abuse is commonly referred to as dark patterns (DP). DPs are defined as user interfaces where designers knowingly confuse users, make it difficult to express their actual preferences, or manipulate them to take certain actions (Luguri and Strahilevitz, 2021). DP were first identified by Brignull, a UX designer, in 2012, who provided a preliminary taxonomy (Appendix 1, Table 6). In essence, DPs are a practitioner-created construct (Grey et al., 2018).

Although many of the studies concerning DP focus on digital endeavours, research clearly shows their presence in the physical world. Even Brignull, in the first article published on the topic, discusses the case of supermarkets putting items in different-sized bundles thus preventing customers from comparing prices (2010). In particular, research on proxemic interactions draws

from Proxemics Theory, which explains people's understanding and use of interpersonal distances to mediate their social interaction with others: it shows that people adopt similar strategies used in social interactions to mediate their relations with nearby digital devices (Greenberg et al., 2014). Although the devices that populate the material world may have honourable purposes, they are also subject to the inaccuracy of interpreting and translating information into action, which immediately raises concerns about privacy, errors, distraction, and intrusion (Greenberg et al., 2014). Ultimately, scholars developed a taxonomy (Appendix 1, Table 7) of DPs in proxemic interaction. In essence, it could be argued that the physical and digital worlds are closely intertwined, so much so that some academics believe that DPs have always existed, being the latest version of selling techniques on the edges of ethics and legality. In fact, DPs are referred to as sludge by behavioural economists, or market manipulation by legal scholars (Luguri & Strahilevitz, 2021).

However, with digital technologies DPs have increased in scale, effectiveness, and persuasiveness with the possibility to massively deploy A/B testing (Maier and Harr, 2020; Narayan et al., 2020). More specifically, using information technology, manipulative practices could be implemented at low costs, at large scale, with unprecedented sophistication and high effectiveness in dynamic, interactive, intrusive, and adaptive environments (Bongard-Blanchy et al., 2021). Although scholars in Human-Computer Interaction tend to focus on the positive aspects of innovative design ideas (Greenberg et al., 2014), in recent years HCI appears to have been a fruitful ground for research on Dark Patterns. After providing a definition of the phenomenon, scholars focused on building taxonomies of Dark Patterns in order to build a shared vocabulary to address the topic. Generally, there are four widely recognized taxonomies:

- Birgnull (2012), who first identified deceptive techniques, highlighting that physical and digital worlds are closely intertwined (Appendix 1, Table 8);
- Bosch et al. (2016), who focus on the notion of privacy and deliberately provide strategies to void privacy (Appendix 1, Tables 10-16);

- Grey et al. (2018), who provide strategic motivations from a business perspective to deploy each dark pattern (Appendix 1, Table 17);
- Liguri & Strahilevitz (2021), who review the definitions focusing more on the means (manipulation technique) rather than the ends (intent), which might become helpful for future policy advice (Table 6)[4].

[4] This taxonomy is placed alongside the dissertation as it is the most recent one. Therefore, the other taxonomies will be placed in a specific appendix.

As DPs manipulate users into providing personal data, they are closely intertwined with privacy. Bosch et al. (2016) note that in the 1990s, privacy was rarely considered a relevant feature of IT systems, therefore privacy-preserving mechanisms were often added a posteriori as an additional requirement. Interestingly, Alexander already came up with patterns for privacy (source, year); for instance, the Intimacy Gradient pattern for Interior Design postulates the placement of chambers in such a way that a further distance from the building entrance allows for increased intimacy (Bosh et al., 2016). However, only in the mid-1990s was the notion of Privacy by Design born, institutionalised with the GDPR[5], which led to the identification of Privacy Design Strategies (Bosch et al., 2016):

[5] General Data Protection Regulation which is privacy and human right law with the European Economic Area.

- minimize the amount of personal data that is processed;
- hide any personal data processed from plain view;
- separate any personal information in a distributed fashion if possible;
- aggregate personal information so that it is processed at a high level;
- adequately inform data subjects;
- control over personal information should be granted to data subjects;
- enforce privacy policies compatible with legal requirements;
- demonstrate the compliance of such policies.

However, normally there are different parties with specific agendas within a development process of an IT system. Therefore, Bosch et al. (2016) identify patterns that intentionally weaken or exploit the privacy of users, often by making them disclose personal data or consent against their real interest. Ultimately, they create

Table 6. Taxonomy of Dark Patterns from Luguri and Strahilevitz (2021)

Category	Variant	Description
Nagging	//	Repeated requests to do something the firm prefers
Social proof	Activity messages	False/misleading notice that others are purchasing, contributing
	Testimonials	False/misleading positive statements from customers
Obstruction	Roach motel	Asymmetry between signing up and cancelling
	Price comparison prevention	Frustrates comparison shopping
	Intermediate currency	Purchases in virtual currency to obscure cost
	Immortal account	Account and consumer info cannot be deleted
Sneaking	Sneaking into basket	Item consumer did not add is in cart
	Hidden costs	Costs obscured/disclosed late in transaction
	Hidden subscription/ forced continuity	Unanticipated/undesired automatic renewal
	Bait and switch	The customer is sold something other than what is originally advertised
Interface interference	Hidden information/ aesthetic manipulation	Important information visually obscured
	Preselection	Firm-friendly default is preselected
	Toying with emotion	Emotionally manipulative framing
	False hierarchy/ pressured selling	Manipulation to select more expensive version
	Trick question	Intentional or obvious ambiguity
	Disguised ad	Consumer induced to click on something that is not apparent as an ad
	Confirm shaming	Choice framed in a way that makes it seem dishonourable, stupid
	Cuteness	Consumers are likely to trust attractive robot
Forced action	Friend spam/social pyramid/ address book leeching	Manipulative extraction of information about other users
	Privacy Zuckering	Consumers tricked into sharing personal info
	Gamification	Features earned through repeated use
	Forced registration	Consumers tricked into thinking registration is necessary
Scarcity	Low stock message	Consumer informed of limited quantities
	High demand message	Consumer informed others are buying remaining stock
Urgency	Countdown timer	Opportunity ends soon with blatant visual cue
	Limited time message	Opportunity ends soon

a template to document DPs, characterizing each item with a set of metadata to enrich the quality of the classification. However, even though they study dark patterns in the wild, Author Names do not provide specific motivations to deploy each DP that has been identified. Finally, Luguri and Strahilevitz (2021) compile the most recent taxonomy, which exhibits a growing interest in studying Dark Patterns by law scholars; in fact, they integrate the list with new Dark Patterns while reviewing the definitions focusing more on the means (manipulation technique) rather than the ends (intent).

In conclusion, there is an economic driver behind the deployment of dark patterns. According to Luguri and Strahilevitz (2021), when we see a user interface nudge consumers toward a selection that is likely to be unpopular with them but profitable for that company, there is reason to think a dark pattern may exist; more specifically, customers pay for something they would otherwise not purchase or surrender personal information that they would otherwise keep confidential. Put in other words, dark patterns might lower the perceived risk of digital endeavours (Moser et al., 2019). It is important to notice that Berdichevsky & Neuenschwander already in 1999 noted how persuaders often exploit information about the people they persuade.

At this point the theoretical framework to identify and define dark patterns has been laid out. Therefore, it is now time to clarify: why do dark patterns actually work? What are the mechanisms they exploit? What is their impact? And most importantly, what is their effect on end-users?

9.5 DARK PATTERNS IN THE REAL WORLD: A USER PERSPECTIVE

In recent years, as a quite sophisticated vocabulary has developed on Dark Patterns, researchers' focus shifted to understanding the mechanisms that choice architects often leverage to influence users' behaviour. As a consequence, the number of studies that investigate dark patterns in the real world significantly increased. IFirst, scholars needed to quantify the effectiveness of Dark Patterns. Interestingly enough, Liguri & Strahilevitz (2021) suggest that the effect of dark patterns might not be a mystery after all, as it is highly possible that this kind of research has been previously conducted by in-house social scientists. Put in other words, behavioral research has been weaponised (Narayan et al, 2020). Nowadays, there is a fundamental urgency to make that internal proprietary research public, consistent with the need for a wider public scrutiny, as discussed in chapter one.

In recent years, significant research has been carried out with users to quantify the impacts of dark patterns. The findings are quite surprising, as they suggest that, although users might be aware of the presence of malicious strategies within the interaction, dark patterns still work (Bosch et al., 2016). This paradoxical situation could be explained by focusing on psychological principles, which suggest that users need both motivation and knowledge in order to comply with the totality of the privacy strategies highlighted by Bosch et al. in 2016 (See paragraph 9.4). In fact, research shows that people tend to frequently opt into System 1 thinking whenever they have the opportunity, making unconscious and effortless decisions the preferred choice, thus simplifying the cognitive load with heuristics (Maier and Harr, 2021). Therefore, dark patterns are different compared to marketing efforts that are specifically designed to alter the very preferences of users (Luguri & Strahilevitz, 2021). Bongard-Blanchy et al. (2021) stress the fact that exploiting System 1 thinking rather than System 2 leads to reliance upon cognitive biases and man-bounded rationality. Moreover, according to Bosch et al. (2016), relying on System 1

leads to a proliferation of biases in the decision-making process, specifically:

- hyperbolic discounting, which causes humans to inconsistently evaluate rewards over time, thus tricking them into favouring a present reward over a similar one at a later time;
- cognitive dissonance, which is a state of discomfort caused by contradictory beliefs and actions, therefore providing justification arguments for sugarcoating user decisions that have negatively affected their privacy.

On top of that, humans are generally believed to have a basic need to belong and thus be accepted as part of a group which may force them to disregard privacy issues (Bosch et al., 2016). This has led many scholars to frame the notion of the privacy paradox. On one hand, people claim to care a great deal about their online privacy, but on the other, they appear to show little concern for it in their actual behaviour (Kozyreva et al., 2020). Put in other words, stated user preferences towards privacy contrast with users' actual behaviour. And what makes dark patterns problematic is they undermine individual or collective welfare (Bongard-Blanchy et al., 2021; Luguri & Strahilevitz, 2021).

The research interest has shifted toward a more user-centred approach, sometimes with a consumer advocate perspective (Moser et al., 2019). In fact, researchers have recently been producing an increasing corpus of both quantitative and qualitative research studying Dark Patterns from an end-user perspective. According to Huang & Bush (2014,) non-transparent nudging appears to be of very narrow application because the consumer is likely to be destined to eventually discover the nudge at some point during use. However, perhaps counterintuitively, Luguri and Strahilevitz (2021) found that mild DPs should worry choice architects the most as they have proved to be highly effective at doubling the number of users who opted into the preferred solution without causing backlash from the subjects of the experiment. On the contrary, the strong DP situation quadrupled the conversion, but users were most likely to show anger (Luguri and Strahilevitz, 2021). Anger leads to detrimental consequences

for businesses as it may create friction in customer engagement, ultimately erode business' profits.

Even though the outcomes of the presence of DP are quite clear, one might wonder whether users are aware of their presence. Findings show that users are generally aware that online designs can influence their choices and behaviours with answers that strongly associated these practices with well-known brands. Thus, the notion of DP blindness could be invalidated (Bongard-Blanchy et al., 2021). Psychological, physical, and financial harms were the most prominent concerns, with cybersecurity and privacy threat being the least considered (Bongard-Blanchy et al., 2021). However, the privacy paradox could very well apply here, meaning that there is a mismatch between stated users' intent and actual behaviours. Interestingly enough, users were more concerned for other people than for themselves (Bongard-Blanchy et al., 2021). However, awareness is not a good predictor of resistance with the optimal threshold to recognize DP being at the age of 40 (older people might have less digital literacy). Also, the achievement of a high school diploma has been shown to increase recognition of Dark Patterns as education is correlated to a decrease in DP susceptibility (Bongard-Blanchy et al., 2021; Luguri and Strahilevitz, 2021).

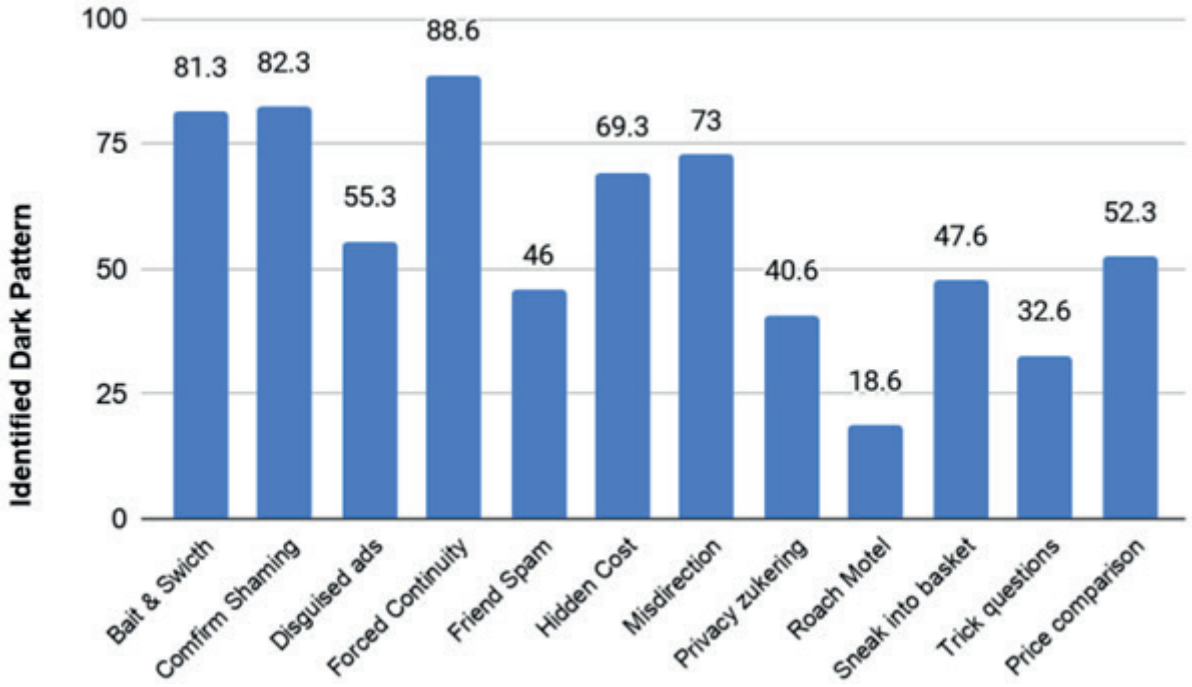
Even though the impact of dark patterns is evident, the specific effects may vary according to the strategy that is deployed. In fact, scholars found that different DPs might have different degrees of influence. Booth et al. (2020) identify five factors that influence the identification of DP:

- frequency of occurrence;
- trustworthiness of the situation;
- level of frustration;
- misleading behaviour;
- physical appearance of the user interface, to describe how appealingthe design of the screen is to the user.

The experiment performed by Booth et al. (2020) suggests that the correlations between the variables may vary with the type of

dark pattern under consideration. Forced Continuity appears to be the most recognized DP while Roach Motel is the least (Figure 28).

Figure 28. Identification rates of each DP from Booth et al. (2020)



Moreover, although users primarily blame business owners, they partially accept personal responsibility as they are conscious of their lack of attention (Booth et al., 2020). In essence, they accept DPs as part of the internet experience, suggesting that deceptive behaviours may have become normalized (Maier and Harr, 2020). Many academics are raising attention around the emerging risk of a new normal dominant logic (Booth et al., 2020; Maier and Harr, 2020; Nelissen & Funk, 2022). The new normal is characterised by the prevalence of rule violations across societies; it may undermine individual intrinsic honesty which is crucial for the functioning of a society (Kozyreva et al., 2020). In fact, a lowering of behavioural inhibitions has been shown to

happen in the online environment that is not seen offline. The change in behavior can be both benign and toxic: on the one hand, it can inspire acts of generosity (es. isupporting shy people in being more extroverted and pushing them to socialize). On the other hand, it can also lead to increased incivility with retaliatory acts damaging companies' assets (Kozyreva et al., 2020). The latter may be due to users' anger, which has already been shown to have detrimental consequences on businesses.

It is worth noticing that users could counteract Dark Patterns. Research demonstrates that users tend to get frustrated when exposed to deceptive techniques losing interest and abandoning tasks, which in the long run could lead to an erosion of the customer base and company profits (Booth et al., 2020; Luguri and Strahilevitz, 2021). Additionally, although regulations are still premature, companies could open themselves to potential liabilities and class actions (Luguri and Strahilevitz, 2021). Therefore, incompliant data becomes a liability in the near future; handling privacy poorly is bad for business (Nelissen & Funk, 2022). These findings are confirmed by Fansher et al. (2018) through a social media analysis which found that authors frequently used the #darkpatterns tag to call outDPs and hold companies accountable for employing unethical design tactics; therefore, social media is used as a tool to boost awareness of dark patterns through the sharing of exemplars, hold companies accountable through public shaming, and promote a conversation about ethical design practices.

