Titta Jylkäs

SHARED PATH

Service Design and Artifical Intelligence in Designing Human-Centred Digital Services

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Service Design and Artificial Intelligence in Designing Human-Centred Digital Services

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Abstract

Titta Jylkäs
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Digitalization and the growing service economy place challenges on organizations for transforming their service offerings to match the high user expectations. Services increasingly exploit digital technologies which play an important role in the creation of service experiences. One of the examples is artificial intelligence (AI), which may actively perform in customer service, but also provide solutions in the back end of services. While AI actively takes part in the creation of service value, the line between human and machine in the service encounters blurs. This creates new type of service components which need to be designed as part of digital service journeys.

This dissertation is constructed around seven scientific publications that explore the merging of AI and service design in creating human-centred digital service solutions. The focus in the publications is on applying service design principles to AI-enabled services, from which an AI assistant is an example. AI assistants interact with users through text and voice interfaces and can be perceived as a gateway to complex digital service ecosystems. AI assistants are rather new as services, and they touch upon areas that, besides the design challenges, are ethically, philosophically and legally demanding. Here, service designers face changes both in the design process and in their role as designers.

This study was conducted as a qualitative research with roots in the practice of design research. The main research data consist of five case studies and seven expert interviews analysed through coding, content analysis and visual mapping to answer the following research question: *How is AI affecting the practice of service design and the design of digital services?*

The findings from the publications are concluded under the following four topics: (1) AI changes the design of digital service interactions, (2) AI assistants perform as actors in digital services, (3) AI needs to be human-centred rather than human-like and (4) AI assists and augments the practice of service design. Under these topics, the discussion highlights the ethical considerations and humanization aspect of AI as a part of designing and the design outcomes as AI-enabled services.

Tiivistelmä

Titta Jylkäs
Yhteinen tie – Palvelumuotoilu ja tekoäly
ihmislähtöisten digipalveluiden muotoilemisessa

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Digitalisaatio ja kasvava palvelukeskeinen markkinatalous asettavat organisaatioille muutoshaasteitta, jotta palvelutarjonnalla pystyttäisiin vastaamaan käyttäjien korkeisiin odotuksiin. Palvelut hyödyntävät yhä enenevissä määrin digitaalista teknologiaa osana palvelukokemusten tuottamista. Yhtenä esimerkkinä teknologioista on tekoäly, jolla voi jo olla aktiivinen osa asiakaspalvelussa sekä ratkaisujen tuottajana palveluiden taustajärjestelmissä. Kun tekoälyn rooli palveluarvon tuottamisessa kasvaa, raja ihmisen ja koneen välillä voi hämärtyä. Tekoäly luo näin uudenlaisia palveluelementtejä, jotka tulee muotoilla osaksi digitaalisia palvelupolkuja.

Väitöstyö pohjautuu seitsemään tieteelliseen julkaisuun, joiden kautta tutkimus tarkastelee tekoälyn ja palvelumuotoilun yhteyttä ihmislähtöisten digipalveluiden muotoilemisessa. Julkaisut keskittyvät palvelumuotoilun näkökulmaan tekoälyavusteisten palveluiden kehittämisessä ja käyttävät esimerkkikontekstina tekoälyassistentteja. Tekoälyassistentti on digitaalisen palvelun muoto, joka on vuorovaikutuksessa asiakkaan kanssa joko tekstin tai puheen kautta. Tekoälyassistentti voi myös toimia keulakuvana laajemmalle palvelutarjonnalle ja palveluekosysteemeille. Tekoälyassistentit ovat palvelumuotona melko uusia ja niiden aihepiirit ovat muotoiluhaasteen lisäksi eettisesti, filosofisesti ja juridisesti haastavia. Tämä luo palvelumuotoilijalle haastavan asetelman niin muotoiluprosessiin kuin omaan työhön muotoilijana.

Väitöstutkimus on toteutettu laadullisena tutkimuksena muotoilun tutkimuksen kentällä. Tutkimuksen ensisijainen aineisto koostuu viidestä tapaustutkimuksesta ja seitsemästä asiantuntijahaastattelusta. Aineistoa on analysoitu koodaamisen, sisällönanalyysin sekä visuaalisen analyysin keinoin. Analyysin kautta vastataan tutkimuskysymykseen: *Mikä on tekoäly vaikutus palvelumuotoilutoimintaan ja digitaalisten palveluiden muotoilemiseen?*

Tutkimustulokset esitellään neljän aihepiirin kautta: (1) Tekoäly muuttaa digitaalisten palveluiden vuorovaikutusten muotoilua, (2) tekoälyassistentit ovat aktiivisia toimijoita digitaalisissa palveluissa, (3) tekoälyn on oltava ihmiskeskeistä, ei ihmis-

mäistä, ja (4) tekoäly tukee ja laajentaa palvelumuotoilutoimintaa. Näiden aihepiirien kautta tutkimustulokset nostavat esiin tekoälyn eettiset ja inhimilliset näkökulmat osana tekoälyavusteisia palveluita sekä niitä tuottavaa palvelumuotoilutoimintaa.

Acknowledgements

Following the title "Shared Path", the path that I have taken during this research process has been windy, with many ups and downs, but most of all, I have had the pleasure of sharing it with a large number of people.

First of all, my gratitude goes to my supervisors – Satu Miettinen and Alexander Borek. Satu Miettinen educated me to become a service designer and researcher and has given me a massive amount of opportunities to develop as a professional and as a person. Alexander Borek guided me through the industry projects that are the basis of this research and gave me an opportunity to develop myself in project leadership. Both my supervisors took part in publishing my research results and helped me to shape my thoughts through the written articles.

I would like to thank Professor Mauricio Manhaes and Associate Professor Amalia de Götzen for reviewing my research and providing valuable comments and recommendations for improvements. I also thank Amalia de Götzen for being my opponent in my public defence.

I would not have accomplished this research without the collaboration with my co-authors.

I have had the pleasure of researching and writing with Andrea Augsten, Bernadette Geuy, Rachel Hollowgrass, Essi Kuure, Marjukka Mäkelä-Klippi, Mikko Äijälä, Tytti Vuorikari and Vésaal Rajab. All of you brought your invaluable thoughts, perspectives and insights in the making of this research. The collaboration has been a pleasure, and I hope to continue researching with you.

As this research was conducted in industry, there is a great number of people who were part of the practical work and projects. For that, I would like to thank my closest colleagues at the Volkswagen Group in Wolfsburg and Volkswagen Financial Services in Braunschweig and Berlin. These are the surroundings from where the insights and inspiration came from.

My special thanks go also to Gregor Stock and Marianna Recchia, who saw the potential in me as a junior service designer and immersed me in the world of industrial service design back in 2014. That may well have been the start of this work. Also, I would like to thank Linus Schaaf who, as a fellow student and doctoral researcher, helped me to build the courage to move to Germany to do my research.

I have also enjoyed sharing this research journey with fellow doctoral researchers at the University of Lapland, especially in the Culture-Based Service Design doctoral programme that I have been part of. This international group of amazing researchers

shares such encouragement and support that I could not be happier for my 'research home'.

My parents, as always, have fully supported me during these past years. Even when living further away, you are always in an important place in my life. My family and friends have kept me balanced during this intensive process and out of research whenever needed. My heart is full of thanks to you for being there for me.

Rovaniemi, September 2020
Titta Jylkäs

List of Original Publications

The thesis is based on the following original articles, which will be referred to in the text by their Roman numerals I–VII.

I. Bernadette Geuy, Rachel Hollowgrass, & Titta Jylkäs (2017). Humanizing an organization through digital experiences. *Proceedings of IASDR Conference 2017, Re: Research*, Cincinnati, Ohio, USA, 31 October–3 November, pp. 1529–1543. doi:10.7945/C2G67F

II. Andrea Augsten, Bernadette Geuy, Rachel Hollowgrass, Titta Jylkäs, & Marjukka Mäkelä-Klippi (2018). Humanizing organizations – the pathway to growth. *Proceedings of ServDes Conference 2018, Proof of Concept*, Milan, Italy, 18–20 June, pp. 1229–1242. Linköping University Press.

III. Titta Jylkäs & Essi Kuure (2018). Embodied design methods as catalyst for industrial service design. *Proceedings of DRS Conference 2018, Catalyst*, Limerick, Ireland, 25–28 June, Vol. 5, pp. 2962–2972.

IV. Titta Jylkäs, Mikko Äijälä, Tytti Vuorikari & Vésaal Rajab (2018). AI assistants as non-human actors in service design. *Proceedings of 21st DMI: Academic Design Management Conference, Next Wave*, London, UK, 1–2 August, pp. 1436–1444.

V. Titta Jylkäs & Alexander Borek (2019). Designing with artificial intelligence – AI assistants as a gateway to complex service ecosystems. In Miettinen, S., & Sarantou, M. (Eds.), *Managing complexity and creating innovation through design.* New York: Routledge. pp. 79–88.

VI. Titta Jylkäs, Andrea Augsten, & Satu Miettinen (2019). From hype to practice – revealing the effects of AI in service design. *Proceedings of Academy for Design Innovation Management Conference, Research Perspectives in the Era of Transformation*, London, UK, 18–21 June, pp. 1203–1216.

VII. Titta Jylkäs, Essi Kuure, & Satu Miettinen (2019). Service design creating value for industrial corporates through AI proofs of concept. *Proceedings of Academy for Design Innovation Management Conference, Research Perspectives in the Era of Transformation*, London, UK, 18–21 June, pp. 620–628.

Articles III–VII are reproduced in their original format with the kind permission of their copyright holders and can be found in the appendix of this thesis. Article I can be found on its permanent address doi:10.7945/C2G67F. Article II can be found on URL:www.ep.liu.se/ecp/contents.asp?issue=150.

Author's Contributions

With the following claims, the contribution of the author in each of the articles is clarified.

Article I:
As the third author, my responsibility was in writing the literature review on service design theory, digitalization and service ecosystems. Together with the other authors, I derived the research results and wrote the section "Discussion".

Article II:
As the fourth author, I contributed to the data collection through co-creating and co-facilitating the workshop that the article is based on. With the other authors, I wrote parts of all the sections of the paper – except section 6 ("Key Learnings"), which was done by the first author (Augsten).

Article III:
As the first author, my responsibility was leading the research and constructing the paper. Together with the other researchers, I collected the data used in the article and performed the whole data analysis. In the writing process, my responsibilities were especially writing the research methodology (section 3), use case description (section 4) and the discussion of the findings (section 5). The literature reviews (section 2) was done entirely by the second author, Kuure.

Article IV:
As the first author, my responsibility was leading the research and constructing the paper with the co-authors. In the paper, I contributed knowledge and a literature review on AI and constructed the discussion of the paper. The first section, "Non-human Actors in Services", was done by the second author, Äijälä, and the section "Digital Media Enhancing the Interactions with AI Assistants" was done by the third and fourth authors, Vuorikari and Rajab.

Articles V–VII:
I was the first author – with the responsibility of leading the writing work, writing a major part of the articles and constructing the papers from the contributions of each author. I also collected and analysed all the research data used in the articles.