In conclusion, it is now possible to isolate causation of changes in users' behaviours in a way that has heretofore been impossible in the physical world, where it is more difficult to assess what tactics significantly affected customer purchases (Luguri and Strahilevitz, 2021). However, as both the theoretical and empirical framework on dark patterns have been laid out, it is now time to adopt a more positive point of view ito clarify: what can be done to counteract dark patterns? And most importantly. who is accountable for actuating specific strategies?

9.6 OPEN ISSUES IN THE DISCUSSION ABOUT DARK PATTERNS

Presently, interfaces are seen as environments that suggest, enable, solicit, instigate, encourage, and prevent or promote certain actions, thoughts, or affects (Pandey, 2018; Chianella, 2021). Although designers create these interfaces predominantly with the intention to aid users in reaching their goals (Maier & Harr, 2020), previous paragraphs highlighted malicious practices in design. These practices have continued despite the introduction of the GDPR (Kozyreva et al., 2020). The General Data Protection Regulation (GDPR), which has been enforced since 2016 at a European Level, shifts the focus from where the data processing occurs to where the subject is located (Nelissen & Funk, 2022). In essence, the regulation strongly limits the processing of data by third parties. The GDPR also introduces the Privacy By Design principle, which is enacted through the strategies of: notice, choice and consent, proximity and locality, anonymity and pseudonymity, security and access, and recourse (Nelissen & Funk, 2022). This principle requires service providers to recognize that users have fundamental rights over the data they produce.

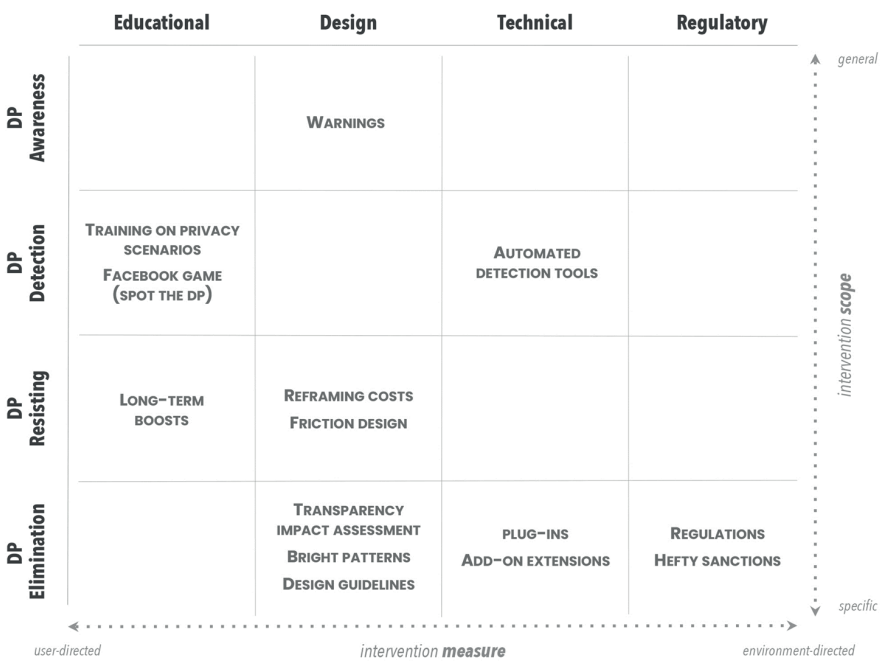
Furthermore, according to Luguri and Strahilevitz (2021), there is a plausible cause to be made that agreements procured through the use of dark patterns are voidable as a matter of contract law under the undue influence doctrine. Ultimately, it means that the current legal system has some countermeasures to put in place. However, there is case to be made for the notoriously slow adaptation process of policies as well. This is the reason why Bongard-Blancy et al. (2021) summarise four intervention spaces (Figure 29) which include:

- environment: even though people seem generally cognizant that digital services could exert a detrimental influence on users, they lack sufficient concern which might impact their motivation to counter Dark Patterns;
- education: trainings on cause-effect in data privacy scenarios

might sharpen manipulation detection abilities, activating more elaborate modes of thoughts such as counterfactual thinking; especially targeting older age groups which have been shown to be less equipped with strategies to cope with manipulative techniques;
- regulation: academic scrutiny, stringent regulations, public pressure, and publication of design guidelines are all factors that might contribute to creating a safer digital environment;
- technology: could play a crucial role in algorithms that collaborate with humans in detecting manipulative techniques. A UX-informed practice might rely upon taxonomies of bright patterns, such as friction design, to create a safer interaction.

Furthermore, environments are more and more populated with agents that are characterized by a combination of physicality and immateriality. In fact, interaction design has recently seen a material turn whereby utilitarian functions are encapsulated in specific physical forms. Physical interfaces are usually minimal and limited to buttons and/or sockets for power, as the configuration of the artefact's network connection occurs through a remote interface accessible via smartphone app or web page (Pandey, 2018). These artefacts clearly transcend the limits of traditional physical interaction in that the agents exist primarily as voice-controlled (Ward et al., 2018). As well, these artefacts clearly transcend the incumbent interaction patterns based on visual elements and gestural behaviours.

Figure 29. Strategies to counteract Dark Patterns and channel operationalization from Bongard-Blanchy et. al (2020)



In fact, these artefacts (S.PSSs) capture, and generate and transmit a continuous stream of data once connected, which is again represented over remote interfaces (Pandey, 2018). Streaming is commonly referred to as a continuous flow (of data) that is transmitted or received over the network connection with actions and controls being able to manipulate the data, or in some cases reconfigure the artefact (Pandey, 2018). In addition, conversational agents may be presented in any form factor - they are no longer limited to a landing screen on a phone or a standalone speaker (Ward et al., 2018). Most methods of interaction with technology have resulted in fairly standard relationships between all users and their devices: clients using a laptop or desktop computer typically have an end goal of productivity in mind, clients using tablets are often seeking entertainment, and clients using phones are typically involved in some hybrid of both productivity (i.e. checking emails, texting, and phone calls) and entertainment. Though there is no clearly defined scope of what consumers should be using agents for, they are commonly seen as tools to accomplish some means (Ward et al., 2018).

Incumbent interaction patterns are changing meaning that digital experiences are shifting as a consequence. In fact, the materials being explored as conversational objects talk back to the designer and such an engagement changes our relationship to, and experience of, these materials (Pandey, 2018). These interfaces might as well be embedded with dark patterns, filtered in as representations and notifications presented to users – and which are not the direct orraw captured data stream. Rather, they contain interpretations and visualizations that are intended to help users make sense of the data (Pandey, 2018). Therefore, such interpretations and recommendations are indicative of subjective meaning-making that is encoded within machine learning algorithms. And subjective meaning-making has been shown to be constrained by frames and personal bias.

Digital agents can be more predictive of human behaviour. For instance, smart home equipment adjusts based on users' habits. Moreover, the interaction with conversational agents have

become deeper due to pertinent follow-up questions driving the conversation. Nowadays, agents can be more proactive and predictive of users' needs; however, should they act on their newfound knowledge without consulting users first? In essence, how much agent proactivity is acceptable? (Ward et al., 2018). The answer is not necessarily limited to the question of proactivity, as when the boundaries of agency blur, ethics becomes increasingly important in the equation.

For instance, IOS introduced a feature that asks users whether they wish to authorise a particular smartphone app to access their phone camera roll in order to highlight to the user what data is being captured and ask for specific consent. At this point, it is worth looking at the real-world and analysing case studies to synthesize successful strategies responsibly design in today's digital artefacts.

10. DISCUSSING CASE STUDIES

At this point, both the theoretical and the empirical framework have been laid out. Therefore, it is time to analyse real world case studies to synthesize an ethical approach to designing S.PSSs, which could be useful to designers to shift to a Bright Patterns dominant logic. As such, it is important for both designers and businesses to be aware of the risks associated with dark patterns in order to design ethical digital artefacts. In fact, research highlights that current guidelines for designers are largely driven by formalized frameworks which do not adequately capture on the ground practitioners' conversation about ethics (Fansher et al., 2018). Overall, these case studies will provide valuable insights into the risks associated with dark patterns in design, and the strategies that designers and businesses can use to avoid or limit their use. By examining these examples, readers will gain a deeper understanding of the importance of ethical design practices, and the role that designers and businesses can play in creating positive user experiences.

10.1.1 STUDYING THE PUBLIC SECTOR

The first case study largely focuses on back-end processes, as the literature review synthesized in previous chapters highlights that the technological infrastructure significantly impacts users' experience. In fact, solutions deployed in the back end notably constrain what can be realised on the front-end. On top of that, studying the public sector is interesting as every solution used within public agencies must be transparent. Therefore, it is possible to synthesize strategies to enhance public accountability of socio-technical service ecosystems. In essence, it is possible to evolve from a dark pattern dominant logic to a more constructive bright pattern approach (BPA). Ultimately, BPA could be the basis for further research. It could both refine the responsible design approach for practitioners discussed in this thesis and inform future policy regulations. .

10.1.2 FRAMING THE CONTEXT

As part of the M.Sc. in Product-Service System Design at Politecnico di Milano, second-year students must complete nine CFUs for a curricular internship, equivalent to 225 hours or nine ECTS (the educational credits exchange system of the European Union). Intellera Consulting S.p.A (S.p.A is the Italian label which stands for “Incorporated”) hired me for a curricular internship. Intellera was previously known as PwC Government, but it detached from the parent company in 2018 through a management buy-out operation facilitated by the investment fund Gyrus Capital. Intellera focus on public sector technological and managerial consulting.

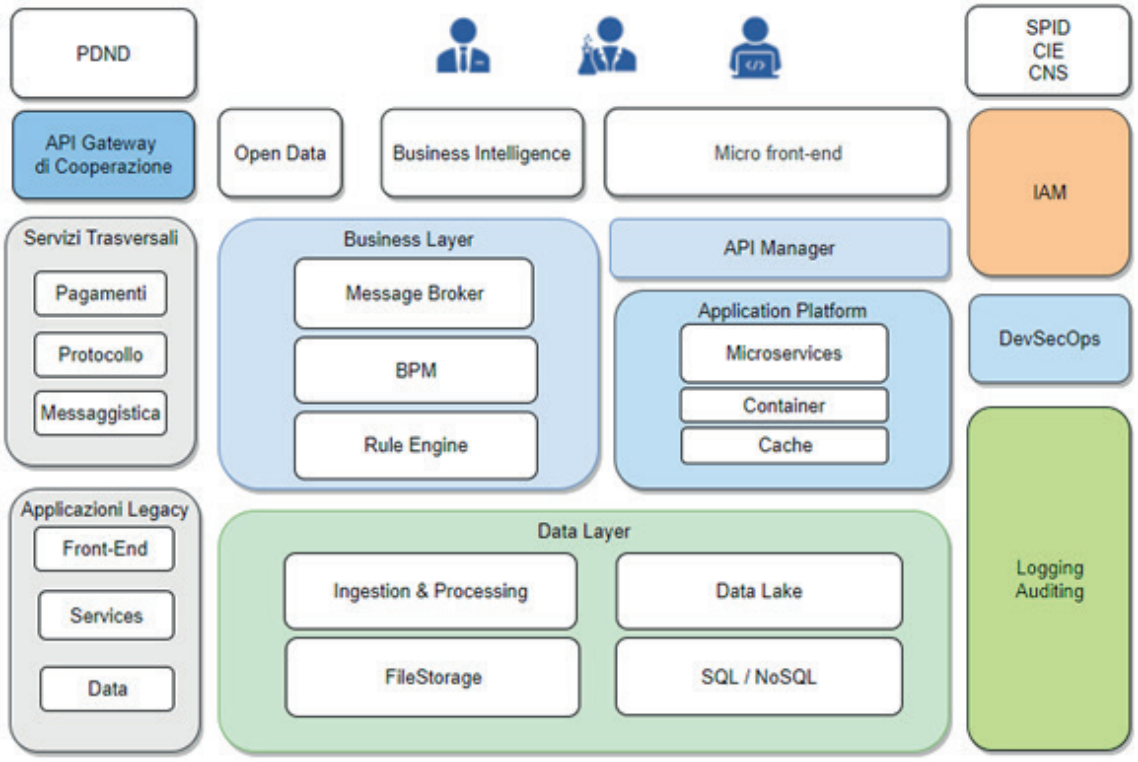
From a personal standpoint, there are many reasons that led me to choose this firm for my curricular internship. During the M.Sc. program, I had the opportunity to briefly touch upon the topic of service design for the public sector, realising the impact that design could have on streamlining public administration processes. Hence, working at Intellera was my chance to gain practical experience across the whole citizen experience, from policy design to digital transformation processes. Additionally, service and UX design is a new expertise for the company, which meansleadership is receptive to the employees’ inputs and suggestions and employees can have an impact across the whole organization. Finally, working in consultancy means being exposed to a variety of projects, which could be beneficial to refine my skillset through a horizontal career experience and seize future growth opportunities as the company quickly develops.

10.1.3 FRAMING THE PROGRAM

As part of my internship program, I was staffed on a project to completely redesign the IT architecture of a major national public agency[6]. The project's scope is wide as it spans from the entire re-engineering of the agency's back-end software architecture to the complete redesign of its front-end processes and digital touchpoints (Figure 30).

[5] The name of the agency shall remain confidential as revealing any names might endanger the transparency of public bids that will be published until the point where the funds coming from the PNRR will run out.

Figure 30. High level architecture of the IT system



The system architecture consists of a review of the authentication methods, enhancing the security guidelines and processes (upper right part). On top of that, the project completely redesigns the datascape in terms of databases, dataflows and data

analysis (lower central part), which allows the client to enhance transparency and public accountably over the processed data by publishing open data. In addition, specific solutions are developed to guarantee the correct functioning of the system (lower right part). New services are developed (central left part); however, some legacy services need to survive (lower left part) to keep the readability over some datasets consistent over time. Ultimately, the central part concerns the gateways that manage the events within the system, while the upper central part concerns the interaction layer with end users.

The project is strategic for two reasons. First, the agency is a key stakeholder within the Italian government ecosystem, as it monitors the transparency of public processes. Second, the project is financed with funds from the Piano Nazionale di Ripresa e Resilienza (commonly referred to as PNRR). In fact, the European Union instantiated in 2020 more than 800 billion euros to be invested in the member states of the union. The investments are carried out within the framework of the Next Generation EU Plan (NGEU) which consists of subsequent rounds of investments contingent to the achievement of specific milestones. More specifically, Italy received 191 billion euros to be invested in a sixfold set of programs:

- digitization, innovation, competitiveness, culture and tourism: 40,29 billion € to transform the public administration by making interactions with citizens and businesses easyer, reducing time and costs and contributing to the creation of new jobs;
- green revolution and ecological transition: 59,46 billion € to strengthen the network of separate waste collection, materials treatment and recycling facilities in order to improve the circular economy and waste management across the country;
- infrastructure for sustainable mobilit: 25,40 billion € to build a modern and accessible railway network and improve the mobility of citizens and goods;
- education and research: 30,88 billion € to build, upgrade and secure kindergartens and schools to improve educational provision from early childhood;

- inclusion and social cohesion: 19,85 billion € to enhance the job market and vocational training by increasing the employment rate, pursuing active labour policies and strengthening employment centres;
- healthcare: 15,63 billion € to improve hospital infrastructure against seismic events; make outreach care more widespread throughout the territory to ensure primary and intermediate care, especially for the most fragile groups.

In essence, the NGEU has been defined as a once in a lifetime opportunity to bridge the gaps that have grown throughout time between the EU states. In fact, during the Covid-19 pandemic, Italian GDP decreased by 8,9%, essentially annihilating its growth between 1999 and 2009 which was 7,9%. It should be noted that in the same period Germany and France's GDP grew respectively by 30,2% and 32,4%.

10.1.4 FRAMING THE PROJECT

The project I was involved in falls under the second most financed The project I was involved in falls under the second most financed cluster of investments - digital transformation processes. It is important to highlight that the European Union made very clear that every investment comes with deadlines and obligations, which are mandatory to meet in order to unlock the subsequent set of funds. More specifically, the projects I am involved with is going to develop in three key moments:

- the first step is more high-level, as it consists in designing the architecture and preparing the documents which establish the guidelines and processes for the correct use of the identified solutions;
- the second step consists in the actual development and coding of the solutions identified in the previous phase. The delivered documents will be updated according to the issues that emerge throughout the project;
- the third step consists in designing the micro-interactions for the front-end, and finally developing and releasing the solutions to the final user. A review of the guidelines may be necessary here.

Hence, it becomes clear that the totality of the projects that are financed under the PNRR must possess a strict governance over the activities. This is exactly Intellera's role within this scenario. In fact, our role as consultants is twofold: monitor the progress of the on-going activities on a daily basis, then the state of work is discussed with the executive director of the contract and all the project stakeholders in a weekly meeting. This checkpoint is essential to redirect activities as soon as they deviate from the planned direction. Tthe monitoring role is useful at a later stage in order to account for and validate every expense, given the strict policies of the PNRR.