List of Figures and Tables

FIGURES

TABLES

Abbreviations

AI	artificial intelligence
FAQ	frequently asked question
HCD	human-centred design
HMI	human-machine interaction
ML	machine learning
NLP	natural language processing
PoC	proof of concept
UI	user interface
UX	user experience

Table of Contents

1. Introduction

Artificial intelligence (AI) is one of the fields estimated to change the way people behave, live and work. In the Anthropocene[1], the intervention of machines in our everyday lives brings disruption to how we see ourselves and the world around us (Cath et al., 2017; Coeckelbergh, 2013; Kile, 2013). During the transition towards larger amounts of digital interactions in the everyday activities, questions about the fundamental human needs arise challenging the perspectives on how AI solutions are created.

As the technological solutions are getting to the point that it is possible to integrate AI into services and products in a meaningful way (Lungarella et al., 2007), the creation of such solutions is no longer about *if* the technology can be used, but rather *how* and *why* it should be used. Along with the technological development, perspectives of service quality (Sousa & Voss, 2006) and responsible use of technology are becoming essential, giving ways for a larger understanding of the effects of AI systems for users, organizations and society. Even though guidelines for the creation and regulation of AI systems exist (Chatila & Havens, 2019; European Parliament Committee on Legal Affairs, 2017), research on the human-centred perspective of creating digital services with AI is lacking (Cruickshank & Trivedi, 2017; Guszcza, 2018).

In the domain of digital services, the inclusion of technology in service experiences is realized as increasingly complex service ecosystems where individual services, products and business networks are connected and intertwined (Vink et al., 2019; Wieland et al., 2012). AI solutions are becoming more common both in the backend of technological systems invisible to the user and in the forefront of services and solutions, adding a crucial element to the experience itself. In the backend, AI enables the functionality of services and provides new ways to collect and use data for constant improvement of the system (Campbell et al., 2020). An AI assistant is an example of an AI-enabled service that utilizes AI in creating interactions with users. The assistant interacts through conversations either as text-based chat or through speech and, thus, provides service value by helping users with the service functions they are created for (Allen et al., 2001; Jacques et al., 2019).

1 Anthropocene is "the period of time during which human activities have had an environmental impact on the Earth regarded as constituting a distinct geological age". Merriam-Webster. (n.d.). Anthropocene. In Merriam-Webster.com dictionary. Retrieved February 7, 2019, from https://www.merriam-webster.com/dictionary/anthropocene

As these so-called AI-enabled services have both visible and invisible components, the inclusion of AI calls for transparency, clarity and ethical considerations. Service design is a field that holistically looks at service systems and, through a human-centred approach, facilitates a co-creation of service solutions involving users and stakeholders (Holmlid, 2009; Miettinen & Sarantou, 2019; Rönnholm, 2017). In industrial corporations, the work of a service designer also includes embedding service design practice in the existing organizational structures through service design methods and tools (Downe, 2020; Miettinen, 2017; Stickdorn et al., 2017). A focus for "humanization" in service systems gives opportunities in findings possibilities for improvements and reveals gaps where potential value could be created for users.

AI and analytics are becoming essential parts of service systems; therefore, service designers need to understand what the possibilities of integrating AI in service solutions are and the possibilities it can give to the work of a service designer. Nevertheless, only a few studies have explored the connection between service design and AI.

1.1. Research Topic and Research Questions

This dissertation bases on the tradition of design research and, through the lens of service design, addresses the topic of AI as a part of (1) the design of digital service and (2) the work of a service designer. The research asks the following questions.

Main research question:
How is AI affecting the practice of service design and the design of digital services?

The research topic is examined through seven publications. Each has a specified focus, providing elements to the main research question through its perspective. The key topics in the articles are the human-centred design (HCD) approach and methods, the humanization of service contexts, service design in industry, digital services, AI assistants and design practice with AI.

Supporting research questions:
Article I: How can humanizing principles be codified and championed in user experience (UX) design work? What does "humanizing" mean and look like from a design perspective for digital experiences?

Article II: How can service design be utilized in humanizing an organization investigating human relations, design knowledge and capabilities?

Article III: How can embodied design methods support an industrial service design process?

Article IV: How can AI assistants affect a service encounter? How should AI assistants be considered in a service design process?

Article V: How is a design process for an AI assistant in automated service interactions in complex service ecosystems? What are the success factors that can be applied in the design of an AI assistant?

Article VI: What are the implications of the change AI brings to the practice of service design?

Article VII: How can industrial service design respond to creating proof of concepts (PoCs) in the industrial corporation context?

The articles and their findings are further introduced in Chapter 5.

1.2. My Research Journey

The research process (Figure 1) started in 2016 through research visitations, during which I had the opportunity to explore the topics of digital service ecosystems and advanced technology. The visits included two months at the University of California, Berkeley, where I observed a large digital student information system renewal project. Articles I–II are connected to the observations and collaboration with the local researchers.

The majority of the research was conducted as practice-based research in industry. I started as a doctoral candidate at the Volkswagen Group in Wolfsburg, Germany, in December 2016. Until June 2018, I worked as "AI Assistants Design Lead" (in the role of a project manager) and as a service designer in several projects on AI assistants that contributed to the research as case studies. In addition, I conducted seven expert interviews with external service design professionals to learn more about the use of AI in service design from the outside perspective. Articles I–V were written during that time.

In July 2018, I moved from the Volkswagen Group to Volkswagen Financial Services Group due to organizational changes. In the new organization, I continued in a similar role as "UX Design Lead", working on and managing data and analytics projects. During that time, Articles VI and VII were written and published. I completed my three-year doctoral programme in industry in November 2019 and continued finalizing the dissertation as a researcher at the University of Lapland.

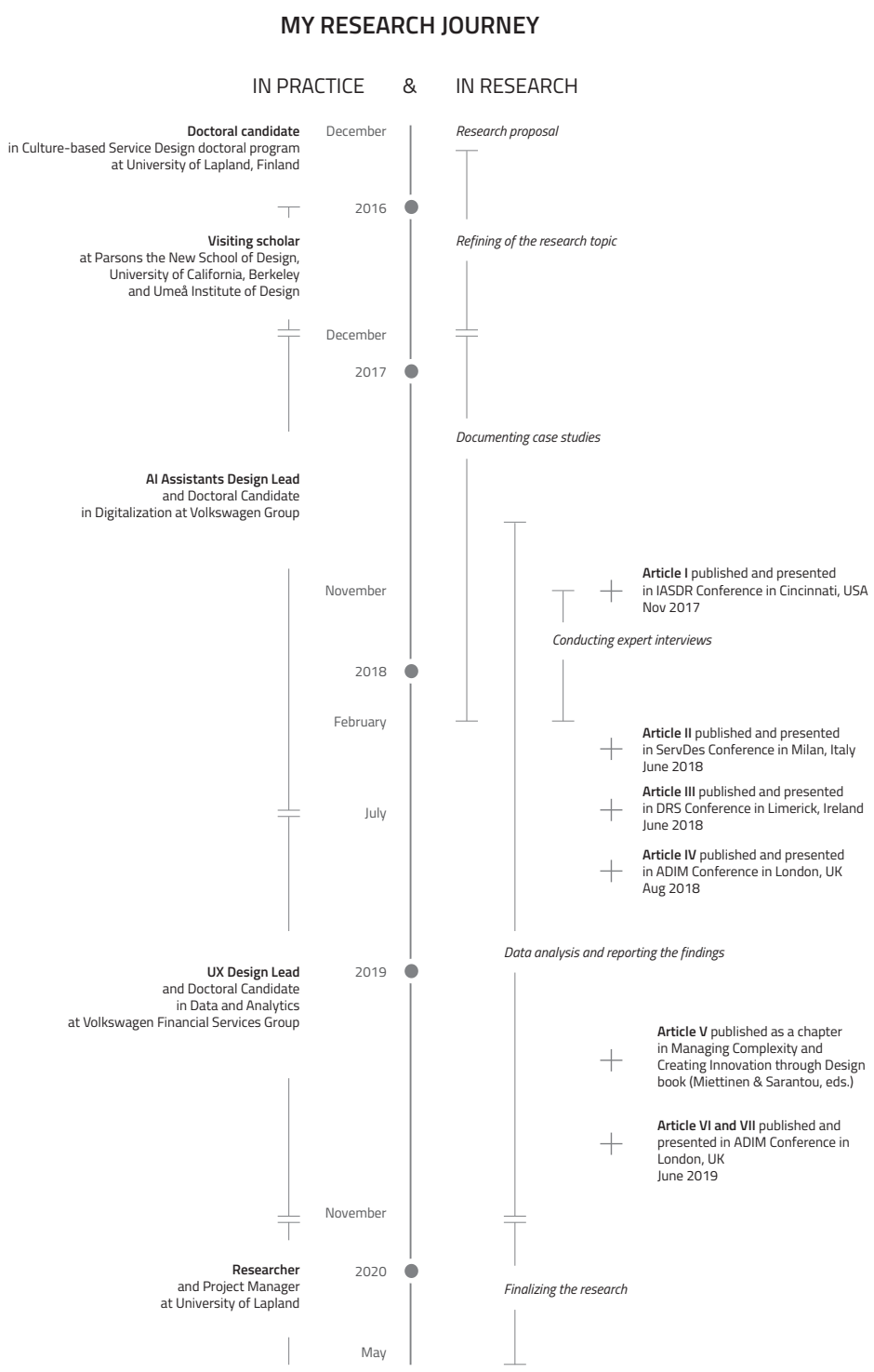

Figure 1: The timeline of the research process.

1.3. Research Context

The majority of the doctoral research was conducted in an industrial setting. As shown in Figure 1, I was employed by the Volkswagen Group as a doctoral candidate in December 2016. The company has a set doctoral programme over the time span of three years, during which the doctoral candidates have the opportunity to work intensively on company projects and use half of the work time for their research activities.

My first position at the Volkswagen Group was in its digitalization department, which was established after the appointment of the chief digital officer in 2015[2] to drive digital transformation throughout the entire group. With this appointment, Volkswagen Group as a traditional manufacturing organization, made commitments to becoming a software and services company and a leading mobility provider.

The Volkswagen Group consists of 13 brands (Volkswagen, Audi, SEAT, ŠKODA, Porsche, Bentley, Bugatti, Ducati, Volkswagen Commercial Vehicles, Volkswagen Financial Services, Scania, MAN and Lamborghini) that are their own entities and follow a common strategy led by the group organization. The Group Digitalization department worked together with the brands in achieving the goals set in the digitalization transformation strategy. The use of AI in products and services, such as AI assistants, was one part of that strategy.

In 2018, after the appointment of a new CEO at Volkswagen Group, a strategic decision was made to terminate the Group Digitalization department, and the teams were split under other departments, according to their specialization. Therefore, I decided to move to one of the brands in the group, Volkswagen Financial Services Group.