Therefore, the team must be multidisciplinary in order to perform our daily tasks. More specifically, the senior manager is knowledgeable about IT solutions, the senior associates are

certified project managers, the associate has a background in economics and accounting and I understand UX and UI principles.

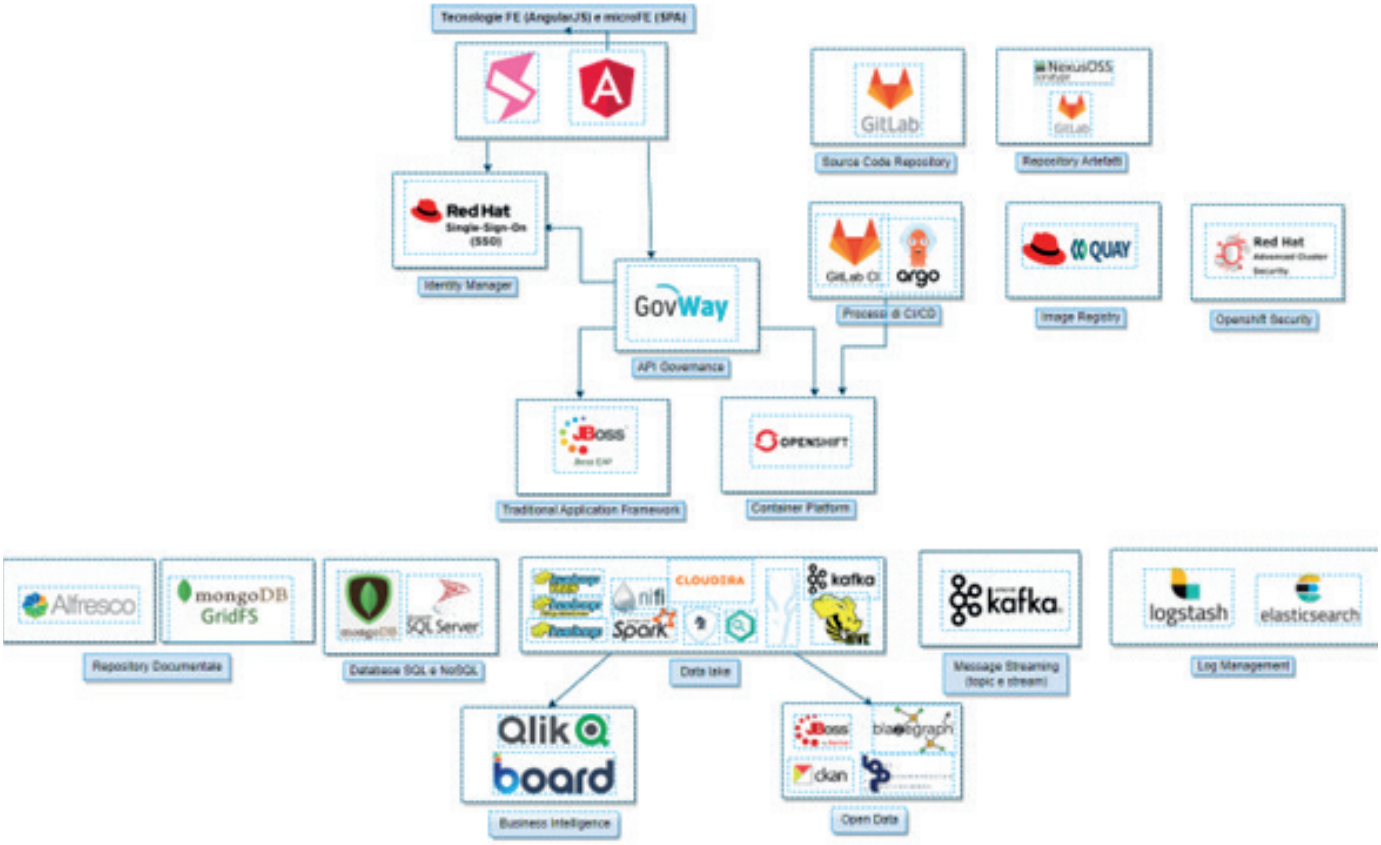
However, if we look at the extended team, the pool of competences increases exponentially. Put in other words, design is rarely a solitary endeavour (Maier & Harr, 2020). In fact, Intellera is not the only stakeholder as our accountability strictly concerns the governance of the project, whereas the architectural solution design, software developments and UX design are contractually fulfilled by a specific IT provider. As a consequence, the IT provider first staffed some project managers to plan the activities and fulfil bureaucratic obligations. Then solution architects were recruited, whose scope was designing the high-level system architecture so that each solution could be integrated. Subsequentely, software developers with different specializations and expertise were tasked to integrate the different platforms validated by the client. Finally, experts in change management and regulation were involved for establishing the guidelines to support the public agency employees in acquiring the new skillsets necessary to run the platforms.

The previous paragraph illustrates exactly what makes the project perfectly fit for this dissertation on S.PSSs and DP In fact, by the admission of the very administration, it would be optimal to develop new code from scratch so it would exactly fit the totality of the scenarios encountered by the administration in its daily operations. However, developing new code would be as time-consuming as effort-intensive. This would not match with the strict timeline dictated by the EU and is not definitely not a consolidated practice. In fact, the stakeholders involved in the project collectively decided to integrate different service providers which offer established solutions and ready-to-use patterns (Figure 31) that could perform the functional requirements identified within the high-level architectural solutions.

Figure 31 illustrates the solution patterns chosen for this specific project. More specifically, the upper left part concerns identity management and authentication patterns, which make the system compliant with Privacy by design and default policy

instantiated within the GDPR. The central part of the scheme is the gateway that coordinates the events within the system. Next, the upper right quadrant consists of security patterns while lower left part concerns applications for data management, namely the databases with warm and cold data: the former must be available in runtime and the latter do not require high performances for immediate consultation. Finally, the lower central part includes solutions to analyse data and create dashboards and reports to audit the overall architecture.

Figure 31. Integration of the different solutions patterns into a unified IT system.



As the different patterns that create the architecture is laid out, it is time to focus on the decision-making flow which characterised the new product development process. Specifically, how were decisions made in order to synthesize the output? And most importantly, what insights can be synthesized from this case study?

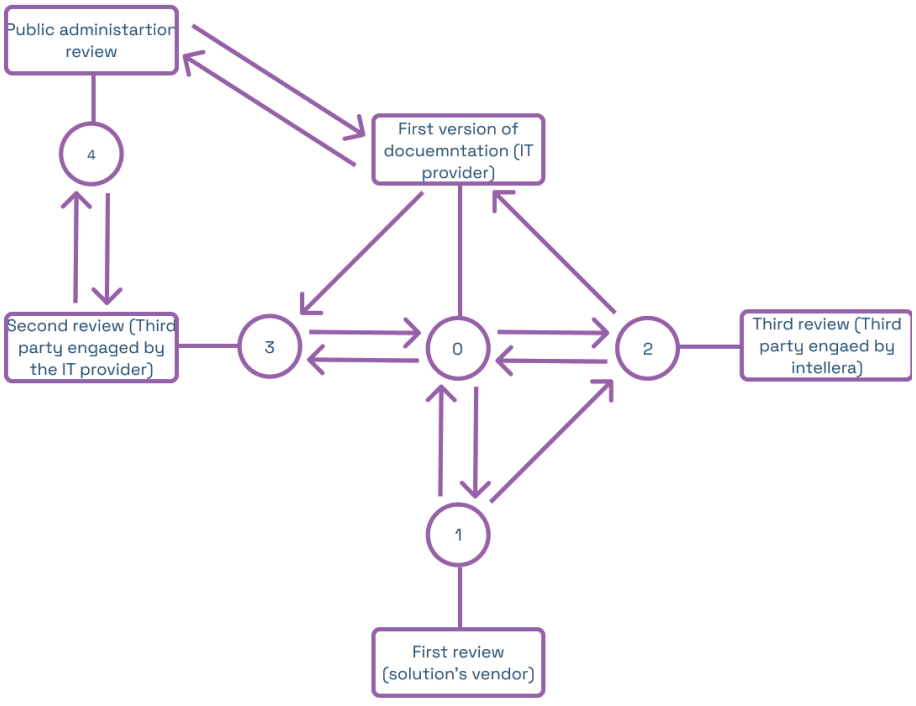
10.1.5 FRAMING SUCCESSFUL STRATEGIES

The integration of resources with multiple backgrounds and diverse point of views indeed contributed to take into account different dimensions and issues emerged during the project. However, having multiple backgrounds was definitely not enough, as time and money unsurprisingly constrained the final criteria that drove the decision-making process. Despite the fact that the client always had the last world over the decision-making process, the public administration specifically asked for multiple rounds of reviews over the solutions presented.

More specifically, the client asked for each solution to be certified by the product vendors and the documentation was then reviewed by technical experts within Intellera. The output was then subjected to a further round of validation by external consultants engaged by the IT provider. Finally, the ultimate round of validation was performed by internal resources of the public agency (Figure 25). Even though multiple rounds of validation could be a successful strategy to include multiple perspective in a solution, the process of managing multiple stakeholders and interests is effort-intensive and time-consuming: in fact, subsequent reviews were performed through a direct collaboration with teams working for the public agency and the IT provider.

Innovative technologies already described in the previous chapter play a crucial role in this project. In fact, the IT provider specifically proposed to combine traditional patterns with new ones powered by Artificial Intelligence and Machine Learning algorithms. For instance, the software Elastic uses Machine Learning to monitor, report and audit the overall architecture. In

Figure 32. Review process



addition, the IT provider also suggested to use, at a later stage when the developments are stabilized, tools powered by Artificial Intelligence for the security tests. Testing is quite an effort-intensive task; therefore, the public administration was willing to adopt new solutions that couple a human operator with Artificial Intelligences to achieve a more precise result. Generally, the public agency was positive and proactive about the proposals as they could relieve tasks from the already overloaded human operators. However, the client clearly explained the requirement for every decision made by a black-box technology to be explainable to and by a human operator. Thus, technologies must be accountable for their decision-making processes and outcomes.

Public administrations, especially in Italy, are generally considered low innovation environments. However, the project is indeed revolutionary for a public agency as it is based on new collaboration patterns between humans and technology. It raises new challenges as it will be interesting to study the overall journey of the adoption process as well as the evolution of the collaboration through times. What new interaction patterns will emerge? What guidelines will be framed? What is the impact on employees' cognition? How will people make sense of a new interactionscape?

The public sector offers important insights concerning transparency, trust, and technological accountability. Arguably, it is the very nature of the public sector to be as transparent as possible. On the contrary, transparency may very well not be as diffused within the private sector as economic drivers are typically the ultimate criteria that run the decision-making process. Therefore, it becomes necessary to study the private sector in order to have a complete and holistic understanding of incumbent servicescapes. Finally, it is interesting to study which guidelines or principles, if any, are used within the private sector and the decision-making processes which shape the solutions delivered to customers.

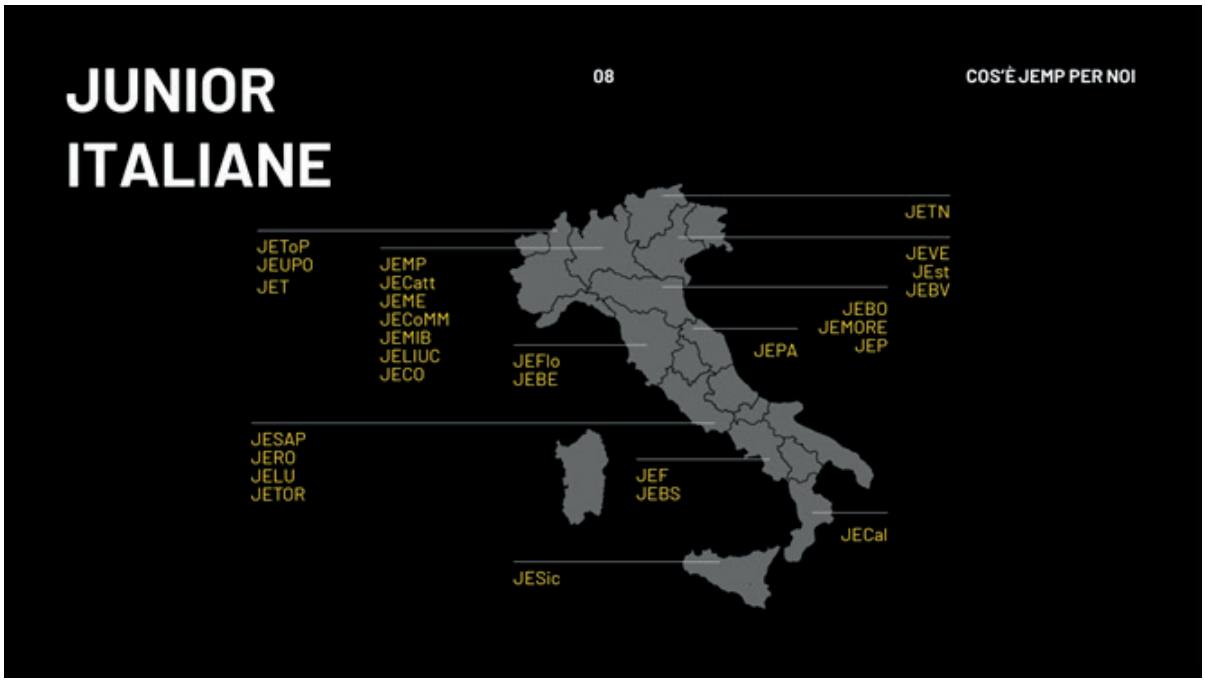
10.2.1 STUDYING THE PRIVATE SECTOR

The public sector offers important insights concerning transparency, trust, and technological accountability. Arguably it is this is the very nature of the public sector to be as transparent as possible. On the contrary, the scenario may very well not be diffused within the private sector as economic drivers are typically the ultimate criteria that drive the decision-making process. Therefore, it becomes necessary to study the private sector in order to have a complete and holistic understanding of incumbent servicescapes. Finally, it is interesting to study which guidelines or principles, if any, are used within the private sector as well as the decision-making processes which contribute to deliver solutions to the final customers.

10.2.2 FRAMING THE PROGRAM

During the M.Sc. program in Product-Service System Design at Politecnico di Milano, I was a member of the Junior Enterprise Milano Politecnico (JEMP). JEMP is a student association which operates as a consultancy firm. Junior Enteprises are grouped within a network spread across Italy (Image 26), which goes by the name of JEItaly.

Figure 33. Review process Location of Junior Enteprises in Italy, from JEMP internal documents



Italy is not the only country to have e flourishing network of Italy is not the only country to have a flourishing network of young entrepreneurs as other networks are spread throughout European and Extra-European countries, such as Brazil and Tunisia. The association that clusters them all goes by the name JEGlobal. More specifically, the Italian Network has three major events in which JE members (also known as JEurs) organize workshops and Exchange sessions:

- Network Day: a one-day long event dedicated to announcing the nominees for the annual prizes along with enriching JEurs' portfolio of competences through workshops organized by the partners;
- JEIOM (JEItaly October Meeting): a three day long event dedicated to the election of the new executive board of JEItaly as well as exchanging knowledge between the different Junior Enterprises;
- JEIMM (Junior Entrepreneurs Italy May Meeting): a three day-long event dedicated to the ceremony for the annual prizes and building up new skills through learning & development activities carried out by the partners of the event.

In 2022, the Network Day (Figure 27) has been organized in Venice at "Museo del '900" with hundreds of Junior Entrepreneurs coming from all over Italy. As wel, the event was populated by a rich line up of partners, ranging from established companies such as PwC and Generali, to smaller and innovative businesses such as Regalgrid: a startup whose focus are independent energy communities.

During the event, I was able to interact with the General Manager and CEO of JENIOT and later I interviewed a service designer that participated in developing the product I was interested to research for this thesis. JENIOT is a corporate venture belonging to the Generali group (insurance market) who presented the business core product: a new and innovative black box device for cars that significantly modifies people's behaviours. It is interesting to investigate the product's development process in order to enrich my thesis with real-world evidence

10.2.3 FRAMING THE CONTEXT

JENIOT is a corporate venture born out of the Generali group. JENIOT is a corporate venture born out of the Generali group. Generali is one of the biggest insurance companies based in Italy with a customer base of millions of people. As introduced in previous chapters, today's competitive arena could be characterised by shifting markets, external constraints and everchanging customer needs. In essence, constant and rapid change appears to be the sole dominant logic. Taking into account the scenario already depicted, Generali – along with many other established businesses – decided to pursue a specific strategy to manage innovation. Generally, innovation is outsourced to a pool of corporate ventures which allow the mother company to retain its established customer base while startups tap into new markets. In essence, Generali's innovation strategy could be characterised as a probing approach where new ventures are tasked to reach new customers.

JENIOT was born in 2018 with a clear objective: developing innovative services in the area of sSart Insurance and IoT for the insurance sector. In fact, Generali's customer base has an average age of fifty years and JENIOT's mission is to reach younger users, who typically have more digital skills. Therefore, JENIOT innovates the insurance sector through the release of Smart Product-Service Systems, where physical products with different functions (ex. a black box for cars, security devices for shops, etc.) are typically intertwined with digital services (ex. seamless payment, remote help, etc.). According to the service designer I was able to interview, the value proposition of Smart Product-Service Systems is clear as they are able to provide streamlined user experiences in exchange for data to be analysed.

As JENIOT is part of the Generali group, it is able to access all the resources of the mother company in terms of financing and competences (ex. HR for recruiting, payroll, etc.). In fact, the service designer I interviewed works within the customer experience team of Generali. The team actually operates intesively upstream during the design phase effectively takes

care of creating homogenised customer experiences throughout the totality of Generali's channels, namely, to optimise the resources. For instance, JENIOT's users should refer to the same customer service of Generali's customer. This is true also for the back-end solutions, as JENIOT's data should actually live on Generali's platforms.

10.2.4 FRAMING THE PROJECT

The product presented at Network Day is called “NEXT” (Figure 28). NEXT is a black box for cars which allows constant monitoring of the vehicle while rewarding positive driving behaviours. Users receive economic incentives to use the smart device as the insurance company is able to clearly determine what happens in case of a crash. Each physical box contains the same technological components; however, the services that power the hardware distinguish the different tiers options:

- Stand-alone self-installable: the basic offering which consists of one black box that records driving data. Second-order digital services can be unlocked later;
- Top-of-the-line car satellite with advanced voice and anti-theft features: second tier offering which offers higher interaction levels with speakers that activate for customer service in case of crashes;
- Hidden device with anti-theft functionality: it could be stand alone or bundled with other devices and offers greater levels of theft protection;
- Windshield device with voice capability: the fourth tier offering which offers higher level automatic services;
- Windshield device with advanced voice functionality: the fifth tier offering which offers smart services offered by a network of stakeholders (Figure 34).

Figure 34. Photo of the device in a car interior scenario

More specifically, the GM & CEO of JENIOT talked about the fifth type of device which was designed in partnership with Telepass, the leading Italian company for highway payments services. The device offers a set of three services:

- Seamless payment services in highways throughout the Italian territory as well as in partner shops such as car sharing, gas stations and so on;
- Safety services which monitor, analyse and give visual feedback to promote positive driving behaviours;
- Insurance services which automate the rescue and bureacratic processes in case of a crash;

Two aspects make “NEXT” interesting as far as this dissertation is concerned: the visual feedback that the device shows in real time to users and the data governance within a network of companies. First, the feedback consists of an LED light on top of the device with three possible colours which symbolise the risk associated with the driving style of the user:

- Red stands for a high risk profile;
- Yellow stands for a medium risk profile;
- Greed stands for a low risk profile.

The classification is mostly derived from data concerning braking patterns and speed limit compliance. In fact, harder braking patterns are associated with higher speeds, which are cross-referenced with GPS data to check the speed limit of a specific road. The company’s proprietary data shows that this feedback effectively modified users’ behaviour with 50% of red category people shifting to the yellow brackets and 20% of people categorised in the yellow brakes shifting to green (Image 35). The results are stunning and prove that “NEXT” could be categorised as a persuasive technology that promotes positive driving behaviors. Booth et al., (2020) actually reinforce the idea proposing that technology has become ubiquitous in people’s lives and most of these are designed with the intent of influencing and changing users’s behavior.

Figure 35. Behavioural changes induced in users by JENIOT Next

On top of that, NEXT is also interesting as it was developed in partnership with Telepass, which is the leader in the highway payment market in Italy. The partnership is beneficial to the clients as they have one single device performing two functions. Indeed, the partnership is also beneficial for JENIOT as they gained direct access to a vast and established customer base. However, the partnership forced the two companies to focus particular attention on the governance of the data produced by the users. More specifically, even though no data could be exchanged between the two companies by law, the data showed how the digital applications of the two services should be synchronised (ex. glocalization data).

In essence, NEXT is a Persuasive Smart Product-Service System as the physical device is paired with intelligent digital services which steer people towards positive driving behaviours through a user-agent interface. Now, is time to define which strategies were implemented during the project to avoid Dark Patterns. were implemented during the project in order to avoid Dark Patterns.

10.2.5 FRAMING SUCCESSFUL STRATEGIES

Even though there is not a specific awareness within JENIOT about the topic of Dark Patterns, there are indeed guidelines to design responsibly. The low level of awareness might be explained by the organizational structure of the company. In fact, JENIOT has no inhouse service design nor UX/UI design teams as it able to access Generali's competences.

The peculiar aspect of this organisational structure is that Generali's service design team effectively acts as a gateway for product optimization. In fact, feedback and data coming from the users is first analysed and then, most importantly, categorised by the service design team who then redirects tasks to specific teams. For instance, some customers reported app usability issues, which was redirected to the UX team; or some customers reported malfunctioning app features, which was redirected to the software development team, and so on. The service design as a gateway scenario allows the creation of a multidisciplinary collaboration environment centred around design-driven problem-solving loops where customer needs are the critical requirements to be addressed.

The second successful strategy concerns a foundational topic of this dissertation - data. The physical products are intertwined with a digital application called "MyJeniot" in order for the users to easily manage service options. Moreover, this application allows the users to choose which type of data the device is able to track. Some data might be critical to a specific service delivery (ex. Geo-localisation data), therefore "MyJeniot" explains the purpose to use each type of data. Thus, transparency appears to be quite an important aspect of the design of the Smart Product-Service System. It should be acknowledged that, even though transparency is a commendable strategy, releasing too much information could lead users to cognitive overload. In essence, a deeper customer education should be put in place.

In order to educate their customers, JENIOT set up monthly reports within the digital application (Figure 35). The reports are elaborated starting from the driving data but most importantly offer strategies to shift from high risk to lower risk clusters. The service design team made a point to implement this feature in the service ecosystem as the customer should not feel judged by the device's feedbackbut instead receive guidance to be better drivers. In essence, the intent is to create uplifting behavioural changes as there is a correlation between low-risk cluster and safer streets with less harm to pedestrian.

To sum it up, JENIOT was able to implement a set of three successful strategies:

- putting customer needs at the centre of corporate strategy through a service design team that acts as a gateway;
- transparency in what data is harvested and the possibility for the customers to opt-out and chose which parameters to monitor;
- customer education to promote uplifting behavioural changes in users.

The combination of these strategies allowed the company to follow a responsible design approach.

Figure 36. UI interface of the monthly report issued by JENIOT

10.3 EXPERT INTERVIEW

To get an even richer pool of insights for the dissertation, I was able to interview a Senior Manager at one of the leading private-owned media entertainment companies in Italy. The second interview was crucial in order to validate the insights emerging from chapter 10.3 as well as enriching my perspective and knowledge on established practices within the private sector. It was a one hour-long semi-structured interview; the protocol is shown in appendix two. Four major insights came out of the conversation which will be explored in the subsequent paragraphs.

Design intent:
The first insight concerns the notion of design intent. More specifically, how do design agencies contribute to perpetuating dark patterns? The manager stated that it is very rare that corporate ask design teams to fulfil an openly and explicitly manipulatory brief upstream in a New Development Process. It should be noted that this insight is coherent with the critique of Chivukula & Grey's experiment (chapter 8.4) whereby a group of design student were tasked to address an openly manipulatory brief (2020). The experiment seemed to be an unrealistic reproduction of real-world conditions. Furthermore, the manager stated that it is more common that marketing departments would suggest implementing strategies that might be characterised as dark patterns in order to optimize conversion metrics. Again, this insight is coherent with Luguri and Strahilevitz's (2021) definition of Dark Patterns as leverage points to gain unfair economic advantage. With two departments that have conflicting views and share accountability of the same topic, it becomes clear that Dark Patterns are a question of internal organizational models. This dimension is investigated in the subsequent insight.

Design leadership:
The second insight focuses on the organizational structure The second insight focuses on the organizational structure of the company. More specifically, how does the design team collaborate with other business units? This insight is consistent with chapter 9.1, where Verganti et al. (2020) acknowledge the new role

that design has within organizations. Designers are acquiring more and more strategic roles within companies tackling new and complex problems. However, the manager acknowledged that in order for design teams to impact the organisation, there should be serious commitment from the company's leadership team. He specifically talked about an executive meeting where his arguements against Dark Patterns were silenced by the Chief Marketing Officer. Later, he was asked by the Chief Design Officer to prepare a presentation about the topic of Dark Patterns to be presented in a formal meeting with the C-Suite. Therefore, the company leadership team should openly and clearly define the accountabilities of specific design teams to all stakeholders within the organization in order for the design department to significantly impact corporate strategy.

Design education:
The third insight focuses on the new set of skills that designers sThe third insight focuses on the new set of skills that designers should acquire in the digital age. The senior manager acknowledged that a new set of skills is needed for designers who want to expand their internal influence in businesses, specifically pointing out expertise belonging to the domain of data science. This position is coherent with the theorical literature which points out how service and UX designers are increasingly asked to collaborate with data scientists (Kunneman et al., 2022). Even though designers are not required to become data scientists, they are able to influence corporate leadership since they can produce data to sustain their arguments. Interestingly enough, user research insights are designer's proprietary data, meaning they are the only stakeholders in a company with the capabilities to mine this type of data. Nowadays, data analysts measure the data they need in order to operate the business; however, as designers become more comfortable understanding data, they are capable of requesting specific information to analytics departments, thus forging instances of interdepartmental collaboration. The strategy used by the senior manager was to organise weekly meetings between the design and analytics departments, where design would ask for data they needed to optimise the product's portfolio while analytics would fulfill the requests, explaining the process to achieve a specific result.

OKR and DesignOps:
Finally, the last part of the conversation focused on near-future scenarios for the design profession. More specifically, which trends are currently shaping design practice? We discussed OKRs, an acronym which stands for Objective Key Results. OKR is a structured methodology to measure projects and business performance which is currently substituting KPIs (Key Performance Indicators). While KPI used to be assigned top-down from the company's leadership to the teams, OKRs allow individuals to participate in the company's strategy definition phase. Clearly, OKRs fit companies that adopt agile methodologies and make iterations key components of each project. OKRs are important for design teams as they demonstrate that design projects have specific objectives which could effectively be measured, ultimately showing the impact of design within companies. OKRs are a key component of DesignOps, a recently emerging practice which enables design expertise that is dramatically reshaping organizations operating models, much like "DevOps" did in companies that needed rapid software development. DesignOps is formally defined as the orchestration and optimization of people, processes, and craft in order to amplify design's value and impact at scale (Kaplan, 2019). DesignOps is an emerging strategy to organise design individuals spread throughout different departments of the company. In essence, DesignOps is a pathway for every company to integrate successfully design methodologies within their operations seamlessly.

10.4 DATA ANALYSIS

Finally, it is time to synthesize and collect the most important insights from previous chapters to contribute to the knowledge in the field of dark patterns. Lessons from the literature review and the analysis of case studies are merged and cross referenced within a table. Ultimately, the value of this work is in providing a useful responsible approach to designing S.PSSs in order to break free from a dark pattern dominant logic (DPDL) and shift towards a bright pattern dominant logic (BPDL). Furthermore, this approach will hopefully be the starting point for further dissertations in other fields such as the regulation of dark patterns or collaboration with data scientist to build better and safer new and innovative technologies.

Having cross referenced all the theoretical knowledge with insights coming from the field of design practitioners, it is now time to frame what designers can do to design better solutions. On the one hand, a new ethical approach to designing S.PSSs is needed which will be shown in the following chapter. On the other hand, this approach ought to inform design methods and tools to establish instances of interaction with other practitioners ultimately shedding a light on Dark Patterns.

Table 7. Cross-reference between literature review insights and case study analysis.

Section	Theoretical evidence	Empirical evidence	Emergent topics	Corresponding Section
4.1, 5.1, 5.4, 8.4	Design as an engine of wider societal transformation with practitioners taking leadership roles within organizations and problem spaces becoming more systemic. In doing so, collaboration with other disciplines is needed.	Some parts of the public sector project have been governed by an inherently design-driven approach. Especially the developments front end applications were first prototyped then iterated and developed according to client's needs. guidelines and prescriptions.	Design education should provide new knowledge to tackle more systemic problems. such as digital ethics for S.PSSs, data science for Service Design,and policy frameworks concerning data governance.	11.3
6.1, 6.2, 6.3, 7.1, 7.2, 7.4, 8.1, 8.4, 9.6	At the development stage, designers script user behaviours (code is law), deciding what they can and cannot do. In fact, new technologies are increasingly intertwined with services, which are more and more incumbent in people's lives (Smart Product-Service Systems, material turn). S.PSS have been shown to influence human cognition and behaviours (persuasive technology, addictive technology, Siren Servers)	The solutions chosen in the back end significantly constrain the choice of interaction patterns at the front-end stage which ultimately influences users' experience.	Designers need frameworks to establish instances of interaction with other disciplines. Furthermore, they need to adapt or create new approaches, methods and tools specifically aimed at design and making sense of complex socio-technical ecosystems.	11.3

5.2, 8.1, 8.2	Scripting behaviours act on people's well-being (nudging vs. boosting) by balancing trade-offs between long-term goals and short-term wants. S.PSSs are dyadic interactions where people acquire knowledge and skills (transformative service research).	In the public sector project, the guidelines documentation was elaborated at the beginning of the process. Furthermore, the guidelines specifically referred to policy frameworks already active at the present moment, such as Zanca law for accessibility or AgID (Italian Digital Agency) for usability.	The most contemporary policy frameworks do not necessarily recognize Dark Patterns. However, non-design disciplines have only recently started to speculate about dark pattern. Therefore, there is a fundamental need for design-driven policy frameworks crafted with greater public involvement.	11.1
4.1, 5.2	The HCD approach reduces the complexity of socio-technical service ecosystems which the More-Than-Human framework tries to address them. Technologies have been developed with a functionality-dominant logic which may lead to unintended consequences. Therefore, the development of S.PSSs should shift to a more experiential approach.	Even though some parts of the project have been inherently design-driven (for instance, iterative approach), each development cycle was functionality-led rather which meas that the Human-Centred-Framework was not applied in full.	More-than-Human is a promising approach to design for SEs (Service Ecosystems) and S.PSSs. On the other hand, concrete strategies to create uplifting behavioural changes are needed to build mindful interactions to nudge or boost users' agency.	11.2
4.1, 7.2, 8.3	Smartness is reached through the cooperation of several factors, such as policies, economy, governance, education, and individuals. Therefore, collaboration is important to overcome unintended consequences that are generated by bounded human rationality (frames) whose biases filter into artificial intelligence (multistabilities).	The project has been characterized by an orchestration of resources with multiple backgrounds and diverse points of view (ex. policy experts for data governance, security experts for software applications and data management, UX/ UI designers for smoother interaction).	Exposing design projects to external auditing might go beyond the classic client-designer dyad as well as contribute to diffusing a design culture with other disciplines.	11.2

4.1, 4.2, 5.1, 5.4, 7.1, 7.4	Strategic alliances are needed in order to develop new S.PSSs, which may lead to conflicting interests and data breaches. Extended networks (constellations) include new actors such as autonomous technologies (interactivity, adaptability, context-awareness) with increasing agency levels, thus forming socio-technical service ecosystems. However, current networks are typically private (intellectual property) which shields transparency (black box). Also, as technology becomes more sophisticated, it is more intelligible from a human operator (education).	The IT provider specifically proposed using AI, ML, and NPL patterns in order to alleviate the cognitive load from human operators within the public agency (ex. automatic security test). While the public administration was indeed enthusiastic about the proposal, it explicitly required the autonomous decision-making process to be clear to human operators.	As S.PSSs come to govern more and more aspects of people's lives, a reframing of the statute of intellectual property might be urgently needed to secure more severe public scrutiny. For instance, continuous public scrutiny could be achieved by requiring the publishing of Open Data.	11.1
4.1, 4.2, 6.3, 7.3	Even though no new product development process outlines strategies to handle data, new processes are specifically developed to de-center innovation and push intelligence towards the edge of constellations. Therefore, it is important to grow participation (co-creation and co-production) and transparency in order to base interactions upon a collaboration paradigm, rather than a prosthesis approach, whereby the former recognises the non-neutrality of technology.	Although no end-users were formally involved in the project, the very first step was crafting documentation that established guidelines and normed methodologies for future developments. Moreover, these documents were reviewed by multiple stakeholders of the project.	As one employee that worked for the IT provider stated, "No organization is able to completely control itself". This is one aspect of growing participation, which means new solutions should be co-created by the communities that will be affected. Co-creation could happen in vaous levels, for instance, these communities could trust delegates in order to audit, verify and certify solutions.	11.1