Volkswagen Financial Services Group differs from other brands, as it is not focused on manufacturing vehicles but specialized in providing banking and finance services to the customers of the group. My position, starting in July 2018, has been in a recently established department, Data & Analytics department. The role of the department is to work on analytics and AI solutions together with other teams and departments of the company, as well as with the international branches. The team sees itself as an internal provider that delivers data products for the needs of different parts of the company. The data products can be both internal solutions (for example, in automating processes) and external solutions that directly affect the experiences of the end users of the company.

Industrial doctoral research positions and programmes give researchers the possibility to connect research activities with practice. Especially in practice-based research, this kind of research setting is fruitful, as new findings emerge when

2 News on the Volkswagen Group website on November 10th, 2015 https://www.volkswagenag.com/en/news/2015/11/Johann_Jungwirth.html

practical experiments and research activities inform each other. This way, research findings can be implemented in practice in a short time span. Therefore, research benefits both practice and research.

When a researcher relates to practice over a longer period, the understanding of the conditions and research topics is substantial compared to the results of individual short-time interventions. This kind of research is needed in forming a deeper understanding of the practical work that informs research.

The industrial setting as a research context not only provides great opportunities to connect with the "real world" around the research topic but also presents constraints and challenges for conducting a doctoral thesis. The fast changes in the organizational setting have caused disruption also to this research. Organizational and working position changes created challenges to consistently conducting the research.

Regarding the industrial research setting, it must be noted that research conducted in one organization can only provide findings limited to one context. Also, the confidentiality of the projects hinders discussing the use cases in a completely open way. In this research, the conduct of external expert interviews (see section 3.5) was an attempt to open the research to a wider input of data.

1.4. Contribution of the Dissertation

This research focuses on the connection between service design and AI in the context of digital services. Through a practice-based research strategy, this research utilizes an example of designing AI assistants as a form of AI-enabled service. The research addresses a broader void in design research concerning the use of AI in design artefacts (objects, services, interfaces) and the utilization of AI in design activities, the work of the designer. Utilizing the theoretical lens of service design, seven publications provide different perspectives on the topic.

Articles I and II have a strong focus on the HCD approach and the so-called process of the humanization of service processes and the organizational context. Article I is based on learnings from a project at University of California, Berkeley, and Article II was constructed together with a workshop concept on humanizing organizations that was held at the ServDes 2018 Proof of Concept conference in Milan. Article III has a human-centred approach through a workshop case study that examines the use of embodiment as a way of supporting the service design process in industry. All three articles provide views on how the topic of humanization and humanness relate to larger contexts such as organizations and service ecosystems.

Article IV continues from the topic of humanness, considering the perspective of non-humans. The article explores, through literature, the meaning of non-humans having agency and performing as actors in services and how that relates to the construct of services that include AI-enabled interfaces, such as AI assistants have.

In Article V, the topic of AI assistants is continued as five use cases are introduced. The article takes the perspective of designing service interfaces that include AI and, through a process-oriented view, describes the found success factors for designing AI assistants. In Article VI, the design process view is explored further, where the case studies are combined with the analysis of expert interviews to form an understanding of the service design process for AI-enabled services. This article also reveals the found implications AI has for the work of a service designer.

Lastly, Article VII researches a more focused area of design, as it examines the use of PoCs as a part of AI assistant projects. This article examines two workshops from case studies 1 and 5 and reflects on the impact of design PoCs in AI projects in an industrial setting.

Through these seven articles, this research constructs an understanding of the effect of AI on the design of digital services as design artefacts and on the practice of service design. Through these findings, this research aims to produce new knowledge of the fields of service design and design research.

1.5. Dissertation Outline

This dissertation is divided into seven chapters:
In Chapter 1 ("Introduction"), the research topic and research aim are introduced, and the research questions are set. In this chapter, I also describe my research journey and explain the context of the research in an industrial setting. Here, I also demonstrate the research gap and my research contribution.

Chapter 2 ("Theoretical Background") focuses on the two main theoretical frames: service design and AI. Under the frame of service design, HCD and industrial service design are discussed. AI is introduced through its history, and its use in services through the example of AI assistants is discussed. Also, theories on the ethics and impact of AI are viewed in this chapter.

Chapter 3 ("Research Design") is dedicated to unravelling the methodological choices in this research. Starting from the research philosophy, I discuss the ontological and epistemological setting of the research and argue the methodology of qualitative research and design research. After explaining the chosen research strategy of practice-based research and case study research, I dive into the data collection and qualitative data analysis approaches.

Chapter 4 ("Introduction of Case Studies") explains the construct of the five case studies that are used as one data set in this research. The case studies consist of five individual AI assistant projects.

In Chapter 5 ("Summary of Findings from the Original Publications"), each of the seven original publications is summarized using its key findings. This gives a foundation for the discussion of the findings in Chapter 6 ("Discussion"). The

discussion is divided into four topics: 1) AI changes the design of digital service interactions, (2) AI assistants perform as actors in digital services, (3) AI needs to be human-centred rather than human-like and (4) AI assists and augments the practice of service design.

Chapter 7 ("Conclusions") concludes the outcomes of this research through reflection on the research questions. This chapter also states topics for future research.

Publications III-VII are included at the end of the dissertation in their original format.

2. Theoretical Framework

The two main theoretical frameworks, service design and AI, are introduced in the following sections. First, service design is defined through its history, and the key aspects of the field for this thesis – HCD, industrial service design and service ecosystems – are explained. Second, the field of AI is explored with a historical look on the development of the technology and the current state of the field, followed by the definition of AI assistants as AI-enabled services and exploration of AI ethics.

2.1. Service Design

This thesis is based on the discipline of service design, and through empirical research, it studies the practice of service design in the context of AI-enabled services. To understand the research subject, the following four sections explain the fundamentals of service design, the HCD approach, the context of industrial service design and the design of service ecosystems.

2.1.1. Definition and History of Service Design

Service design started as a design discipline in the 1990s and early 2000s through an initiative of design practitioners in Europe and Northern America, when they began specializing in the design of service solutions and founding design agencies under the term (Sangiorgi & Prendiville, 2017). Along with servitization transitions as the move from a manufacturing focus towards a service economy in industry (Lay, 2014; Vargo & Lusch, 2004; Windahl & Wetter-Edman, 2018), service design has become an essential discipline in service innovation. Similarly, service design is a well-established field in academia in the European context, where this research is located.

The service design field is interdisciplinary, and it has adopted methodologies from other fields – such as design research, design management, service marketing and participatory design (Wetter-Edman, 2011). In both practice and research, service design has close connections to other design fields that are connected to service innovation, including design thinking and UX design (Stickdorn et al., 2017). In many respects, these fields overlap with each other, and often, it is the design context that defines which term is used for a design activity. For example, design thinking has strong business management origins, and it is widely used in the business context (Brown, 2008; Johansson-Sköldberg et al., 2013), whereas UX design is often connected with human-computer interaction design and software

development (Forlizzi & Battarbee, 2004; Hassenzahl & Tractinsky, 2006). Service design, on the other hand, has a strong connection to participatory design and co-creation (Holmlid, 2009).

Rooting into the tradition of design, the activity of "designing" can be defined as the creation of artificial artefacts that are produced and consumed in a multiuser context supported by virtual environments (Krippendorff, 1997). Simon (1996) defines "artificial" as something that is man-made and points out that the design focus should be in the interactions that happen between the artificial and natural world. According to Dorst (2019), a design activity addresses "design problems" that, through the design process, are in co-evolution with the sought design solutions. This entails that design is dealing with topics and challenges that are difficult to formulate into a comprehensive definition since there are variables (such as the context, situation and people) that influence the design. Connected to this note, Norman (2013) indicates that the aim of design is to create solutions that are to be used by people. Therefore human-centricity is an essential part of design activity.

The focus of service design activity has, from the beginning, been on the design of service experiences that provide solutions to user problems and connect users and service providers through service interfaces (Miettinen & Koivisto, 2009; Polaine et al., 2013; Stickdorn, 2013). These interfaces can be both digital and analogue, and they are part of a holistic user journey that connects the service moments to form a larger experience. Regarding the development of the service design field, the design focus has become wider, and service designers are now addressing complex challenges far beyond individual service interfaces (Sangiorgi & Prendiville, 2017) towards strategic and transformational service interventions (Margolin, 2015; Sangiorgi, 2011). This can be seen both as an organizational change through the expansion of the servicescape (for example, through extended product-service systems; Morelli, 2006) and as service ecosystems (Banoun et al., 2016; Wieland et al., 2012) that, in the digital context, may grow large through multiple service channels and complex service backend systems (Geuy, 2017).

Service design aims at a comprehensive understanding of service systems and the human needs behind them, those of both the users and the business stakeholders connected to the service system (Miettinen et al., 2016; Segelström, 2013). Different from other areas of design, in service design, the outcome may be other than a design artefact. Here, the design and innovation activities resulting in value-generating processes between the user and a service provider are considered as design outcomes (Lusch, 2007; Stickdorn et al., 2017). Especially when the design targets are immaterial and abstract, the ability for concretization, visualization and prototyping are important skills for service designers (Blomkvist, 2014; Rontti & Lindström, 2014). With a human-centric focus, service designers facilitate a service design process where solutions are co-created with service stakeholders and users (Buur & Matthews, 2008; Grönroos, 2008).

2.1.2. Human-Centred Design

Human-centred design (HCD) is one of the core values in service design. It refers to design activity where the people impacted by the design are put into the centre of the focus. This means, for example, that the needs of users are in the core of forming the design challenges and that both users and stakeholders of the service provider are involved in the design activities during and, potentially, after the service design process, supporting the change the co-design brings along (Rönnholm, 2017).

An international standard for human-centred systems (International Organization for Standardization, 2019) defines HCD as an "approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques". Giacomin (2014) proposes that HCD can be structured under a hierarchy that describes the focus of the activity from "the physical nature of people's interaction[s] with the product, system and service" (p. 613) to a more abstract level of metaphysical meaning that people form through the interactions.

Buchanan (2001b, p. 36) explains that HCD is closely connected to human dignity – which the design should support in the context of social, economic, political and cultural circumstances through the view of a user. This connects to the topic of the fundamental understanding of human nature and the ability to create and show empathy through design decisions (Young, 2015). Also, the topics of inclusion and equality are reflected through the design activities either as a conscious choice or as unintended negligence (Holmes, 2018).

In the context of digital services, HCD addresses the border between humans and machines (Sack, 1997). Nevertheless, translating complex human needs and behaviour to generalizable solutions through machines is a difficult task (Morley et al., 2019). Especially when working with technologies such as AI, Guszcza (2018, p. 38), regarding HCD, points out that "smart technologies are unlikely to engender smart outcomes unless they are designed to promote smart adoption on the part of human end users". Maglio et al. (2015) argue that to solve complex human challenges through technological systems, multidisciplinary approaches are required to support HCD. Service design can be one of those disciplines.

2.1.3. Service Design in Industry

The service sector has grown into an important role in modern economies. In countries like Finland and Germany, a major part of national employment (85% and 80%, respectively) comes from the service sector (Buckley & Majumdar, 2018). With this growth, and with the increasing attention to the quality of services, service design has got a steady place inside industrial organizations.