6.3, 9.3	As S.PSSs broaden the notion of user participation, they generate bigger streams of data. Therefore, their engagement and attention have become the primary driver of value creation within digital business models. In essence, data is the new source of value as new technologies rely on huge datasets generated by everyday interactions with humans (always on).	The IT provider specifically crafted guidelines for data management further up in the project pipeline. However, it was specifically requested by the public client, which means that private clients might be indulgent to less stricter guidelines in terms of data management.	The data governance model should be transparent as it should be clear what data is extracted and for what purpose. Users should be allowed accessible opt-out options. Finally, every decision-making process should be transparent to a human operator (no black-box paradigm).	11.1
8.4, 9.1, 9.2	As people participate more, they are more ethically involved in the design process (experiential ethics). On top of that, designers are increasingly tasked to choose what problems to address (designers as everyday ethicists). Therefore, culpability becomes co-shared between the stakeholders of the project.	In order to involve more people, or at least increase transparency over internal processes, the public administration specifically dedicated some work packages (allocating significant budget) to realise a reporting system for Open Data. Generali create monthly reports for users which gave them strategies to improve their driving style based on the data extracted.	Open Data might be a viable pathway to enhance transparency. However, organizations should make this data legible to users with explanations.	11.1
9.1, 9.2, 9.4	Designers increasingly use a recurring set of solutions (design patterns) to address problem spaces which often delegate decision-making to autonomous technologies (problem-solving loops). These solutions could either backfire (anti-patterns) or purposefully favour the use of system 1 thinking modes (dark pattern).	The project did not have the budget nor the necessary time frame to develop code from zero; in fact, many existing solution patterns were integrated within the overall system architecture. These patterns were certified by an array of different stakeholders directly and indirectly involved in the project.	A greater participation by users in decision-making processes is needed. Co-creation should have: firstly, clear channels and a defined time to listen to the voice of customers (VoC) in each development cycle. Secondly, formalized methods to clarify how to incorporate VoC in established processes. The result would be a shift in the primary driver of value creation, from experiences to feedback.	11.2

11. SYNTHESIZING A RESPONSIBLE APPROACH TO DESIGN S.PSSS

According to Verganti et al. (2020), design practice refers to the phenomenology of design in a specific context: its process ("how" design decisions are made; through which phases, methods, tools, or collaborative practices) and the object of design (which design decisions are made; which novel solution it creates, whether a good, service or process). Design principles, instead, refer to the perspective and philosophy that inform the act of designing, and that constitute an ontology of what design is (Verganti et al., 2020). Previous chapters addressed design phenomenology, while here design principles will be presented. It is important to notice that it is impossible to identify one single intervention that could free the web from all Dark Patterns, therefore, drafting appropriate interventions is a design problem in itself (Bongard-Blanchy et al., 2021).

Even though user values have often been supplanted by shareholder value (Grey et al., 2018), it could be generally argued that UX designers could improve their methods and processes to bring in their user-centric perspective in tech organizations, control "how addictive" a designed experience should be, and help users understand how their actions "feed" these systems (Chianella, 2021). In fact, many academics note there is a strong argument by academics for the necessity to go beyond Human-Centred-Design. In fact, HCD was formalized by Don Norman in the 1980s when design was mostly focused on bringing products to the market (Cruickshank & Trivedi, 2017). Conversely, previous chapters highlight that decisions are increasingly being made autonomously with human agency delegated to machines. In addition, the design practice scope is growing as there is a changing cultural, social, commercial, and technological landscape that will require a reassessment of the fundamental assumptions that underpin HCD (Cruickshank & Trivedi, 2017). In essence, it is not just in terms of design process that there are grounds for going beyond HDC, there are also arguments made in terms of social responsibility (Cruickshank & Trivedi, 2017).

Not only do these smart objects increasingly surround people in physical spaces, but users also experience different relationships with different devices within new interaction landscapes

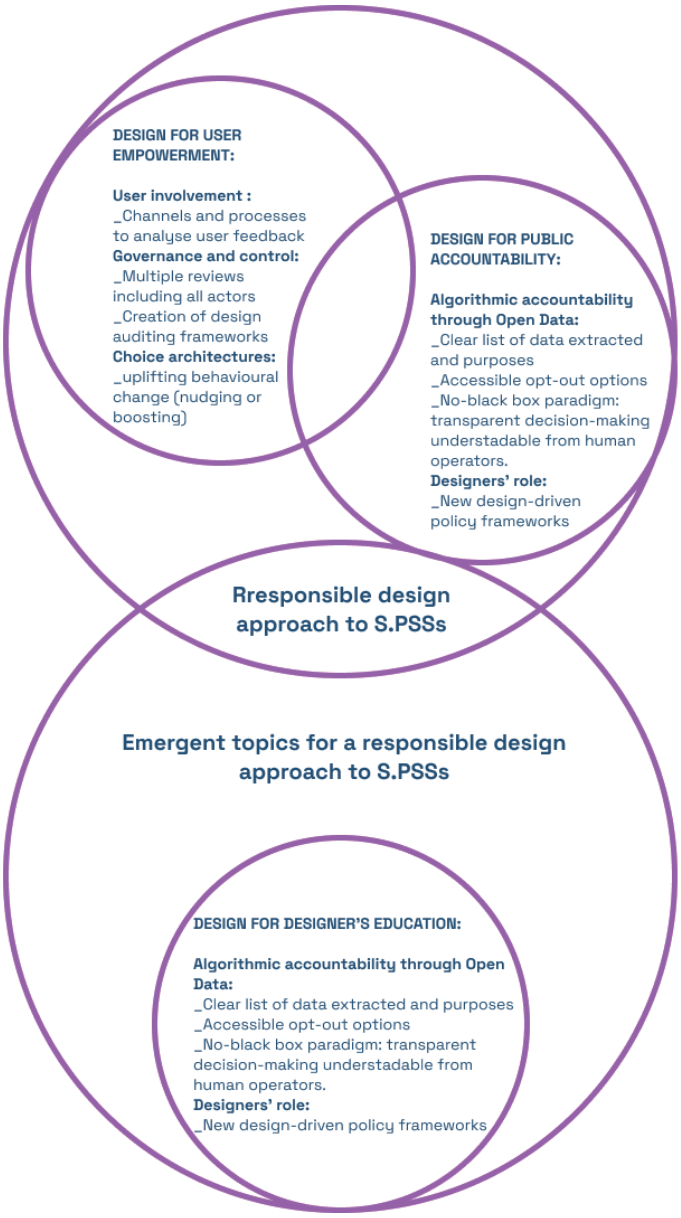
(Ghajargar et al., 2018). According to Chivukula & McKay (2019), researchers in HCI are increasingly interested in describing ethics and values relevant to design practice, including methods to guide their application. Moreover, it could be argued that research emphasizes the importance of values in relation to design, however it provides little guidance to reveal the values that impact designers' decision-making (Chivukula, 2018).

Therefore, table 7 combines the literature review insights with the case study findings and used this to further refine and formalise a responsible design approach to designing S.PSSs which might be useful for the practitioners in their daily activities. Our hope is that this approach could be the starting point for further research, thus expanding the debate on Dark Patterns to other domains of knowledge. From a high-level perspective, the findings from both the literature review and case study analysis could be clustered in three major clusters which together contribute to the paradigm of responsible design (Figure 36):

- design for public accountability, which argues for increased participation in the design process of digital solutions;
- design for user empowerment, which argues for the design of more mindful interactions between technology and users.

Furthermore the literature review and case study analysis outlined an emergent topic: designing for designers' education implies reflecting on implementing new methods and competences in future design curricula in order to address complex challenges.

Figure 36. Design responsibly diagram



11.1 DESIGN FOR PUBLIC ACCOUNTABILITY

Previous chapters highlight the emergence of black-box technologies whose decision-making processes are often difficult to explain retrospectively from a human operator point of view. Decision-making processes are complicated by either because the number of variables used for their computation is enormous, or because in certain cases the machines themselves are increasingly tasked to infer meaning to the dataset they are trained for. The issues concerning intellectual property confidentiality have already been noted by Cathy O'Neil in her book "Weapons of Math Destruction" (2017), where she highlights that despite being packed with bias, autonomous algorithms are already dictating many of the activities that people perform in their daily lives. For instance, an algorithm assigns a score credit to people determining whether they are eligible for a loan or not; other algorithms have been developed to define prison sentences, but they have been shown to repeatedly suffer from racial bias. However, these very algorithms are often privately owned and intelligible to the larger public both in terms of patent secrecy and skills necessary to understand data science.

As such, the argument for wider public accountability comes from many voices within academia. In fact, the lack of developed frameworks for algorithmic accountability is an opportunity to work in ways other than the conventional client-designer dyad (Guy & Kimbell, 2018). Design scholars have already started to develop tools, methods and approaches to grow the design table and include a diverse set of stakeholders. However, at the present time design is seen as a service, inevitably paid by the client (Ayazova, 2017). In fact, many academics and practitioners argue for an even greater need for participation as design outcomes might appropriately be taken up in a public way, rather than the responsibility laying solely at the feet of designers: this might be termed "design by society" (Pilling et al., 2019). In essence, according to Kozyreva et al. (2020). data privacy and its protection in the context of AI assisted information environments should be seen not merely as an individual good but as a public good whereby many voices are integrated.

For instance, one possible strategy to operationalize the cluster of design for public accountability could be to diffuse the practice of auditing in design projects. Design audit, in fact, goes beyond the client-design dyad by introducing independent third parties within and throughout the design process. Luguri and Strahilevitz (2021) who analysed dark patterns from a legal point of view propose to have consent decrees that let companies permit to independent audits of the firm's compliance with its legal obligations. Ultimately, design auditing implies building design capabilities in practitioners typically coming from other backgrounds which in turn could enrich the design as a consequence of the interaction. In addition, another necessary step towards public accountability would be designers to taking up roles that go beyond the design practice itself. In fact, Sloane (2019) highlights the need for infrastructures for public accountability: conceiving of social design beyond the client–designer template and locating social designers according to the multiplicity of roles they may take up—for example, as public servants, politicians, or citizens and establishing new and interventionist methodologies.

Furthermore, the notion of public accountability has huge implications for society as whole as it is connected to the debate on responsibility and culpability. In fact, culpability should not bear solely on the shoulders of designers. As Stoimenova & Knleinsman (2020) put it, designers cannot be held universally responsible. Therefore, responsibility becomes co-shared between the all the stakeholders involved in a design problem. It could be argued that businesses, designers, technologies, and users themselves all contribute with varying levels of agency to the success or failure of a designed outcome.

Arguably, what has been described in this paragraph is a roadmap that would take several years to complete. On top of that, transparency may not be sufficient to push back against the influence, resignation, benefits, cognitive costs of opposing dark patterns, and other factors that might undermine users' ability to resist (Bongard-Blanchy et al., 2021).

In conclusion, there is a need for immediate strategies that could counteract dark patterns directly within the design process. Therefore, which are the immediate strategies, that might be ultimately referred to as bright patterns? ?

11.2 DESIGN FOR USER EMPOWERMENT

In recent years, human-centred interaction research has begun In recent years, human-centred interaction research has begun promoting a design approach for digital well-being and enhanced user self-control in order to prevent unconscious habits, such as infinite scrolling or auto-play (Widdicks et al., 2020). Generally, according to Maier & Harr (2020), ethical products should support people's autonomy by default. The outcome of ethically designed S.PSSs would be the stimulation of reflective thinking (system 2 mode) which is intended as a distributed cognitive process that relies on external stimuli and activities: such as materials, situations, talking with other people and writing (Ghajargar et al., 2018). In essence, it is a meaning-making process through which people move from one experience to the next with a deeper understanding of its relationships and connections (Ghajargar et al., 2018). Essentially, later thoughts grow out of, and support, the earlier ones, in a chain or thread of thoughts that is not only an individual process, but it also involves other entities: such as other people, objects, activities and places (Ghajargar et al., 2018). There are three approaches for a reflective thinking relationship with technology, which progressively becomes deeper (Ghanjarfar et al., 2018):

- Augment me: In this kind of relationship, the user and the computing artefact exist in an equal and balanced collaboration. The user directly inputs commands to the computer which provides outputs in the form of perceptible feedback. These flows of inputs and outputs assist the user in achieving a functional goal;
- Engage me: This process collects and stores data to later build knowledge from it. Users are provided with feedback which has been proven to make users reflect on their actions and personal aspects of their lives. Generally, feedback is provided through a user interface (UI) and, in almost all cases, through videos, photos or data visualization techniques on screens;
- Make me think: It uses computing technology as a medium that helps transcend the limitations of the mind, such as

memory, in activities of thinking, learning and problem-solving. Cognitive or mind tools promote learning and thinking with – instead of through –computers. Thus, it enables a learning "with" interactive technology approach as an intellectual and active partner.

Feedback loops have been proposed as a useful strategy to counteract dark design strategies. They have been defined as actions taken by (an) external agent(s) to provide information regarding some aspect(s) of one's task performance (Hermsen, 2018). Interactive feedback mechanisms help customers to assess a specific situation and act accordingly (Sayar & Er, 2019). A user interacts with an artefact and then the artefact provides feedback, creating loops of actions and feedback that can shape and personalize the interaction (Ghanjarfar et al., 2018). Feedback could support more mindful interactions through the addition of nudges or design friction (Chianella, 2021), as it may stimulate analytical, or system 2, thinking. Kozyreva et al. (2020) propose useful strategies, such as:

- making people pause and think to explain why a certain headline was true or false may reduce their intention to share false headlines;
- introducing reminders about accuracy before sharing – thus subtly prompting people to attend to accuracy – can reduce people's intention to share false headlines;
- a simpler version of friction can be used to prevent uncontrolled sharing cascades of false and misleading information.

In fact, the frictionless design mantra (a byproduct of HCD) robs users of precisely those moments that may give opportunities for reflection and enable them to reject their baser impulses (Narayan et al., 2020). For example, Instagram introduced an AI-powered feature in June 2019 that delays posts containing offensive comments by notifying users that their comment may be considered offensive and allowing them to cancel the post; messaging app Telegram recently introduced a "slow mode" that enables group administrators to impose a waiting period before users respond. In these cases, users' ability to resist needs to

be improved by adding design that disrupts automatic behaviour (Bongard-Blanchy et al., 2021). In addition, Nelissen et al. (2022) propose tools or plug-ins with indicators for the amount of risk associated with sharing certain data types. The paragraph about blockchain specifically shows that it is possible to have such tools available for use now.

Previous chapters show the strategic value of the datascape. More specifically, when talking about data, Pilling et al. (2019) propose three levels of empowerment for users:

- Legibility is primarily concerned with ensuring that the use, storage, sharing of data and associated algorithms are made clear and understandable to users.
- Agency relates to how users of data-enabled systems are able to manage their data and who has access to it. Aside from the basic ability to opt-in or opt-out of data collection, agency also relates to how data is stored and used, including the ability to modify data and the inferences that may be ascribed from it.
- Negotiability acknowledges the transactional nature of data collection, particularly in the context of trading functionality. Negotiation seeks to facilitate an ongoing engagement by users in data collection and use so that they can withdraw access completely or in part and derive value from data collection themselves.

Feedback is not the only strategy that has been proposed to counteract dark patterns. In fact, Bongard-Blanchy et al. (2021) stress the responsibilities of policymakers as well as technologists: both stricter control from authorities (policy-making) and stricter environmental protections are needed (responsible design).

Furthermore, the interest in designing for reflective thinking in human-computer interaction (HCI) and design communities has been growing, especially with the purpose of creating uplifting behaviour changes in users (Ghajargar et al., 2018). Positive behavioural change could be critical in addressing a widespread

phenomenon within digital endeavours which is commonly referred to as “echo chambers” or “social bubbles.” Echo chambers are information environments in which individuals are exposed only to information from like-minded individuals whereas filter bubbles refer to content selection by algorithms according to a viewer’s previous behaviours (Kozyreva et al., 2020).

In conclusion, the ultimate goal for user empowerment should be to let them develop their own ways of mitigating anti-patterns and dark patterns through fixing strategies. Widdicks et al. (2020) suggest that it has already happened for work-life balance where users have been seen to deploy micro-boundaries of technology. In fact, Valencia et al. (2015) in their series of workshops note that consumers do want the necessary tools to make decisions or take action on their own terms.

Arguably, in order to empower users to prefer the use of system 2 thinking, designers must be empowered in the first place. In fact, designers need to develop a deep awareness about dark patterns, ethics, responsibility, and behaviour change. In essence, designers need to acquire a new set of skills and competencies to actively have a stance in the discourse around policy and technology.

11.3 EMERGENT TOPICS FOR A RESPONSIBLE DESIGN APPROACH: DESIGN FOR DESIGNERS' EDUCATION

The literature review and case study analysis highlighted two levels for a fruitful design education intervention. First, a deeper awareness about ethics and second, a deeper understanding about the underlying mechanisms of new technology and even more specifically about data which has been shown to be the new frontier for value creation. In fact, the majority of designers are not trained to think critically about socio-technical problems and ethical challenges (Forlano, 2016).

Concerting the issue of ethics, HCI researchers note that other fields, such as engineering, have required ethics education as part of the core curriculum for more than a decade. On top of that, these professions have core ethical committees as means of controlling who can call themselves a practitioner (Grey et al., 2018). Even though the latter appears difficult to extend to design practice, the former appears more manageable.

Regulating design professions is difficult because it is a field where many practices, at times very different, overlap (to name a few: architecture and interior design, communication and branding, urban planning and policy, business and service, psycology and UX, and many more). In fact, according to Nelissen & Funk (2022) it is still unclear who bears responsibility for implementing legal boundaries in design. However, introducing ethics within design curricula appears more feasible. In fact, research-through-design has long tried to frame strategies to embed values within the design practice, revealing hidden agendas and values and exploring alternative design values (Bardzel & Bardzell, 2013). Certainly, within the history of research through design, significant attention should be placed on critical design. In fact, design practices rooted in the arts, such as speculative design, critical design, critical making, and design fiction, offer great potential to broaden the scope of engagement (Forlani, 2016). It tries to go beyond concerns about usability, framing the dramatic changes

over the past three decades of technology as socio-cultural implications (Bardzel & Bardzell, 2013). In essence, critical design rejects how things are now as the only possibility (Cakiroglu & Pazarbasi, 2019), thus seeking to disrupt or transgress social and cultural norms (Bardzell et al., 2012). Essentially, critical design recognizes that designers are ethically implicated whether they want it or not (Bardzel & Bardzell, 2013). The aim of critical design would be to leverage the practice of design to make consumers more critical about their everyday lives and, in particular, how their lives are mediated by assumptions, values. Ideologies, and behavioural norms inscribed in designs (Bardzel & Bardzell, 2013). In essence, critical design could help bringing more mindful interactions between users and technology.

Despite having all but negative attitudes and principles, Critical Design fails to address some key points as its formulation is more vague and political rather than professionally useful. In fact, being critical, having interpretative methodologies and sceptical predispositions has often be misunderstood for provocation (Bardzel & Bardzell, 2013). Furthermore, there are no principles to decide whether a design is affirmative or critical (Bardzel & Bardzell, 2013). In fact, interaction with users is represented as essential to the critical design approach, thus confining critical design projects to exhibitions is an ineffective method (Cakiroglu & Pazarbasi, 2019). Research on Critical Design might be reinvigorated by introducing the notion of frames, where criticality is expressed through the use of counter-frames which are strategies to move past the status quo.

On the other hand, as the scope of design interventions enlargens, the skillsets of designers must grow accordingly. Significant research points out that designers should become experts, or at least knowledgeable, about data and how that data is leveraged throughout its lifecycle. In fact, by ignoring the functioning components of algorithms, designers can only see AI as something “magic” (Chianella, 2021). Furthermore, Kunneman et al. (2022) note that data science outputs are highly dependent on the data quality and its structure. This is exactly the reason why designers must be knowledgeable not only about artificial

intelligence in general, but they should master the basics that new technologies build upon. As Stoimenova & Price (2020) put it, designers need to understand the technology (particularly its core—the algorithm). These findings are consistent with the new role of the designer that has been highlighted in previous chapters. As automation moves upstream within the design process, producing a high number of alternatives given a certain set of conditional rules, the task of the designer is not giving form to a product but seeding the system and evaluating the results (Ferrari, 2017). As well, designers are increasingly tasked to set the boundaries of the system or, put differently, taking accountability over the definition of the problem space. Moreover, understanding data is a key part in order to frame the relationship between smart service ecosystems characterized by a constellation network. In fact, without understanding the work behind the scenes, people find it difficult to see who benefits from the projects and how (Fox et al., 2020). To conclude, with this new knowledge designers might put effort towards making it easier for users to understand the output of AI models (Stoimenova & Knleinsman, 2020).

Designers need to be more aware of not only data but also policies. In fact, practices at the intersection of User Experience Design and privacy are under-explored and a clear definition of Privacy UX has not yet emerged (Nelissen & Funk, 2022). The participants in the workshop organized by Nelissen & Funk (2020), where designers were asked to solve an explicitly manipulative brief, suggested that choices were more attributable to a lack of training and experience rather than ill intent. Ultimately, it means that the design community will have to seek better ways of educating modern designers about ethical issues, their responsibility, and viable approaches in order to prepare them for the challenges of daily design practices. In fact, governmental agencies, such as the Dutch Data Protection Authority, offer more materials to help understand the GDPR, but they focus on system perspectives, not necessarily on UX. As well, while practical advice is certainly helpful in designing interfaces, these reports tend to overlook the macro perspectives on designing for privacy (e.g., transparency and consent) that are the backbone of privacy by design.

In conclusion, even if these three clusters would be implemented perfectly, it is ultimately the client's interests that would prevail over any suggestions that design consultants might propose. In fact, there is a belief that one should change jobs if the values of an organization are misaligned with one's own values regarding individual responsibility (Stoimenova & Knleinsman, 2020).

Indeed, a general awareness about the issue of Dark Patterns is rising even beyond the design field. The following chapter illustrates: how do practitioners design solutions with new and innovative technologies? How can they be supported in designing better solutions? In essence, are there any methods that could support designers in their practice?

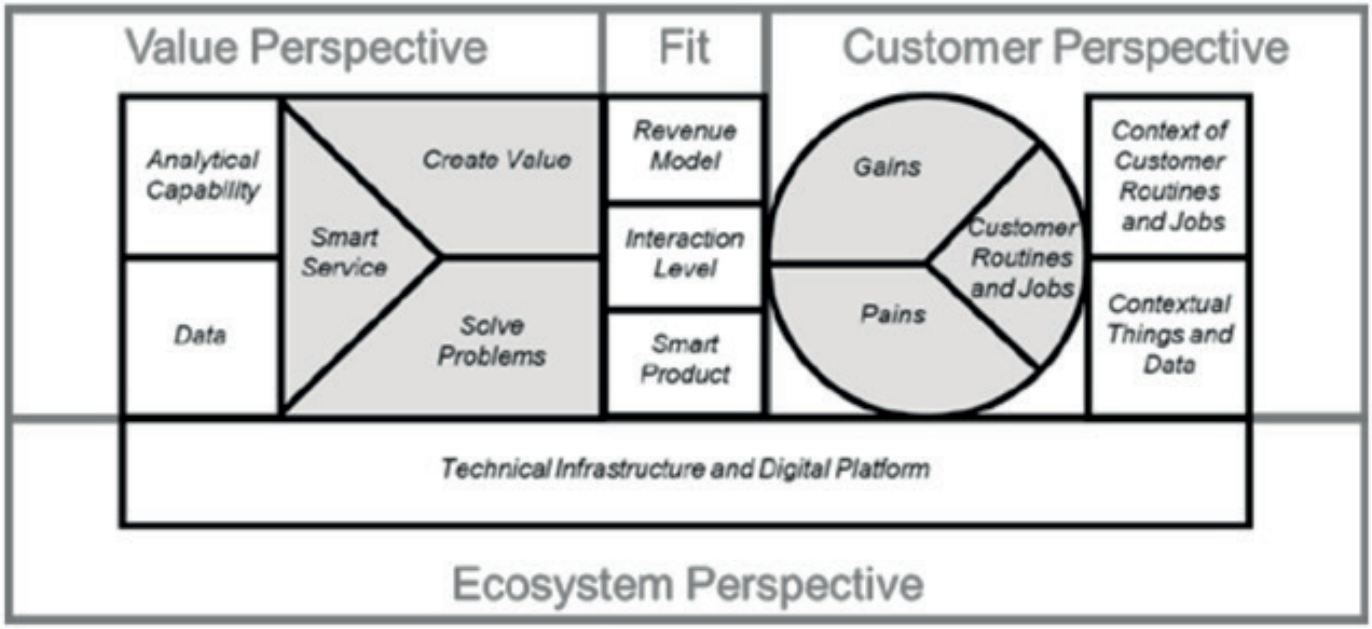
12. METHODS AND TOOLS TO RESPONSIBLY DESIGN SMART PRODUCT-SERVICE SYSTEMS

Widdicks et al. (2020) note that there is an increased need for concepts and tools that help us better understand how and why problematic consequences form in design, and how to mitigate potential negative impacts. In fact, the literature review highlighted emerging streams of research concerning tools to support designers and the design process. Even though some of these tools are still at a prototype level, they cover the overall design process: from the early stage where it is necessary to craft the value proposition, to the detailed design phase where the smart product-service system needs to be blueprinted. Generally, it could be acknowledged that new tools try to make sense of systems by offering space to detail the components that build up the system. Thus, research in design tools is coherent with the ecosystem perspective highlighted in the very first chapter of this dissertation. In fact, according to Poirer (2017), it is important not only to reflect on our design practice but also on the design infrastructure available to us.

12.1 SMART SERVICE CANVAS

The Smart Service Canvas (Figure 39) resembles the Business model Canvas, a much more diffused tool. As such, the Smart-Service Canvas could be described as a concise and easy-to-understand representation with a visually appealing overview of the key components required for a specific subject area (Poeppelbuss & Durst, 2019). In essence, it shows all the system's components in a single visualization. Furthermore, exactly like the Business Model Canvas, it could be used multiple times during the design process both to assess as-is concepts and model would-be concepts. The former scenario could be used to map and optimise already existing solutions, while the latter may guide system innovation.

Figure 39. Visualization of the Smart-Service Canvas from Poeppelbus & Durst, 2019.

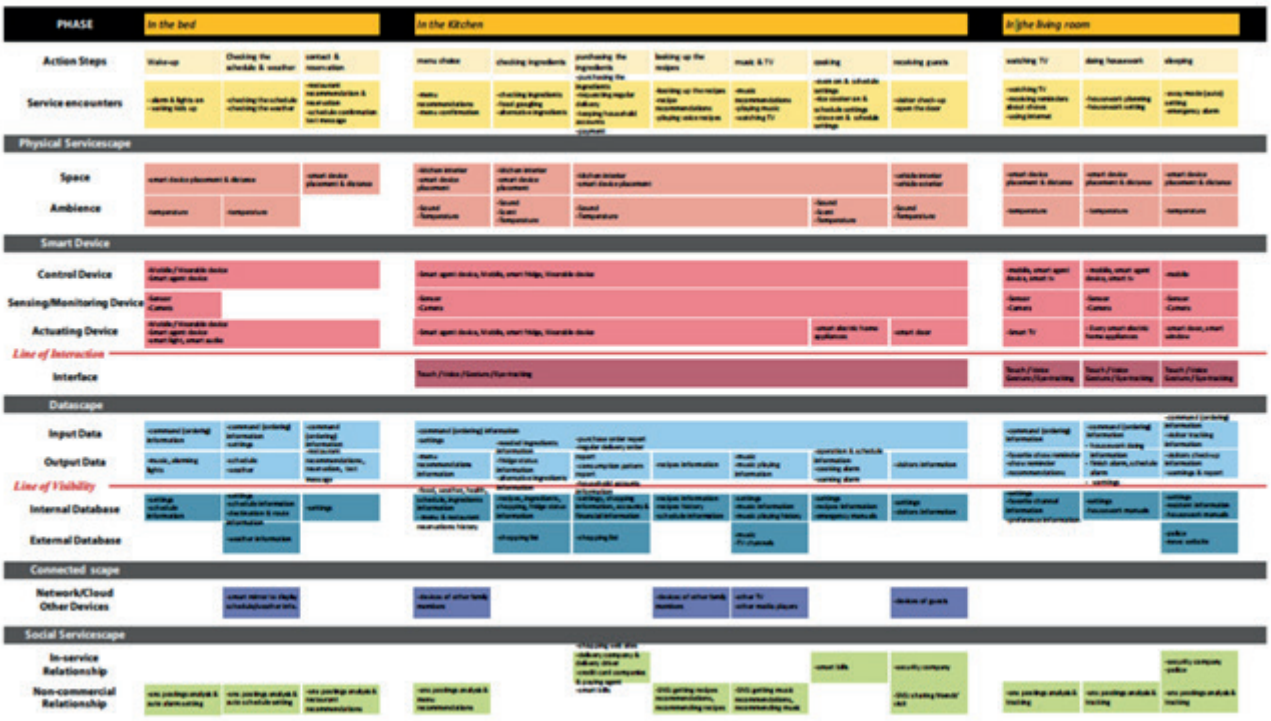


The Smart Service Canvas is characterised by three building blocks. First, the customer perspective whose focus is pain, gains and details of target users; after that, the value perspective whose emphasis is on the availability of relevant data and the expertise required to process them. In fact, it is a point of this dissertation to show the fundamental importance of data within the framework of S.PSS. Finally, the ecosystem perspective whose focus is on the technical infrastructure that powers the system. In essence, the Smart-Service Canvas tries to recognise the stance of each stakeholder involved in the design and delivery phase of S.PSS. This is extremely important as traditionally secondary stakeholders are ignored in the design process (Friedman, 2002). However, the Smart-Service Canvas encompasses only a high-level perspective. It does not provide guidance to better detail the network (ecosystem/ constellation) which is a fundamental dynamic of S.PSSs.

12.2 SMART SERVICE BLUEPRINT

The Smart-Service Canvas (Figure 40) resembles a much more he service blueprint is the queen among the tools used within service design. In fact, it enables to design the activities beyond the line of interaction with the end-user which enables designers to have holistic control over the totality of activities that build up the service. The smart-service blueprint receives the influence of previous research concerning the notion of servicescape by declining them in two dimensions. On the one hand, the physical servicescape concerns the characteristics of the environment in which the interaction takes place; on the other hand, the social servicescape focuses on the multi-directional exchange that occurs between the actors involved in the service interaction. It is important to notice that the social servicescape is described with a more-than-human approach, recognizing that relationship go well beyond human actors.

Figure 40. Smart Service Blueprint from Kang et al., 2017



On top of that, the smart-service blueprint recognizes the value of data as a critical element in the smart service experience. Thus Kang et al. (2017) frame the notion of datascape to describe how data is being processed along the interaction. Furthermore, the smart-service blueprint better details the ecosystem perspective rather than the previous tool. In fact, the connectedscape is a separate category of the smart servicescape, which explains the network infrastructure enabling smooth data communication (kang et al., 2017).

Despite the innovativeness of the smart-service blueprint, issues remain. In fact, the borders of the line of interaction or the line of visibility might be ambiguous in reality (Kang et al., 2017). In fact, previous chapters show how the borders between the physical and the diglital world are blurring, this might be one explanation of unintended values emerging in the real world when services do not align with user values.

12.3 SMART SERVICE MIND MAP

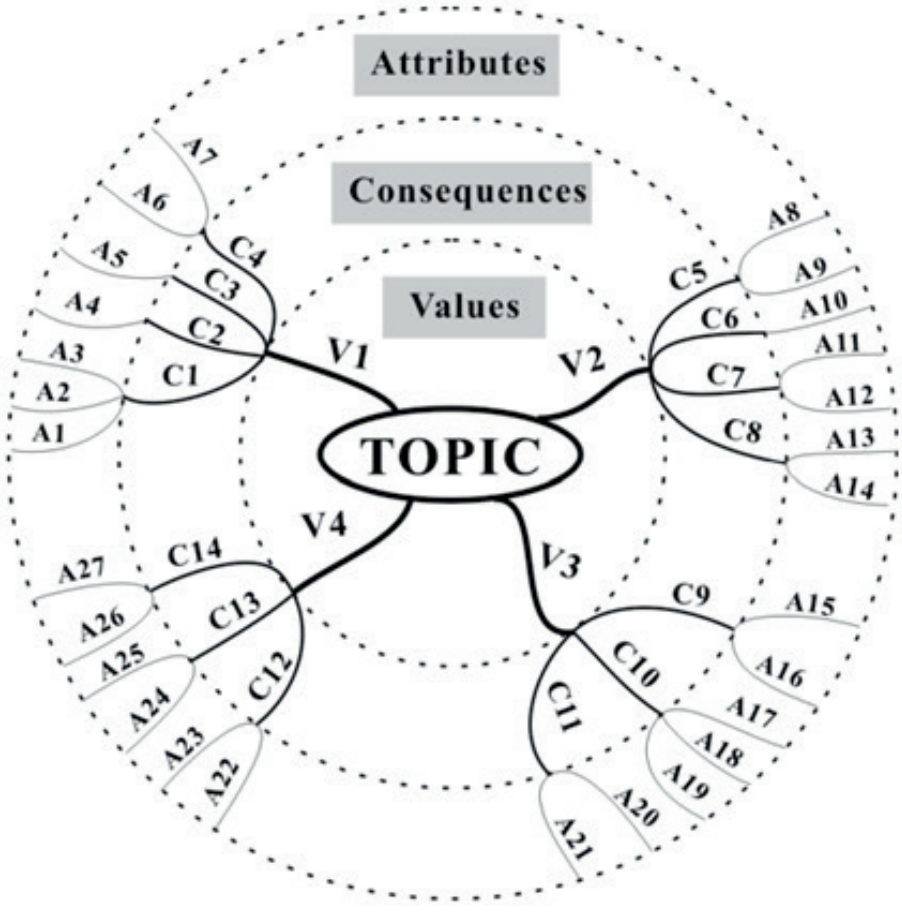
The previous chapters clearly highlighted the concrete possibility fAccording to Hsieh et al. (2013), a product can convey various special meanings to various consumers. The previous chapters clearly highlighted the concrete possibility for solutions to backfire as when put in practice they might generate unintended values. On top of that, Hsieh et al. (2013) note that the majority of consumers lack the capability to clearly and comprehensively describe their needs.