Miettinen (2017) describes the role of a service designer in industry as fostering human-centricity and a deep understanding of users, promoting service design across the organization and creating room for cross-sectional collaboration in service

innovation and the improvement of organizational functionalities. These so-called in-house designers are bringing an outside view of users in the organization and, through a human-centric approach, help in aligning the business with user needs (Reason et al., 2016). This outside-in view can benefit an organization at all levels of design maturity, from the practical design of service solutions to strategic service design.[3]

Miettinen (2017, p. 9) also points out that "the industrial service design process needs to be embedded into existing corporate structures and processes". This implies service design activities may take different forms in different organizations. For example, the adjustment of service design activities to the existing processes such as agile development and lean software development can provide opportunities for scaling up the service design solutions and benefits in the organization (Geuy, 2017). Together with HCD and systems thinking, the integrated design approach helps in addressing complex problems in the transformation of systems in industry (Zhao, 2019).

2.1.4. Design of Digital Service Ecosystems

The growth of digital solutions through digitalization has provided to organizations new possibilities for creating service offerings for customers (Rytilahti et al., 2016). A digital service refers to a service transaction that is produced and consumed through digital channels. A digital service can be provided on its own, or it can be connected to other types of services (Williams et al., 2008). These multichannel services are often also a part of a larger service ecosystem.

Service ecosystems can be defined as "relatively self-contained, self-adjusting systems of resource-integrating actors connected by shared institutional logics and mutual value creation through service exchange" (Vargo & Akaka, 2012, p. 207). A digital service ecosystem relies largely on digital components in the service frontend and/or backend.

In digital services, the service interaction happens through digital channels – such as websites, applications, chats or other types of digital media. This interaction can be defined as a touchpoint[4] – which, combined with other service touchpoints, creates a service journey for a customer (Stickdorn et al., 2017). A sum of alternative service journeys with their front and backend elements creates a service system. When a service is connected to a physical product, they create a product-service system (Guidat et al., 2014; Morelli, 2006). A service ecosystem connects several

3 The design ladder by the Danish Design Center (2001) introduced four levels of design maturity: step 1 – non-design, step 2 – design as form-giving, step 3 – design as a process and step 4 – design as a strategy. https://danskdesigncenter.dk/en/design-ladder-four-steps-design-use

4 Touchpoint is any point of contact between a customer and a service provider/brand. Read more on the blog post by Jeff Howard (2007). On the origin of touchpoints. https://designforservice.wordpress.com/2007/11/07/on-the-origin-of-touchpoints/

service systems and, potentially, several service providers to a network that, as a whole, can ensure the delivery of value to customers and the stakeholders of the network (Banoun et al., 2016; Meynhardt et al., 2016).

The design of digital service ecosystems includes the understanding of the social structures (rules, norms, roles, values, beliefs) connected to the system and their physical enactments (symbols, artefacts, interactions, practices; Vink et al., 2019, p. 10). In a service design process, these partly immaterial and complex structures of an ecosystem can be mapped and visualized (Grimes, 2018) to enable a common understanding of the constructs as a basis for the creation or improvement of a digital service ecosystem. The value co-creation in a digital service ecosystem happens through the act of exchange at various levels where technology has a significant role. Nevertheless, the "value co-creation [in service ecosystems] is bound up in a wider system, and the process is dependent on specific spatio-temporal conditions" (Lusch et al., 2016, p. 2959) – namely, the context and situation of the user.

2.2. Artificial Intelligence

This section introduces the theory of AI through the lens of service ecosystems. The first subsection focuses on the history and definition of AI. The subsection highlights the scientific fields incorporated in AI and explains the different levels of intelligence, from weak AI to superintelligence. The second subsection introduces the concept of AI-enabled service through the example of AI assistants. The third subsection examines the ethics and impact of AI when applied in use.

2.2.1. Definition and History of AI

In summer 1956, at Dartmouth College, a group of 10 scientists wrote a proposal for a two-month research on AI aiming to find out "how to make machines that use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves" (McCarthy et al., 2006, p. 12). This research proposal is one of the first documents that specify AI research problems – including machine automation, the use of natural language, neural networks and self-improvement.

Already in the first definitions, AI was set to achieve the abilities of humans and reach their intelligence. This kind of definition is problematic, as when milestones are reached and AI improves, the abilities it has are not considered anymore to be intelligence only humans possess. Therefore, if AI is the ability of a machine to perform tasks that require human-like intelligence, which previously only humans could do, the definition of AI also needs to evolve. This makes defining AI challenging, and the given definitions should reflect the point in time they were given.

One of the first attempts to measure machine intelligence was a test known as the Turing test – set by a mathematician and computer scientist, Alan Turing, in 1950. He proposed a game-like set up where a human interrogator examines two anonymous players, from which one is a computer and another one a human, by asking questions through written text and attempts to identify which one of the players is a computer and which is a human (Turing, 1950). If the interrogator cannot determine a difference between the two of them, based on Turing, a computer has reached the level of human intelligence. This is where the limit of the Turing test lies (Shieber, 1994). It can be argued that a machine can have human-like behaviour without the need for intelligence if the behaviour is only mimicked and not based on self-initiated decisions by the machine. This concern was also raised by Herbert Simon in his definition of artificial things: "Artificial things may imitate appearances in natural things while lacking, in one or many respects, the reality of the latter" (Simon, 1996, p. 5). In modern AI, the aim is to go beyond mimicking human behaviour to give machines intelligent capabilities that may also exceed human intelligence. Nevertheless, we are still in an area of narrow AI (Figure 1), and the reach to human-level intelligence as artificial general intelligence, let alone artificial superintelligence, is still in the unforeseeable future (Bostrom, 2014).

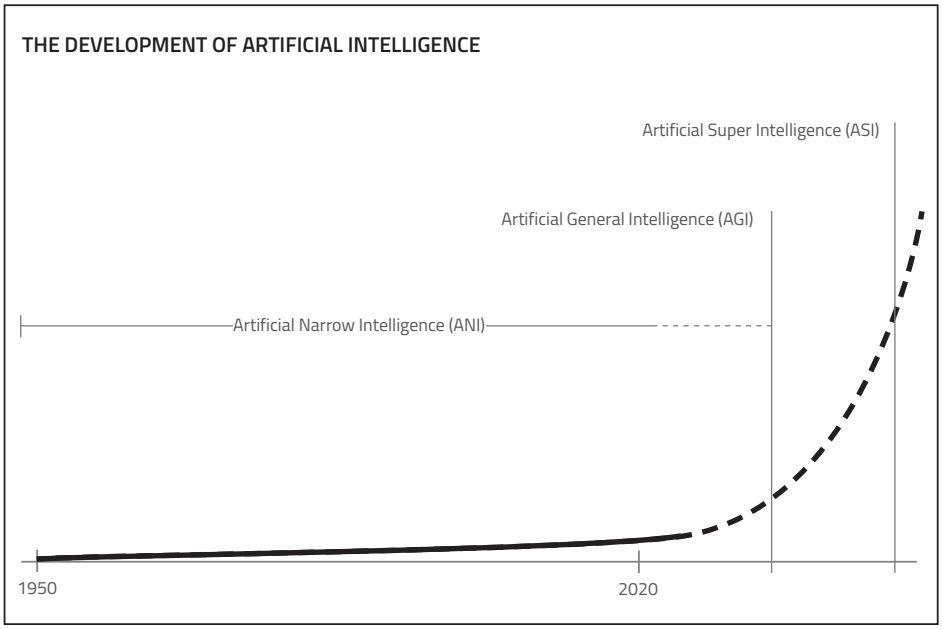

Figure 2: The timeline of AI development.

To enable machines with human-like intelligence, we have to understand how the human mind works. As Russell and Norvig (2016, pp. 2–5) illustrate in their four fields of AI (thinking humanly, acting humanly, thinking rationally and acting rationally), the interdisciplinary field of cognitive science is in close connection with the AI field to solve how machines can *think humanly*. Concerning *acting humanly*, a Turing test is used to evaluate machine abilities such as natural language processing (NLP), knowledge representation, automated reasoning and machine learning (ML). In the field of *thinking rationally*, Russell and Norvig (2016) include the area of AI that bases on logic aiming to make "the right" decision according to the given information. Lastly, *acting rationally* incorporates the use of rational agents that act to achieve the best expected outcome.

As a scientific field, AI is located under computer science (Figure 3). Under the domain of AI is the field of ML. ML utilizes large amounts of data to detect patterns and use the uncovered patterns to "predict future data or to perform other kinds of decision making" (Murphy, 2012, p.1). For AI to achieve the aim of machines acting and thinking humanly and rationally, ML is the engine that allows AI to reach that goal (Domingos, 2015). By applying effective algorithms, ML progressively improves its performance without the need for pre-specifications (Paschen et al., 2020; Sarkar et al., 2018). Under ML, there is also the field of deep learning, which addresses complex learning problems with multiple levels of representation and abstraction (I. Lee & Shin, 2020). Deep learning employs neural networks, for example, in creating prediction models (Agrawal et al., 2018).

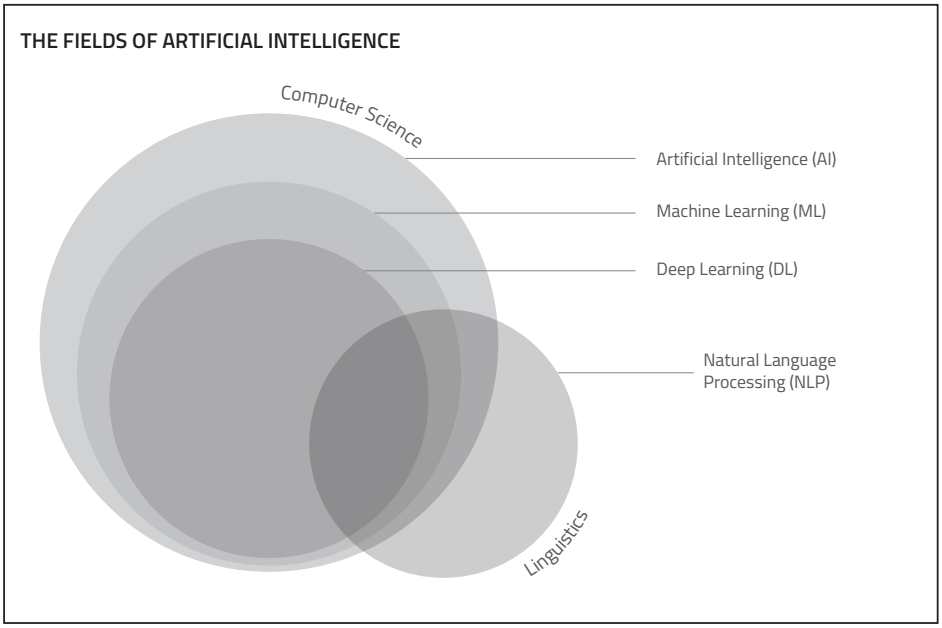

Figure 3: The fields of AI.

The AI research field is closely connected to other fields. Computational linguistics and AI, for example, are connected in the attempts to train machines to understand and use natural human language. This field of AI is called NLP, which is used to understand meaning out of human language input and generate responses in the form of written or spoken text. This is not a trivial task, as the construct of language is not only the sum of words but also contextual, personal and cultural connotations that are difficult for a machine to interpret. NLP is used in AI applications that require direct human-machine interaction (HMI) with a conversational structure (Clark et al., 2010; Kurdi, 2016; Russell & Norvig, 2016).

Basing on the definitions above, *in this thesis, the definition of AI bases on the ability to act humanly and rationally.* This kind of intelligence requires an AI system to understand the tasks, acquire information, derive conclusions and act upon them. As Russell and Norvig (2016) also explain, when AI is implemented in the real world, surrounded by people, the capabilities for humane action is needed to, first of all, receive the needed information and then communicate the action in an understandable way to humans. Therefore, humane action is an important supporter of rational action and vice versa.

Arriving at rational decisions is not always straightforward, as the context of society and the environment in which the technology is functioning create "situations with many variables and many interconnections among them" (Simon, 1983, p. 91). *In this thesis, AI technology is viewed through service ecosystems where HMI happens through, or with, AI.* Each service encounter is unique because of the human element and contextual effect. Here, AI allows us to formulate, model and solve problems with a large range of variables to model the HMI to the service circumstances. These types of services are framed as AI-enabled services, for which AI assistants are an example.

2.2.2. AI Assistants as AI-enabled Services

As defined in the previous subsection, in the context of this research, AI systems are considered to have the intelligence required to act humanly and rationally. Nevertheless, acting humanly does not necessarily mean AI would be "human-like". The public perception of robots and intelligent machines is heavily influenced by media. Robots and machines with human-like behaviour have long been a subject in science fiction, and movies such as *Her*[5] and *Ex Machina*[6] portray anthropomorphic representations of machines that fluently interact with humans and act in complex environments. The reality, however, is yet far from those images.

5 *Her* is an American science fiction romantic movie written by Spike Jonze that premiered in 2013.

6 *Ex Machina* is an American science fiction psychological thriller movie written by Alex Garland that premiered in 2014.

Many of us have, by now, interacted with chatbots either in a corner of a website or through messaging apps. A chatbot is a text-based AI assistant designed to interact with users through conversational interfaces and help them in a specific service area. Chatbots use NLP to understand the meaning of what users write to them and formulate the service content back into the conversation. The range and complexity of the chatbot content may vary heavily, depending on the purpose and service domain. For example, ordering a pizza can be a trivial task, but renewing travel insurance requires more capabilities and actions from the chatbot (Brandtzaeg & Følstad, 2018; Grudin & Jacques, 2019; Janarthanam, 2017; Shevat, 2017).

Another type of intelligent machines that have become common in public is voice assistants. These are AI assistants that communicate with users through a voice user interface either via smart devices or through a specific device[7] designed for this purpose. Similar to chatbots, voice assistants are based on NLP technology; only the input and output format of language is different (Cohen et al., 2004; Harris, 2005; Lewis, 2011; Pearl, 2017).

In this research, chatbots and voice assistants are placed under the term "AI assistant". In the literature, AI assistants are also referred to as "virtual personal assistants" (e.g. Arafa & Mamdani, 2000), "digital assistants" (e.g. Mahnič, 2019), "conversational agents" (e.g. Jacques et al., 2019) and "intelligent assistants" (e.g. S. Lee et al., 2017). An AI assistant is a computational system that utilizes NLP as a basis for HMI in a conversational manner. An AI assistant performs service tasks within the given limits and does not require human involvement. Nevertheless, AI assistants use supervised learning,[8] and the conversation flows that are used to create the conversations are created, for example, with decision trees[9] and defined by humans (Janarthanam, 2017).

7 Such as Amazon Echo, which is dedicated for communicating with Amazon Alexa.

8 Supervised learning is one of the three main learning styles of machine learning, where the input and output are known and the goal is to learn and train algorithms to map their way between the two (I. Lee & Shin, 2020).

9 Decision trees are used in solving classification problems in supervised machine learning (Sarkar et al., 2018).

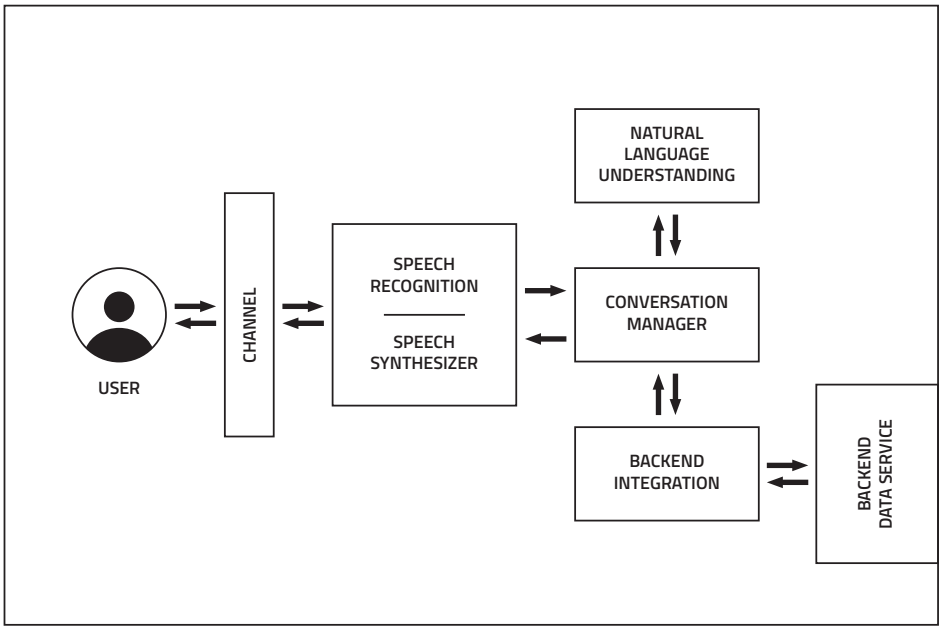

Figure 4: Architecture of a conversational interface based on Janarthanam (2017).

In addition to the NLP capability that allows AI assistants to converse with users, many AI assistants require further capabilities in the service backend to meet customer needs (Figure 4). In the service backend, AI may provide intelligence, for example, through data analysis, predictions and automation. Here, ML allows longitudinal improvement of service functionalities by learning from the data of anonymized conversation histories.

An AI assistant is a complex construct, and it presents a lot of potential in connecting services with users, either as individual service features or as a larger service ecosystem. An individual assistant can be an expert in a specific service field, but when several assistant capabilities are combined under one assistant frontend, the possibilities to provide service value to users become higher. In this thesis, case studies of AI assistants (see Chapter 4) form examples of "AI-enabled services". This is a term for a wider variety of services that includes AI capabilities in service backend and/or service frontend and is not limited to conversational HMI.

2.2.3. Ethics and Impact of AI

Compared to other types of technological solutions, AI entails complexity that can be seen through the use of machine intelligence on actions that affect human life. The aspects of autonomy and agency of AI solutions raise concerns on safety, risk, responsibility (e.g. Dignum, 2017b), control and the distribution of power (Iaconesi, 2017; K.-F. Lee, 2018). These kinds of questions and ethical concerns were not in the

minds of AI pioneers, as their focus was primarily on the technological development of AI (Bostrom, 2014). However, computer programs that follow technological guidelines and performative norms are not necessarily following the ethical norms of the society (Floridi, 2016; Kile, 2013; Moor, 2006).

To implement AI solutions in the "real world", ethical issues and the impact of the solutions on the society around it should be thoroughly examined. To do that, many companies,[10] institutions[11] and governmental organizations (Cath et al., 2017) have attempted to define principles for the development and use of AI. For example, the European Parliament Committee on Legal Affairs (2017) report tightly connects the machine ethics on legal matters and presses that "a clear, strict and efficient guiding ethical framework for the development, design, production, use and modification of robots" (p. 9) is needed.

Studies have also expressed concerns that the use of AI systems will have a negative effect on humans' capabilities for improving themselves (Lanier, 1995, p. 67). On the other side, there are the views of human enhancement and cyborgs (Allhoff et al., 2010, 2011; Haraway, 1991; O'Mahony, 2002; Steiffer, 2019; Yi, 2017), transhumanism (Cole-Turner, 2011; Ferrando, 2013) and posthumanism (Hayles, 2010; Kurzweil, 2017; Raipola, 2014) that challenge the current view of technological involvement in human life. When technological enhancement affects human nature and the ability to act, it may also have major impacts on societal order. This could, for example, lead to a scenario where "human enhancement creates an undesirable new class of enhanced people who can outperform others and, in this way, change the functions of the society" (Allhoff et al., 2011, p. 203).

There is a clear message from ethicists and philosophers towards the scientists and practitioners working on AI to be more aware of the ethical impacts of the choices made in the development and implementation of AI solutions. People working on AI systems capable of autonomous ethical reasoning and decision-making should be aware of the challenges and pitfalls of the ethics related to the machines (e.g. Ashrafian, 2015; Dignum, 2017a), including understanding and implementing universal moral norms and international human rights and avoiding human bias (Gordon, 2019).

In the context of service ecosystems, the ethical concerns lie in themes such as inclusiveness, diversity, segregation and unintentional discrimination (Broussard, 2019; Buolamwini & Gebru, 2018; Howard & Borenstein, 2018; O'Neil, 2016; Smith, 2019), changes and loss of jobs (Atkinson, 2017; Daugherty & Wilson, 2018;

10 For example, Google https://ai.google/principles/, Microsoft https://www.microsoft.com/en-us/ai/responsible-ai and IBM https://www.ibm.com/watson/assets/duo/pdf/everydayethics.pdf

11 For example, The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems https://ethicsinaction.ieee.org and AI Princples of the Future of Life Institute https://futureoflife.org/ai-principles/

Marttinen, 2018), the misuse of AI systems (Russell & Norvig, 2016), changes in human behaviour (Lanier, 1995; Ollila, 2019; Sack, 1997; Vahvanen, 2019) and distribution of power over data and algorithms (K.-F. Lee, 2018). In addition, there may be various unseen and unintended side effects on the personal, organizational and socioeconomic levels that only become apparent when service ecosystems apply AI-based solutions (Maeda, 2019; Scholz et al., 2018).

In this thesis, I am not aiming to make any claims on the ethical issues around AI. I am simply pointing out that this is an important aspect to keep in mind when designing service solutions that include AI, especially when they have autonomous abilities. If one is looking at HCD of AI, one also needs to be aware of what kind of changes AI might bring into the definitions of "humane" and "human-centricity".

3. Research Design

Research design is constructed through several layers (Figure 5). Research philosophy creates a foundation for the research and provides an angle on how the research interacts with the research context and theory. The research methodology roots the research into theoretical discourse in the research discipline. The research strategy outlines how the research is planned and conducted. The methods of data collection and analysis are the practical techniques used to carry out the research. In addition, the ethical considerations are laid out to transparently reflect the responsible conduct of research.