This is why Hsieh et al. (2013) identify a tool that guides users in expressing their values that could later be translated into the designed solution. It is important to notice that this tool could be used during the design research phase as well as downstream during product optimization in order to continuously check the assumptions behind the product development. Hsieh et al. (2013), specifically point out that businesses often:

- fail to listen to consumers' voice;
- fail to let the customer voice deeply influence design processes;
- fail to identify the similarities and differences between the cognition of designers and that of consumers.

The tool consists of a mind map (Figure 41) with three specific layers, making it possible to correlate the values and benefits of the users with designers' intentions or product attributes. Product attributes are defined as physical or observable features of a product or a service (Hsieh et al., 2013). They specifically

Figure 41. Mind mapping form Hsieh et al., 2013



chose a mind map as it could visualize the relationships between different ideas and concepts (Hsieh et al., 2013).

More in detail, the inner circle starts from a high-level perspective, eliciting values that the solution/ prototype is conveying. These have consequence over users' experience which finally turn into product attributes. The tool could also be used, for instance, during workshops with users and where the results are then pairedwith what emerged during internal workshops to identify overlapping and/or conflicting areas. In essence, when changes in the market occur, the cognitive structure model can be applied to help businesses quickly change the direction of designs and make important decisions (Hsieh et al., 2013). Indeed, further research is needed to validate this tool in the field.

In conclusion, Smart Product-Service Systems are increasingly incumbent in people's everyday lives which makes the need for mitigating potential risks, including Dark Patterns, even more pressing. Designers are building strategies to design within even more complex environments; furthermore, awareness about the topic is rising even in non-design endeavours which could lead to a more fruitful integration of resources for responsible and safer online interactions.

13. CONCLUSION AND LIMITATIONS

Computing technologies are increasingly incumbent in people's everyday life. They colonize all aspects of everyday life (Forlano, 2016). In fact, according to Eggink et al. (2022), their architecture could very well be compared to the pervasiveness of water and electricity infrastructure. As well, the World Wide Web has increasing levels of autonomy, which allow constant evolving and adaptative capabilities to survive even if most nodes were to disappear or malfunction at any moment. Therefore, many academics note significant similarities with the network that plants (Figure 42) have built up through time, also referred to as Wood Wide Web (Mancuso, 2010).

owever, contrary to the obvious benefits that plants bring to

Figure 42. World Wide Web and Wood Wide Web from Mancuso, 2010

ecosystems, this dissertation urges a focus on the surprising effects – or, more formally, unintended values – of technologies. In fact, the things that we make, in turn make us: technologies do not have an unambiguous function, they often surprise us with their effects, and they do not follow a simple scheme of a means for an end. (Eggink et al., 2022).

The sciences help us understand the behaviour of patterns and technologies, management allows us to allocate and manage resources according to the desired balance between exploration (research and innovation) and exploitation (re-use of design patterns), while design gives purpose and direction to science and management (McMahon et al., 2021). On the other hand, others have argued that design can only ever be responsive to social situations, rather than having responsibility for changing them (Guy 6 Kimbell, 2018). However, framing design as a meaning-making practice effectively implies that design should be anticipatory to spot emergent themes and issues in the design process, rather that reactive (Giaccardi, 2020).

Therefore, this piece of research showed that there are further areas of competencies that designers need to be knowledgeable of, as it may be argued that design could be remapped from the study of things to the study of systems. However, according to Pilling et al. (2022), design today is reactive: barriers to adoption and acceptability typically occur only after potentially problematic design patterns have become established, resulting in diminished impact of unintended consequences.

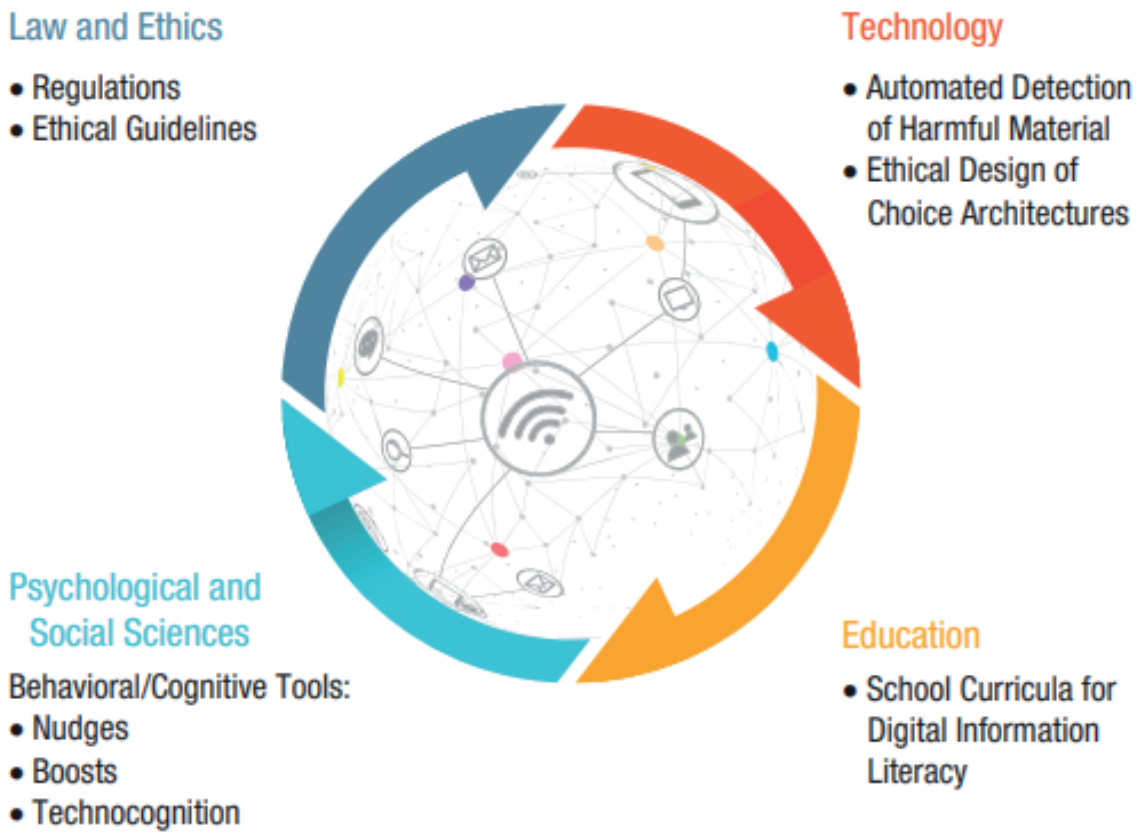
Especially when discussing Dark Patterns, it has been shown that there is no way to avoid dark patterns fully (Mauer & Harr, 2020). Therefore, design efforts should be directed to creating resources that help users build what Silicon Valley investor Paul Graham defined as “antibodies to addictive technologies” (Chianella, 2021). This is the very purpose of the advancement that this dissertation brings to design knowledge. In fact, it is possible to adopt strategies for designing with dark patterns by framing a responsible approach to designing S.PSSs. Thus, taking into account the complexities of the service ecosystems

that populate our world as well as putting in place strategies to channel this complexity for the good of the totality of the stakeholders involved.

Another crucial insight that this approach show is that designers should definitely not bear all the burdens. On the one hand, designers working within different traditions have varying competences, identities, resources and accountabilities (Guy & Kimbell, 2018); on the other hand, any solution will require the orchestrated efforts of regulators, policy makers, educators, and users (Kozyreva et al., 2020). In essence, ia bidirectional dialogue is much needed between technology developers and those affected by it, a position commonly known as debate through design (Hidingsfelder et al., 2019)

It is our hope that this dissertation will inspire further research as it does not come without limitations. In fact, according to

Figure 43. Entry points for policy interventions in the digital world from Kozyreva et al., 2020

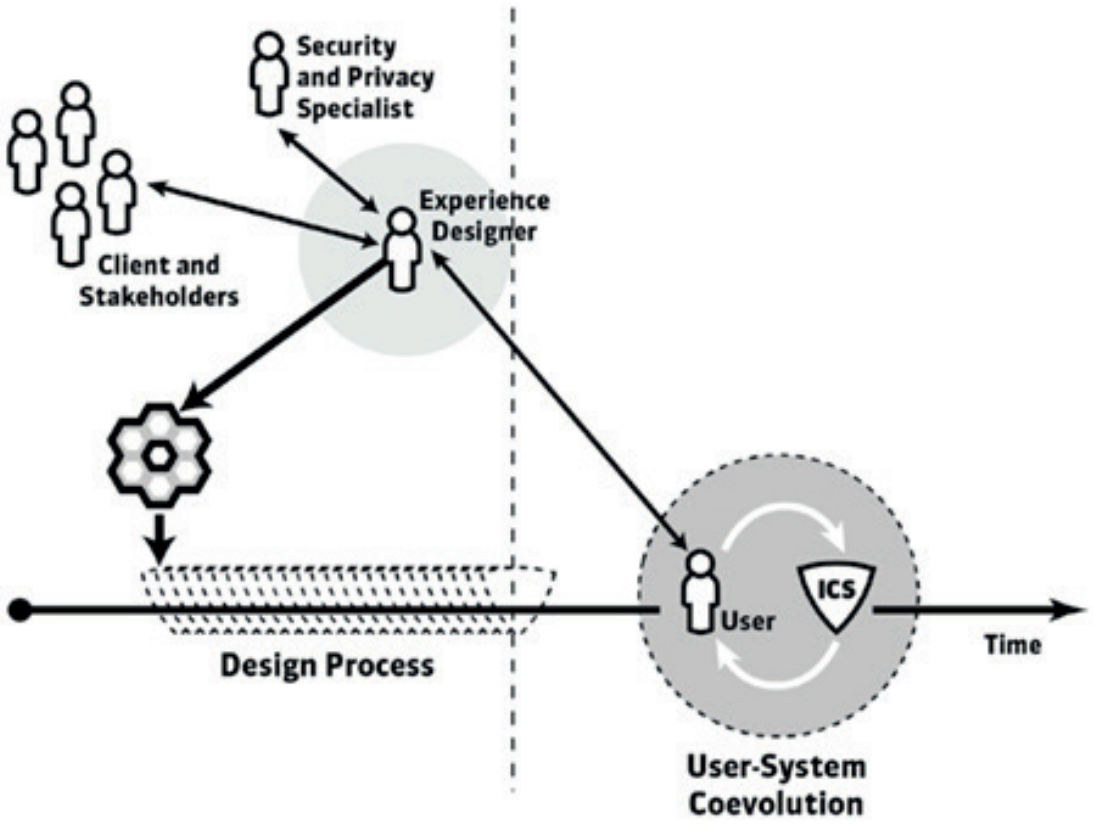


Kozyreva et al. (2020), a broader scrutiny of Dark Patterns is needed along four lines: law & ethics, technology, psychology and social sciences, and education (Figure 43).

Policy intervention appears to be the most fertile ground for future research. As far as law & ethics is concerned, Soe et al. (2020) note that the most obvious implication of the GDPR was the cookie consent banner; this is indeed an example of design friction which users tend to ignore as they typically vary in visibility and visual complexity. Therefore, any regulation of a computational system that aims to protect users' rights should be accompanied by a regulation of user interface design. It is worth asking whether it is possible to regulate UI. Mauer & Harr (2020) propose consumer protection regulations – exactly what Liguri & Strahilevitz (2021) refer to as stricter environmental protections. In addition, Kozyreva et al. (2020) suggest creating a coherent user-protection framework instead of the fragmentary legislative landscape currently in place; however, new adjustments and features are added to these environments on a continuous basis, making it nearly impossible for most users, let alone regulators, to keep abreast.

Therefore, education appears to play a crucial strategy for safe human-computer interactions with education directed at the public as recipients and producers of information (Kozyreva et al., 2020). One possible step is promoting users' education though crafting system 2 interactions, which include the psychological and social sciences, for mindful behavioural and cognitive interventions (Kozyreva et a., 2020). Ultimately, designers' education appears crucial for designers to keep participating in the discourse around new technologies, their risks, and benefits. For instance, Sun et al. (2020) specifically developed an ML prototyping tool for designers which forces designer to label their own data, thus enabling them to get comfortable with the roots – more specifically, data – of new and innovative technologies. Nematzadeh & Sosa-Tzec (2014) note that education implies acquiring and mastering a new set of competences, which in turn allows enhanced collaboration within multidisciplinary teams (Figure 44).

Figure 44. The role of the experience designer in the design of Large-Scale ICSs from Nematzadeh & Sosa-Tzec, 2014



In conclusion, even though Dark Patterns could be positioned amidst a privacy erosion crisis, it is worth noticing that in the Chinese language, the sign for “crisis” (危机) comprises two meanings: danger and opportunity. Ultimately, it is only through reinforcing a deeper collaboration paradigm between designers, policymakers, technologists, autonomous agents and the environment that it will be possible to design responsibly, thus limiting the presence of Dark Patterns with Smart Product-Service Systems

14. ANNEXES

14.1 TAXONOMIES OF DARK PATTERNS

Chapter 9.4 frames the different taxonomies of Dark Patterns that have been iteratively elaborated by academics. During the dissertation it is shown the most recent taxonomy elaborated by Liguri & Strahilevitz in 2021. Therefore, hereafter all the available taxonomies on Dark Patterns are reported.

Table 8. First taxonomy of Dark Patterns from Brignull, 2015.

Title	Desctiption
Trick questions	While filling in a form you respond to a question that tricks you into giving an answer you did not intend. When glanced upon quickly the question appears to ask one thing, but when read carefully it asks another thing entirely.
Sneak into basket	You attempt to purchase something, but somewhere in the purchasing journey the site sneaks an additional item into your basket, often using an opt-out radio button or checkbox on a prior page.
Roach motel	You get into a situation very easily, but then you find it hard to get out of it (e.g., a premium subscription).
Privacy zuckering	You are tricked into publicly sharing more information about yourself than you intended to. Named after Facebook CEO Mark Zuckerberg
Price comparison prevention	The retailer makes it hard for you to compare the price of an item with another item, so you cannot make an informed decision.
Misdirection	The design purposefully focuses your attention on one thing to distract your attention from another.
Hidden costs	You get to the last step of the checkout process, only to discover some unexpected charges have appeared, e.g., delivery charges, tax, etc.
Bait and swithch	You set out to do one thing, but a different, undesirable thing happens instead.
Confirmshaming	The act of guilting the user into opting into something. The option to decline is worded in such a way as to shame the user into compliance.
Disguised ads	Adverts that are disguised as other kinds of content or navigation, to get you to click on them.
Forced continuity	When your free trial with a service comes to an end and your credit card silently starts getting charged without any warning. In some cases, this is made even worse by making it difficult to cancel the membership.
Friend spam	The product asks for your email or social media permissions under the pretence it will be used for a desirable outcome (e.g., finding friends), but then spams all your contacts in a message that claims to be from you.

Table 9. Taxonomy of Dark Patterns in Proxemic Interactions from Greenberg et. al (2014). Although this taxonomy focuses on the physical world, it has similarities with the previous taxonomies which mainly focus on the digital world

Title	Description
The captive audience	The person enters a particular area to pursue an activity that takes a given time, and that does not involve the system. The system senses the person at that location and begins an unsolicited (and potentially undesired) action because the person is now captive.
The attention grabber	The person happens to pass by the field of view of a strategically located system. The system takes deliberate action to attract and keep that person's attention.
Bait and switch	The system baits the viewer with something that is (from the viewer's perspective) desirable, but the system then switches it to something else after the person directs his or her attention to it and moves closer.
Making personal information public	Making personal information public: As the person enters a particular area, the system makes that person's personal information publicly visible.
We never forget	In day-to-day life, proximity is an ephemeral phenomenon. The proxemic relationship between parties dissolves as soon as they separate. In contrast, systems can tag any proxemic interactions as indicating a permanent, persistent (and undesirable) the relationship that is never forgotten.
Disguised data collection	Information gathered to provide a certain service is abused to build a rich user profile, without the consent of users.
The social network of proxemic contacts or unintended relationships	The system tracks your proxemic relations with others and constructs a social network on the assumption that you are somehow socially related, when there is no relationship.
The milk factor	The proxemics system forces you to move through or go to a specific location to get a service.