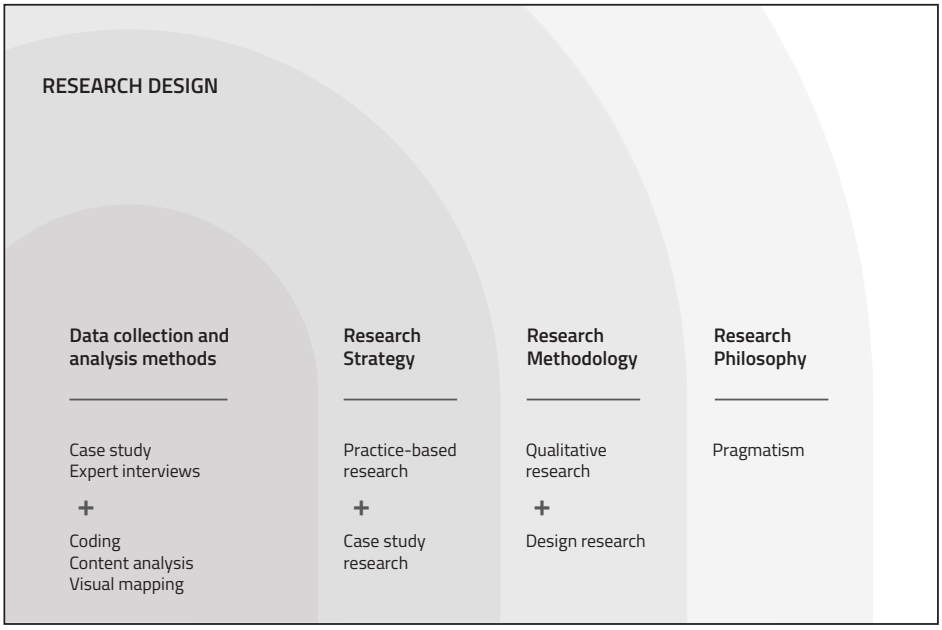

Figure 5: The research design.

3.1. Research Philosophy

The philosophical foundation of this research comes from the tradition of pragmatism. The theory of pragmatism bases on the work of the following philosophers: Charles S. Peirce, William James and John Dewey. Peirce (1878) first proposed a pragmatic theory that is based on the notion of objectivity and self-doubt that leads us towards the truth. James (1907), on the other hand, connected truth to utility and, from there on, to practicality. Dewey's theory on pragmatism introduced the aspect of experimentation and the notion that truth can be constructed through trial and error (Hickman, 2007). This Deweyan pragmatism is where design research philosophy is often rooted (Dixon, 2019; Goldkuhl, 2012).

In contemporary pragmatism, the approach to research starts from a research problem and a research question which directs the methodological choices. Pragmatism emphasizes practical outcomes, and therefore, the approach for achieving research results is adopting methodologies that best produce the outcomes. Therefore, multiple research methodologies can be selected and combined. The pragmatic viewpoint of reality (ontology) is complex. Pragmatists see that the reality is a flux of processes, and it is constantly renegotiated in the light of new situations and contexts that may be confronted during the research process. The knowledge in this potentially changing context is created either through observation or subjective participation in the research context or both, depending on the research question. Pragmatists consider "true" knowledge (epistemology) as theories that produce practical outcomes and enable successful action. (Saunders et al., 2019; Wahyuni, 2012)

Pragmatism provides a framework for a research setting where the researcher is both observing the research context and actively taking part in it, which is the situation in this research. As stated before, pragmatism as a paradigm also allows the use of multiple methodologies in research and several research strategies that are chosen depending on the research question. As this dissertation is constructed from multiple research articles, the possibility of choosing the methodology for each article has provided the flexibility needed for approaching the research topic from various angles.

Together with pragmatic philosophy, the approach towards theory in this research is abductive. Abductive logic is a combination of inductive (from data towards theory) and deductive (from theory towards data) reasoning (Ormston et al., 2014). This is an approach that, especially in qualitative research, gives opportunities in fluently bridging the interpretation of data towards theory and, through the alteration of the induction and deduction phases, allows an iterative construction of the research outcomes. In this research, the continuum of the research articles with their own, mostly inductive, research analysis processes produce an answer to the main research question through abduction.

3.2. Research Methodology

The methodological positioning of this research is in qualitative research and design research. Qualitative research practice, through the tradition of design research, gives the frame for the research strategy and the methodological choices in data collection and research analysis. The two research methodologies are explained in the following subsections.

3.2.1. Qualitative Research

This research is rooted in the research methodology of qualitative research. Compared to quantitative research, which looks at phenomena that produce measurable evidence, qualitative research aims to interpret and make sense out of the social world through data that are non-quantifiable (Mayan, 2009; Saldana et al., 2011). The qualitative research methodology is widely used in various fields – including social sciences, anthropology, psychology, health care, education and design, to name a few.

Due to the range of adoption, there are also different views on the meaning of qualitative research (Seale et al., 2004). Nevertheless, there are some common characteristics that can be recognized between the different views on the practice. Ormston et al. (2014, p. 4) summarize these characteristics as follows: qualitative research aims at "providing an in-depth and interpreted understanding of the social world", it uses "adapted methods of data generation" to collect "data that are detailed, rich and complex" and the analysis "respects the uniqueness of each participant or case, as well as recurrent, cross-cutting themes".

Qualitative research, through its various forms, gives a certain freedom for researchers to adapt the used methods to the context, research goals and access for data collection. Qualitative research even encourages utilizing various forms and sources of data to get a more comprehensive understanding of the research phenomenon. The conduct of this research clearly presents the methodology of qualitative research as practice-based research inquiry. The research also uses case studies, which is one of the most common methods in qualitative research, as one of the research strategies. Design research gives a more specific academic context to the research methodology within qualitative research. In connection with the design research methodology, this research can be identified as *qualitative design research*.

3.2.2. Design Research

Design research as a field has developed, over the course of time, together with the transitions of design from craftsmanship towards an academic field (Cooper, 2019). Without getting into the details of the history, it is important to point out that design as a practice has matured quickly over the century (Tonkinwise, 2017), and the design target, along with it, has shifted from material objects to abstract

immaterial artefacts, such as service systems. This change also reflects through the topics addressed by design research – varying from the definition of design (Papanek, 1971; Simon, 1996), the knowledge creation through design practice (Cross, 1999), the definition of design problems (Dorst, 2006) and the broadening scope of design from artefacts towards larger immaterial systems (Miettinen & Sarantou, 2019).

Buchanan (2001a, pp. 17–19) describes three types of research that also affect design research: clinical, applied and basic research. Clinical research focuses on individual cases, with the aim of problem solving often in (design) practice. Applied design research is a systematic process with the aim of discovering answers to problems that are discovered in the general class of products, services or situations. The common aspect is to connect several individual cases under a hypothesis that would give answers to a research question. Basic research, on the other hand, focuses on fundamental problems that explain a phenomenon.

When discussing design research, it is important to distinguish the differences between research in design and research about design (Crouch & Pearce, 2012). The categorization of the issues that design research addresses, presented by Collins et al. (2004, p. 16), includes the need to ask theoretical questions about the world around us. This reminds us that design research is not merely for the purpose of refining the design practice but also for conducting serious academic research about design. As Joseph (2004, p. 241) states, design research "creates opportunities for focusing on key questions" through which "emergent theory shapes research methods as well as design". In this thesis, design research refers to the academic field of researching design practice, and it can be categorized under applied design research.

3.3. Research Strategy

The research strategy in this thesis is constructed through practice-based research and case study research. As each of the articles in this research has its own approach to the research topic. Also, the strategy used in the research varies (see Table 1). All of the articles are empirical studies based on design practice and a practice-based research strategy – except for Article IV, which is theoretical research. In addition, Articles III, V, VI and VII adopted the strategy of case study research. These two strategies complement each other. While practice-based research is a wide definition of research that investigates new knowledge by the means of practice, case study research generates in-depth knowledge about a phenomenon through a limited case – for example, as a design process. The concepts of practice-based research and case study research are explained in the following subsections.

Table 1: The choice of research strategy in the original publications.

Research strategy	Article I	Article II	Article III	Article IV	Article V	Article VI	Article VII
Practice-based research	X	X	X		X	X	X
Case study research			X		X	X	X
Other				X			

3.3.1. Practice-Based Research

Practice-based research can be defined as an investigation of actions, processes and outcomes of practical work to gain new knowledge (Candy, 2006). The research strategy of practice-based research is widely used in different fields, and therefore, there is also a variety in how "practice" and "research" are defined. Candy and Edmonds (2018, p. 64) propose that practice involves "doing something that extends beyond everyday thinking into actions that may lead to new outcomes". In this research, "practice" is framed as the work of a service designer; the service design process, including co-creation sessions in workshops (Articles II, III and VII); and the outcomes of the service design process – for example as AI assistants (Article V).

In the context of design research, the focus of practice-based research is on "understanding the nature of practice and how to improve it, rather than creating and reflecting on new artefacts" (Candy & Edmonds, 2018, p. 63). The range of design practice itself has become wider over its history, and similar to the focuses of service design, design research investigates larger contexts and complex socioeconomic systems. This gives practice-based design research new opportunities for investigation areas (Vaughan, 2017).

As practice-based design research closely investigates the design practice, it is important to distinguish between practice and research. Vaughan (2017) explains that besides academic research, design research is connoted by the professional design work in practice. In fact, according to Fox (2003), it is the reflexivity about practice and the critical approach that allow practice-based research to produce new knowledge and academic outcomes. This implies that the differentiation of practice and research is not trivial but is a necessary requisite for quality academic outcomes. In this research, case study research provides a supporting strategy in achieving clarity in the approach of investigating practice through bound units of practice.

3.3.2. Case Study Research

A case study is a research approach that aims at understanding a phenomenon through a bound system. Instead of gathering a large data set, a case study is valued "as a unit that permits in-depth examination" of a research phenomenon (Saldana et al., 2011, p. 8). However, this does not restrict using multiple cases under a research strategy. This is referred to as a multiple case study, which is also applied in this

research. As Yin (1981, p. 101) explains, a multiple case study is appropriate "when the same phenomenon is thought to exist in a variety of situations".

A case study can be seen both as a research strategy and a method for data collection. This means that when a case study has been chosen as the strategy for a study, a method for data collection still needs to be decided (Mayan, 2009, p. 50). As Yin (1981) points out, a case study is not based on a specific data collection technique. Stake (1998) also indicates that instead of focusing on methods, the interest of a case study is in the case itself.

In this research, the case study research strategy allows a close examination of service design processes in AI assistant projects in an industrial setting. According to Saldana (2011, p. 9), a case may be chosen deliberately or strategically or chosen out of convenience. Here, the selection of cases was done out of convenience through the context of design practice as a multiple case study with five cases analysed through various forms of data (see subsection 3.5.1).

3.4. Ethical Considerations and Limitations

Ethics is a part of every research activity that involves human participants in any way. In empirical qualitative research, the ethical considerations lie especially in the empirical research actions, the data collection, the treatment of data and the representation of research analysis. The Finnish Advisory Board on Research Integrity (2012) outlines the ethical principles for research, including the aspects of respect towards research participants and their dignity and autonomy and towards their material and immaterial culture. All studies should avoid "damage and harm to research participants, communities or other subjects of research" (Finnish National Board on Research Integrity, 2019, p. 50).

In the research with the articles, the ethical considerations involve given consent from research participants for involvement in the research. This includes both workshop situations and interviews. The consent was given through a signed consent form which described the purpose of the research activity; provided permission for documentation; explained the treatment of the data in storage, analysis and reporting (including the anonymization of the data); and explained the rights of the participants, including the right to discontinue their participation any time during the research. All data have been stored securely, and the anonymity of the participants in all research activities have been anonymized in the research analysis and outcomes reported in the original publications. This way, the privacy of the participants has been secured.

Another aspect of ethics in qualitative research is connected to credibility and trustworthiness. As qualitative research cannot be reproduced the same way as many quantitative and theoretical research can, it is important to establish credibility in

other ways. According to Saldana (2011, p. 135), this can be reached through the following ways: citing existing research, specifying the choice and use of methods transparently, describing the data collection and triangulation and verifying the data analysis with participants. Trustworthiness, on the other hand, shows through transparent reporting of the entire research process.

In qualitative research, as in any other form of research, there are many limitations. Especially in practice-based research that utilizes case studies, the boundaries of case studies as a research sample is a clear limitation, as the sample rules out any other type of case study. Case studies are limited contexts (see subsection 3.3.2) which need to be acknowledged when reporting the research outcomes and aiming for any kind of generalization from the data towards theory. This has been implicitly addressed in the articles when claiming them as case study research.

In the articles utilizing case studies that are connected to the industrial context (Articles III, V, VI and VII), the ethical considerations go beyond the individuals as participants to an organizational level. The confidentiality of business projects in case studies limits how detailed the contents of a project can be discussed in the analysis and findings of the research. This has been addressed in the article through statements of confidentiality.

3.5. Data Collection

The data used in the articles vary from service design projects to expert interviews and workshops (Table 2). The reason for having a variety of data sources bases on the aim of covering a wider spectrum on perspectives in the research. According to Saldana et al. (2011, p. 76), multiple data sources diminish the limitations of one data set and gives the research more credibility.

The two main data sets used in the research include five individual AI assistant projects as case studies and seven expert interviews. The case studies are described in Chapter 4 ("Introduction of Case Studies") with further details. These particular case studies are used in Articles V and VI and, in part, Article VII. The interviews are included in Article VI.

Article I is based on data that are owned by the co-authors of the article. Articles II and III include data from workshops which are not connected to the five main case studies presented in Chapter 4. Article IV is based on a conceptual literature review and does not include any empirical data. As the case studies and expert interviews are the primary data of this research, only those are presented in this chapter.

Table 2: The use of research empirical data in each research article.

	Article I	Article II	Article III	Article IV	Article V	Article VI	Article VII
Case study 1					X	X	X
Case study 2					X	X	
Case study 3					X	X	
Case study 4					X	X	
Case study 5					X	X	X
Expert interviews						X	
Other	X	X	X				
No data				X			

3.5.1. Case Studies

A case study as a technique for data collection entails a collection of data from various sources connected to a phenomenon being researched (Hancock & Algozzine, 2006). As described in subsection 3.3.2., a case study is always connected to the natural context of a phenomenon. In this research, five AI assistant projects are used as cases studies. The project setting and the topic of AI assistants form a context for the case studies. The topic, aim in value creation, design process and means of the deliverable of the AI assistant projects vary in each case study (Table 3), and this way, the collection of the case studies aim at producing a wider perspective on the design of AI assistants.

Table 3: Description of the case studies.

Case study	Topic	Pursued customer value	Design phases	Service interface	Deliverable
1	Service sales	Access information, connect to the retailer	Content definition, character design, conversation flows, UI design, prototyping, testing and implementation	Chatbot on website	Customer-facing pilot
2	Customer support	Find information quickly and easily	Content definition, conversation flows	Chatbot on website	Customer-facing pilot
3	Mobility services	Find the right service solution for current need and situation	Content definition, UI design, prototyping	Smartphone application	Prototype
4	Product support	Find information quickly and easily	Content definition, conversation flows, UI design	Chatbot on smartphone	Proof of concept
5	Service orchestration	Use proactive personalised services	Content definition, conversation flows, UI design, prototyping	Smartphone application	Prototype

Each case study includes data sources such as project documentation, reports and presentations, project deliverables and design outcomes such as prototypes and PoCs. Such documents include textual and visual information that reflects the decisions, actions and value systems of the project team (Saldana et al., 2011, p. 54) and can therefore reveal detailed information about a case study. As I was part of the case study projects, I also carried out participant observation during the projects as well as created process maps during the projects and produced field notes.

In the data analysis, the case studies are treated either as individual data sets or as one collection of data, depending on the article and the research question: in Articles V and VI, the case studies are analysed as one data set, and in Article VII only parts of two case studies are used as data, including only two workshops. Each of the case studies is explained in more detail in Chapter 4.

3.5.2. Expert Interviews

Interviewing is an important method in creative practice in various fields, especially when gathering information on users (Portigal, 2013). Nevertheless, it is important to recognise the difference between user interviews and expert interviews conducted as a part of academic research. Many of the practicalities in preparing and conducting an interview do not change whether using the technique in practice or research (Mayan, 2009). Rather, it is the depth of content and complexity of topics that can

be addressed in an interview that differentiate an academic interview technique from the one in practice.

Interviewing is an effective way of collecting data from the perspective of an individual or from a broader collective that an interviewee represents (Saldana et al., 2011). In this research, the interviews were conducted as expert interviews, which means the interviewees were treated as specialists on the research topic rather than individuals representing their personal experiences (Table 4). However, it needs to be remembered that we all represent our culture and personal history, and this context cannot be taken out from interviews either – the interview data reflects "a reality jointly constructed by the interviewee and interviewer" (Rapley, 2004, p. 16).

The aim of expert interviews is to search for facts around the research topic. The construct of an interview relies on the researcher's current understanding of the topic and bases on information and facts that the researcher has collected prior to the interview. Therefore, when multiple interviews are conducted, the understanding of the topic incrementally increases over the course of the interviews. This can also be seen as possible changes in the interview structure and questions in order to address the gaps in knowledge and, for example, verify the views from previous interviews (Alastalo & Åkerman, 2010).

In the interview setting, knowledge is co-constructed through the interaction between the interviewer and the interviewee (Berner-Rodoreda et al., 2020). This approach, together with continuous analysis throughout the interviewing process, was adopted in Article VI's research, where the expert interview data were utilized. The interviews were constructed as semi-structured interviews, which allows the exploration of the defined interview themes in the interview situation (Hancock & Algozzine, 2006).

Table 4: Description of the interviewee profiles in expert interviews used in Article VI.

Interviewee	Work role	Country
1	Chief digital officer	Finland
2	Data science lead	Finland
3	Creative director	Finland
4	Service architect	Finland
5	Senior consultant	Germany
6	Service designer	Germany
7	Senior service designer	USA

3.6. Data Analysis

The analysis methods in the articles fall under three categories: coding, content analysis and visual mapping. Visual mapping is used in combination with coding in Articles III and VI (Table 5). The choice of the data analysis method is based on the research question and research data in an article. The three analysis methods are explained in the following subsections.

Table 5: The choice of data analysis methods in the original publications.

Data analysis method	Article I	Article II	Article III	Article IV	Article V	Article VI	Article VII
Coding		X	X			X	
Content analysis	X				X		X
Visual mapping			X			X	
No data analysis				X			

3.6.1. Coding

Coding is an analysis method used widely with qualitative data. Coding refers to an activity of going through research data, sorting and categorizing it, and marking segments that may be important to the research question by a code. A code is a word or phrase that describes the meaning of a piece of text (Boeije, 2010, p. 96), or as Saldana (2009, p. 3) describes it, "A code in qualitative data analysis is most often a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data". Coding is the first step towards understanding the meaning of the data and finding out how it may answer the research questions (Mayan, 2009, p. 89).

The process of coding is an iterative activity, and it may be done in several cycles. Coding was used in Articles II, III and VI. In Article II, the coding was done manually and, in three cycles, as open coding. In Article III, the coding took two cycles through open coding and thematic clustering, and in Article VI, there were three coding cycles as open coding, versus coding and thematic clustering. In the analysis process of Articles III and VI, Atlas.ti, a computer program for qualitative data analysis, was used for the coding process.

Open coding usually takes place at the beginning of research. The aim of open coding is for the researcher to familiarize themselves with the data and ask questions from it. "Open coding encourages a thematic approach since it forces the analyst to break up the text into pieces, to compare them and to assign them to groups that address the same theme" (Boeije, 2010, p. 96). The result from open coding is a list of codes and memos that help to understand the content of the data

in light of the research question. Open coding can be done in several cycles when the codes get deeper into the topic in each round. Open coding can also be the first coding cycle followed by other types of coding, such as versus coding that was used in Article VI.

Versus coding aims at finding and identifying tensions in the data. When there are direct conflicts or dualities that can be identified in the research data – for example between individuals, within systems or in the described phenomena – versus coding helps in documenting and labelling them. In versus coding, "the codes can range from the observable to the conceptual and can be applied to data that show humans in tension with others, themselves, or ideologies" (Saldana, 2014, p. 595).

Thematic clustering, or theming, addresses a larger portion of information than a single code. A theme is a phrase or sentence that "can consist of such ideas as descriptions of behaviour within a culture; explanations for why something happens; iconic statements; and morals from participant stories" (Saldana, 2013, p. 267). The goal of thematic clustering is to create overarching themes out of the data and through the process to depict narratives that the data represent. Thematic clustering was used in Articles III and VI.

3.6.2. Content Analysis

Content analysis originates from communication research and has been traditionally used as a quantitative method to analyse media messages through the study of reports, newspapers, adverts and books – any type of written communication (Prior, 2014). In the time of media, web and technology, the span of focus in content analysis has widened to cover the study of any type of text and visual – including images, videos and artefacts (Saldana et al., 2011, p. 10). At the same time, content analysis is no longer considered to only be a quantitative method. It has also been adopted in qualitative research either on its own or in combination with other data analysis methods (Mayring, 2000).

In some ways, qualitative content analysis resembles the process of coding, but instead of creating a theory out of the data, the result may be concept development or model building (Hsieh & Shannon, 2005). Hsieh and Shannon (2005) divide qualitative content analysis into three approaches: conventional, directed and summative. To follow their description, the content analysis approach used in Articles I, V and VII can be categorized as conventional content analysis. Conventional content analysis is used in situations when the "existing theory or research literature on a phenomenon is limited" (Hsieh & Shannon, 2005, p. 1279). It is an inductive approach where the researcher searches for themes and categories of topics predominantly from the research data, avoiding any prerequisites. This type of analysis can be also identified as latent content analysis with the process of "identifying, coding and categorizing the primary patterns in the data" (Mayan, 2009, p. 94).