Table 10-16. Taxonomy of Dark Patterns from Bösh et al., 2016

Name/ Aliases: Privacy Zuckering	
Context	The access and usage of personal data is often governed by user-specific, modifiable privacy settings. By doing this, users can choose privacy settings that reflect their privacy requirements.
Effect	While the service provider will claim that users have full control over their privacy settings, the presentation, terminology and user experience will highly discourage users from making changes. When combined with the Bad Defaults pattern, these patterns facilitate the enforcement of privacy settings suggested by the service provider. Privacy Zuckering could lead to unintentional changes of privacy settings, when the complexity of the settings does not align with the user's perception, and hence prevents originally intended preference adjustments.
Description	A service provider allows users to change their privacy settings. However, the settings are unnecessary complex, overly fine-grained, or incomprehensible to the user. As a result, the user either gives up, or makes unintended changes to their privacy settings.
Countermeasures	When service providers apply Privacy Zuckering, users require the help of third parties that clarify the settings and guide them through the intended preferences.
Examples/Known Use	In the past, Facebook has been accused of applying Privacy Zuckering to their users' privacy setting pages, which termed the mechanism in the first place [11]. For instance, in August 2010, an updated privacy settings page of Facebook allowed for highly customized settings but required users to change dozens of settings on multiple pages to maximize personal privacy.
Related Patterns	When Bad Defaults are in place, Privacy Zuckering prevents changes and increases the a number of retained default settings.
Psychological Aspect	Overly complex settings and inappropriate terminology require System 2 thinking. When a user is motivated to change their settings, but is overwhelmed at the same time, and hence lacks the opportunity to do so purposefully, the user may either switch back to System 1 thinking and make vague changes, or the user may refrain from doing so at all.
Strategies	Obscure

Name/ Aliases: Bad defaults	
Context	This dark pattern is used on websites, by applications, or in social networks. For Bad Defaults to have an effect it is often necessary that the system has some form of the user account.
Effect	This pattern causes the user to share more information with the system or other users than the user intends to do. This includes but is not limited to which sites the user visits, parts of his user profile, and his online status.
Description	When creating an account at a service provider the default options are sometimes chosen badly in the sense that they ease or encourage the sharing of personal information. Most users will be too busy to look through all the options and configure their account properly. Thus, they often unknowingly share more personal information than they intend to.
Countermeasures	Users need to be educated to develop more awareness of bad default settings so that they become self-motivated to configure their accounts properly. However, this is hard to achieve.
Examples/Known Use	Facebook Default Privacy Settings
Related Patterns	Privacy Zuckering demotivates users from changing the defaults
Psychological Aspect	When users are not aware of the defaults that are in effect, a deliberative processing of this information is inhibited.
Strategies	

Name/ Aliases: Forced registration	
Context	This pattern can be applied to every service which provides some functionality to users. When the functionality technically requires an account, e.g., in online social networks, this pattern degenerates. In this case, we are not speaking of a privacy dark pattern anymore since without an account the service cannot be provided in an intended way.
Effect	The effect of this pattern is that the user is forced to register an account at the service provider, thereby allowing the service provider to track user behavior on his platform. Additionally, the registration the process often requires an e-mail address and other personal identifiable information. Since the user does not want to have an account in the first place, the user is unlikely to configure the settings properly, thereby possibly revealing even more personal information not intended for disclosure.
Description	A user wants to use some functionality of a service which is only accessible after registration. Sometimes this is necessary to use the service in a meaningful way or prevent misbehavior. But very often this is unnecessary and serves the interest of the service provider by giving him access to (unneeded) personal data. The personal information collected regularly includes an e-mail address, since this is required for creating the account, but is often augmented by birthdates, home addresses, etc.
Countermeasures	One countermeasure is to create a new account and fill it with random data. Often, one can use an anonymous one-time e-mail address4 during registration to receive the activation link for the account. Another countermeasure is provided by the service BugMeNot5. They enable users to bypass the forced registration by allowing many users to share their account details creating a large anonymity set. A user can try accounts published at BugMeNot for using the service. BugMeNot allows users to create new accounts and share them with other users of BugMeNot. It can even be used as a browser extension by some web browsers.
Examples/Known Use	As of Feb. 2016, the popular question-and-answer website Quora.com requires external visitors to sign up and log in when opening a question page. While the page is rendered initially, it is then blocked by pop-up modal dialogue that forces visitors to register, even for one-time, read-only access.
Related Patterns	When a user is required to register, an Immortal Account will prevent the later cancellation of the account. Forced accounts can come with Bad Defaults.
Psychological Aspect	As the user's original goal is prevented by the necessary registration, account creation often happens as part of an automatic behavior for achieving that goal. This gives the user an instant gratification, and critical and deliberative thoughts are inhibited.
Strategies	

Name/ Aliases: Hidden legalese stipulations	
Context	This pattern can be used by all systems which incorporate a document describing the terms and conditions of using the service.
Effect	Usage of this pattern leads to the service the provider being able to hide his malicious deeds from the user without necessarily violating legal regulations.
Description	Terms and conditions are mandatory by law. Nevertheless, most users do not read them, since they are often long and written in a complicated legal jargon. This legal jargon is necessary to provide succinctness and clarity but is not user-friendly. The inability of the user to grasp the legal jargon puts him in a vulnerable state, since the policy is legally binding. If this vulnerability is exploited, the policy turns into an instance of a privacy dark pattern. Service providers can hide stipulations in the policies which target the privacy of the user. Often the user will not notice this, not reading the terms and conditions or being unable to understand their implications. Some service providers state that they will change their policies without further notice, preventing the user even further from learning what happens to his data.
Countermeasures	There are various proposals for easier communication of legal conditions. One solution is to make the legal conditions machine-readable. This was the approach that P3P, the Platform for Privacy Preferences Project, followed. P3P is a standard by the W3C6 for a machine-readable rendering of privacy policies. The basic idea is that an XML-file specifying the privacy policy can be retrieved from any participating web pages. This policy can automatically be checked against the preferences of the user by the browser. The Privacy Bird7, for example, was a tool which could show the P3P description as an icon, namely a bird. The colour of the bird, i.e., red or green, signified if the policy of the site matched the users' preferences. The drawback of this approach is, that the service provider needs to provide the machine-readable P3P description. A malicious service provider who wants to trick his users with hidden legal stipulations will of course not provide such a description. Since this countermeasure depends on the collaboration with the service provider, it is not effective. 6 https://www.w3.org/P3P/ 7 http://www.privacybird.org/ Another approach is the one followed by the Terms of Service; Didn't Read (TOSDR8) webpage. This is a community-driven repository of ratings of privacy policies. TOSDR is available as a browser add-on and shows the rating of the terms of service of the current web page as a small icon. When clicking on the icon one can see the positive and negative points of the terms of service in an easily understandable language.
Examples/Known Use	In 2000, the then-popular instant messenger service ICQ introduced a "Terms Of Service — Acceptable Use Policy"9 which granted the service operators have the copyright on all information posted by their users. Hidden in this legalese, the operators granted further rights of use "including, but not limited to, publishing the material or distributing it". The British firm Game Station owns the souls of 7,500 online shoppers, thanks to an "immortal soul clause"10 in the terms and conditions. This April Fool's gag reveals the effectiveness of this pattern and shows that companies can hide everything in their online terms and conditions. Please note that McDonald et al. [36] calculated that reading the privacy policies you encounter in a year would take 76 workdays.
Related Patterns	//
Psychological Aspect	Even if the user is motivated to read terms and conditions, missing opportunity to fully comprehend all details makes a System 1-based processing more probable.
Strategies	

Name/ Aliases: Immortal accounts	
Context	Many services require user accounts, either because they are necessary for service fulfilment, or because user accounts represent a benefit for the service.
Effect	When the user interface makes the account deletion options are hard to access, and the barrier to deleting the an account is increased. If the users are required to call the customer support, the process is even more cumbersome. Both of these deliberated inconvenient users experiences may cause the user to reconsider the actual deletion decision. A deletion process where the service provider claims to remove the account, but instead just flags the user records as deleted while still keeping the data gives the user a false feeling of deletion.
Description	The service provider requires new users to sign up for accounts to use the service. Once users decide to stop using the service, they might want to delete their accounts and associated data. However, the service provider prevents the user from doing so by either— unnecessarily complicating the account deletion experience, or by not providing any account deletion option at all. Additionally, the service provider might trick the user in the deletion process by pretending to delete the entire account, while still retaining (some) account data.
Countermeasures	Online resources such as just delete. me11 or accountkiller.com12 curate a list of service providers and their policies towards account removal. They provide step-by-step tutorials for users how to delete an account at those providers. If the service to be used is known for a non-delete policy but requires a user account, the usage of a throwaway account with incorrect data should be considered.
Examples/Known Use	As of February 2016, the community-curated data set of just delete.me lists 474 services. 75 services thereof do not provide the possibility to delete the account at all and 100 services require contacting customer support. From the remaining 299 services listed; another 31 services have a non-trivial deletion process that requires additional steps.
Related Patterns	The creation of accounts can be required due to Forced Registration.
Psychological Aspect	When the service provider renders the user experience for account deletion deliberately painful, users might struggle in the process. If the user wants to delete the account, but fails to do so, cognitive dissonance may emerge. As a result, the user could then reduce the inconsistent mental state by reconsidering their original intent and deciding not to delete the account.
Strategies	

Name/ Aliases: Adress book leaching	
Context	A service provider offers users to upload or import their address books to connect with known contacts on that service.
Effect	Using an import feature may lead to exposing unwanted information, specifically the contents of personal address books to third parties. A potential usage of such information is the dispatch of invitations or other advertisements, at worst even in the name of the original uploader without consent. Service provider may misuse such data for profiling and tracking individuals that do not yet possess a user account.
Description	When the user imports the list, the service executes a lookup against its database. It then provides suggestions for connections to the user. However, the service provider stores the list of all contacts as internal data records for further processing—including purposes that have not been initially declared.
Countermeasures	If it is unknown or unclear how a service provider is handling and processing imported contact lists, such a feature should be avoided. Many mobile and desktop operating systems allow users to deny applications access to address book data. Users should routinely click on deny unless it is required or in their interest to share those data.
Examples/Known Use	goodreads.com attracted negative attention for unsolicited invite emails based on the address book import feature. The experiences of customers and reactions of the service providers are still available on a customer support page13. Based on a misleading upload form design, users thought they would only provide contacts for matching against goodreads' user base. Instead, goodreads sent invite emails to persons which had mail addresses not yet registered at goodreads, thereby referring to the user who provided the address.
Related Patterns	This pattern is a potential source of information for Shadow User Profiles.
Psychological Aspect	Trading personal information for instant connections to friends or known contacts is motivated by the need to belong.
Strategies	

Name/ Aliases: Shadow user profiles	
Context	A service provider tracks personal information about individuals.
Effect	The service provider stores and processes information on individuals without their knowledge or consent. The affected individuals are not aware of personal data records they have accidentally created or that have been provided by third parties.
Description	While registered users have deliberately opted in for a user account and an associated profile, the service provider may collect information and keep records about individuals that do not use the service. For instance, in a social network, the social graph can be supplemented with persons that are not members of the network, but are known to the network based on data from members (e.g., imported address books, content metadata, or mentions). Such non-members enrich the graph and improve the quality of algorithms such as contact suggestions.
Countermeasures	While it is possible to minimize the own data trail, the accidental release of personal data through third parties cannot always be prevented.
Examples/Known Use	The basic mechanism of shadow user profiles fuel the entire online advertisement industry. Although not verifiable, social networks may store information of non-users. This notion is based on the experiences of newly registered users of social networks who received accurate friendship suggestions without having ever interacted with these persons on the social network before.
Related Patterns	Address Book Leeching is a potential source of information for this pattern.
Psychological Aspect	Given the fact that this pattern operates without any knowledge of the affected users, it is not targeting any psychological aspects.
Strategies	

Table 17. Review of Brignull taxonomy by Gray et al. (2018)

Strategy	Description
Nagging	It is a redirection of expected functionality that persists beyond one or more interactions. Nagging often manifests as a repeated intrusion during normal interaction, where the user's desired task is interrupted one or more times by other tasks not related to the one the user is focusing on.
Obstruction	It makes a process more difficult than it needs to be, with the intent of dissuading certain action(s). INCLUDES: - "Roach Motel": a situation that is easy to get into, but difficult to get out of; - "Price Comparison Prevention": seeks to dampen the effect of market competition by making direct price comparisons between products and services difficult; - "Intermediate Currency": is another subtype of obstruction where users spend real money to purchase a virtual currency which is then spent on a good or service.
Sneaking	It attempts to hide, disguise, or delay the divulging of information that is relevant to the user. INCLUDES: - "Forced Continuity": continues to charge the user after the service they have purchased expires; - "Hidden Costs": provides users with a late disclosure of certain costs; - "Sneak into Basket,": adds items not chosen by the user to their online shopping cart, often claiming to be a suggestion based on other purchased items; - "Bait and Switch": makes it apparent that a certain action will cause a certain result, only to have it cause a different, likely undesired result.
Interface interference	It is a manipulation of the user interface that privileges certain actions over others. INCLUDES: - "Hidden Information": options or actions relevant to the user but not made immediately or readily accessible; -"Preselection": any situation where an option is selected by default prior to user interaction; - - -- "Aesthetic Manipulation": any manipulation of the user interface that deals more directly with form than function; - "Toying with Emotion": any use of language, style, colour, or other similar elements to evoke an emotion to persuade the user into a particular action; - "False Hierarchy": gives one or more options visual or interactive precedence over others, particularly where items should be in parallel rather than hierarchical; - "Disguised Ad": ads disguised as interactive games, or ads disguised as a download button or other salient interaction the user is looking for; - "Trick Questions": question that appears to be one thing but is actually another, or uses confusing wording, double negatives, or otherwise leading language to manipulate user interactions.
Forced actions	It requires the user to perform a certain action to access (or continue to access) certain functionality. INCLUDES: - "Social Pyramid": requires users to recruit other users to use the service; -"Privacy Zuckering": tricks users into sharing more information about themselves than they intend to or would agree to; - "Gamification": situations in which certain aspects of a service can only be "earned" through repeated (and perhaps undesired) use of aspects of the service.

14.2 INTERVIEW PROTOCOL (ITALIAN)

The following page shows the protocol used during the interviews conducted during the empirical research phase for this thesis. It in composed by an introduction stage whereby an icebreaker was used to make the interviewees comfortable. It was followed by a declaration concerning the use, storage and treatment of the data generated during the sessions. Finally, during the core stage of the interviews, the questions spanned from new product development processes to data about user behaviour change. Each question comes with suggested probes which were used in order to deep dive in the topics emerged during the interviews.

Protocollo di Intervista - GENERALI JENIOT x Politecnico di Milano
Intervistatore Matteo Sciortino, Scuola del Design – M.Sc. Product-Service System Design
Profili ideali: Service/ UX designer

1. **Introduzione – Circa 5 min.**

Buongiorno, innanzitutto ci tengo ringraziare per il tempo che mi sta dedicando oggi. Avevo pensato di strutturare la nostra conversazione con una nostra introduzione, seguita poi dalle domande effettive.

- *Quindi, mi presento + all'interno della mia tesi sto approfondendo la relazione tra design e comportamenti delle persone*
- *Presentazione dell'intervistato*

2. **Data management – Circa 1 min.**

Tutto le informazioni che verranno esplicitate all'interno di questo incontro verranno utilizzate esclusivamente per scopi di ricerca essendo inserite all'interno della mia tesi di laurea e condivise con la relatrice della stessa e la commissione di laurea.

- *Sarebbe possibile registrare questa riunione?*

3. **Setting the stage – Circa 1 min.**

Il nostro incontro deve essere una chiacchierata, sono interessato a qualsiasi informazione potrebbe essere rilevante alla mia ricerca; al contrario, se vi è la possibilità di violare qualche accordo di riservatezza non esiti a dirmelo in modo da procedere con il resto della conversazione.

- *Possiamo iniziare?*

4. **Temi e probes**

- <u>Ice braker – Circa 5 min.</u>

Per cominciare sono interessato a capire quale è stato il suo ruolo all'interno del progetto?

- *Da quali figure professionali era composto il team?*
- *Quale è stato il ruolo di voi designer?*

- <u>Main 1 – circa 10 min.</u>

Riuscirebbe a raccontarmi l'intero processo di sviluppo del prodotto?

- *Come funziona il coordinamento del team?*
- *Come funziona il processo di ottimizzazione?*

- <u>Main 2 – circa 10 min.</u>

Qual è la journey di ogni user quando si approccia al prodotto?

- *Come funziona l'on-boarding?*
- *Vi sono delle frizioni?*

- <u>Main 3 – circa 10 min.</u>

Quali impatti avete potuto notare rispetto a cambiamenti nel comportamento dei vostri clienti?

- *Vi aspettavate cambiamento X?*
- *Qual è stato il cambiamento più importante?*

15. BIBLIOGRAPHY

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