In the content analysis within the scope of the articles, the research data incorporated documentation from projects (including presentations, reports, field notes, documented personal reflection and visual data such as process and journey maps). Even though open coding and content analysis can be considered as similar in many ways, the main difference between content analysis and coding in the analysis of the articles is in the type of data used (various forms of project documentation vs. interview data) and the process involved in the analysis. Content analysis as a process is more free-form than the process of coding, which makes it fit better with the variety of data used in the analysis.

3.6.3. Visual Mapping

The third analysis method used in the articles is visual mapping. In qualitative research, the collected data sets often include both textual and visual data. In design research, visual data are often analysed through semiotics when the aim is to examine the visual and material culture (Muratovski, 2016). In the approach used in Articles III and VI, however, visual mapping refers to an analysis process that produces visual outcomes. Following the principles of content analysis (see subsection 3.6.2 "Content Analysis") and pattern matching, the research data are analysed by utilizing visual methods.

Pattern matching is a qualitative analysis method that aims at detecting similarities and recognizable patterns in the collected research data. The method supports the collective view of the array of different forms of research data and going beyond the recognition of content to constructing patterns (Saldana, 2014, p. 584). In the visual mapping process used in Articles III and VI, the construct of patterns occurred as process maps instead of as a list of codes. The format of process maps has been adopted from the practice of service design (see, for example, Stickdorn et al., 2017).

4. Introduction of Case Studies

As the use cases are close to the core business of the company, they are not discussed in detail in the original publications to respect confidentiality. In this chapter, I will explain a bit further the needs behind the use cases, the unique aspects that each of them brings to the topic of AI assistants and the design practice. I had various roles in the projects, and those roles have been marked in the team role descriptions of each case study by underlining.

All case studies were done within the Volkswagen Group in collaboration with several group brands. For the purpose of confidentiality, the brand names are anonymized, and the designations "Brand A, Brand B and Brand C" are used to differentiate the brands from each other. Some of the use cases were done at the group level of the organization, meaning no individual brand of the group can be specified as a stakeholder.

4.1. Case Study 1: Service Sales Assistant

Project aim:	A full functioning sales assistant as a chatbot on a brand website
Done with:	Brand A
When:	2017–2018
Outcome:	Released chatbot on the brand website
Involved roles:	Project management, brand product owner, market product owner, group-level strategic steering, service design, UX design, user research and testing, data analytics, chatbot development, software development, copywriting, marketing, law
Used in publications:	V, VI, VII

The case study presents a project with a whole design process of an AI assistant, starting from case definition and ending in a released chatbot on a website of the brand in one market country. The assistant helps customers in finding relevant information while they are visiting the webpages, supports them in the process of selecting a suitable product for their needs and connects them with brand representatives and dealers for further consultation and product purchase. The assistant is an ambassador and the face of a brand; therefore, the design of the assistant was thorough.

The project team was wide and mostly located under the organization of Brand A. Also, external experts were included especially for the development and deployment of the chatbot. My role in the project was to manage the project from the group perspective and steer the project strategically as well as provide service design expertise in the design process of the project.

The design process started with the definition of the main purpose of the assistant based on customer needs and was followed by the content definition, as use cases that the chatbot covers in its conversation flows were formed. The use cases were chosen based on the direct value they can bring to the customer and the brand. At this state also, the NLP technology was chosen based on the requirements for realizing a good-quality chatbot.

The design of the assistant was divided into three main categories: the design of the character and personality, the design of content and conversation flows and the design of the graphical interface. The character design included naming, the creation of a background story, appearance, a way of talking (tonality) and word choices. The character needed to reflect the brand values and had to be appropriated to the culture of the market area. Here, a close collaboration with marketing was fruitful.

The defined use cases were then structured under conversation flows that create fluent conversations with customers. As the conversation flows were built through a rule-based system and decision trees, the assistant could only chat about predefined topics. Therefore, trying to cover all possible routes a customer can take in their journey on the website was a challenge. The aim was to support the customer on each of the journey steps through appropriate content and responses.

The user interface (UI) design included, besides the design of the chatbot widget and its position on the website, the design of the visual appearance of the assistant and the chat experience. The assistant was given an avatar with a female-like appearance, combined with machine-like features. This way, it is clear to the customer that they are not talking with a human, but a machine. The chat experience included, for example, the timing of responses, showing how the assistant is taking its time with "thinking" and "writing" the answer.

The assistant was directly prototyped with the end technology, and therefore, the quality of the NLP technology could be tested with the defined conversation flows. Besides the technological testing, the assistant prototype was tested with users in a co-creation workshop using scenarios to structure the context of use and a limited number of conversation flows to test the UX.

The chatbot was implemented on one brand market website first as a pilot. There, customers can interact with the chatbot around the clock and get guidance when needed. At the same time, the brand can learn more about customer needs through the collected data from the chatbot and engage better with customers online, followed by encounters with brand representatives and dealerships.

4.2. Case Study 2: Customer Support Assistant

Project aim:	Providing customers with answers to FAQs through a chatbot
Done with:	Brand B
When:	2017
Outcome:	Released chatbot
Involved roles:	Project management, product owner, group-level strategic steering, service design, UX design, UI design, data analytics, chatbot development, software development, copywriting, marketing, law
Used in publications:	V, VI

This use case is an AI assistant that helps customers to get answers to their questions in an easy and always available way as a chatbot on the customer support website of the brand. The aim was to create a chatbot that is neutral in its way of communication, providing information plainly and correctly. The source data of the assistant come from the already existing log of frequently asked questions (FAQs) from customer support. Some of the topics had already been shown on the website, but others were included in the chatbot only.

An important aspect of the assistant is that when the topic by the customer is not included in the defined content in the dialogue flows and, therefore, the chatbot is not able to answer the customer with satisfactory content, the assistant is able to connect the customer directly to a human agent from customer support. The main aim of the assistant from the business point of view was to reduce calls to customer service, and while the chatbot covers the FAQs, customer service personnel has more time to focus on the more complex customer needs.

The design process of the assistant started with content definition by identifying FAQ topics from the existing log, as well as through other customer contacts, and prioritizing them into the use cases the assistant should cover through the chat. The conversation flows were created in the form of questions and answers based on the identified use cases. The existing material was formatted to fit in a chat format. For example, to avoid too long text that is difficult to read, the answers were shortened where possible, keeping still the legally approved text as such. There, an approach to include "conversational content" as separate bubbles in addition to the FAQ content made it easier for customers to understand which part is the official content and what was the content just for the purpose of making the chat experience smoother.

As the solution is rather straightforward without any complexities in the conversation flows, the main challenges were not in the design and the creation of the chatbot content but rather in the process of getting everything approved inside the company and getting the connection between the chatbot and live chat with a human agent to work fluently. When the chatbot connects a customer to a live chat,

the human agent also gets the chat content so far and, according to that, can get fast into solving the problem of the customer.

The chatbot was implemented on the brand website as a pilot in one market and with one language first. After going live, the assistant reduced a significant amount of customer contacts from customer support and, that way, was able to perform as a buffer between customers and human agents as it was planned to.

4.3. Case Study 3: Mobility Assistant

Project aim:	Orchestrating several sources into a personalized service offering through an application
Done with:	Group level + Brand C
When:	2017
Outcome:	Prototype
Involved roles:	Project management, product owner, service designer, UX and UI design, data analytics, data science, software development
Used in publications:	V, VI

This project focused on customers' challenge of choosing and finding appropriate service choices (mobility services) depending on their travel model preferences, time, weather, general traffic and the journey from place A to place B. The aim of the project was to prove that such a service can technologically function and that there is a concrete value from such service to customers.

The content definition started with understanding the situations of users where the assistant can provide value. Through user interviews, the team built an understanding of which parameters needed to be taken into account in forming a service offering, how to make the user journey as fluent as possible and the key behavioural aspects that should be in the core of providing the service solution to the customer. A major part of the project was to find out which systems and data sources are available and how the key parameters can be integrated in the backend system of the assistant to provide the right content for users.

With the defined service journey possibilities and the service offerings, the design process continued with the UI design. The main intelligence of this assistant and the actions it makes happen in the backend service system. The user interacts with the assistant through a chat view in a mobile app where the NLP technology allows the assistant to understand what the intents of the user are and, based on that, selects and orchestrates the service offerings to fit the user needs and usage context. The UI, therefore, consists of a chat view and graphical presentation of service choices the assistant suggests to the user. Here, the design challenge was to connect the

conversational content with the visual interface to function together seamlessly.

The first prototypes of the assistant were created as paper prototypes and low fidelity digital wireframe prototypes. These prototypes offered a way of learning how the UX can be built and what the backend systems the assistant needs to connect with to provide the service are. The project ended as a mobile app prototype that demonstrates the technical functionality and possibilities of the assistant, as well as the customer experience with the UI.

One of the biggest challenges for creating the assistant was incorporating contextual understanding in the system. External data sources provide a base for understanding the context. In addition, contextual understanding through the conversational interaction can increase the accuracy of the assistant in fitting the service offerings, as well as the chat content, to the right situation the user is in.

4.4. Case Study 4: Product Support Assistant

Project aim:	Providing information on product functionality through a mobile app
Done with:	Brand B
When:	2017
Outcome:	Proof of concept
Involved roles:	Project management, product owner, service design, UX and UI design, data analytics, data science, software development
Used in publications:	V, VI

The product support assistant is a project focusing on providing customers with information on the features and functionality of a product as a chat interface in a mobile application. The need for such an assistant comes from acknowledging the user situation when something goes wrong and reaching the user's manual to get advice on how to solve the situation. Instead of doing the tedious work of going through a manual book and searching for answers, a user could just talk to a chatbot and get the answer directly.

The design process for the assistant started with defining the most crucial content that the user needs and, therefore, should be included in the chatbot. From the technical point of view, the team had to discover the backend systems that the assistant needs to be connected to in order to provide the service to users and the kind of technology that would be most suitable for the purpose of the assistant.

In addition to the NLP in the chatbot, the assistant also needed a technology to detect the content in a digitalized user's manual and extract the text and visual content into a form that is suitable to be displayed in a chat view. In the definition process, it was realized that the content for specific user questions may be scattered

in various sections of a manual and, therefore, the assistant should be able to connect different sources into a fluent chat answer.

The aspect of having scattered content was also a challenge for the design of the chatbot. For the purpose of creating a PoC, an exemplary conversation flow was created to demonstrate the possibilities of creating a fluent conversation with the content that helps users with their problems. The PoC also included the design for the UI with a chat-view style on a mobile app and the design of the assistant's character and tonality. The interface also allowed the use of visual content, which was included in the chat bubbles.

The main challenges in the project were getting the source content to be compatible with the NLP system and getting the content in a form that is suitable for chat view. Often, the content text was too long; it had too detailed images that were impossible to extract into the chat view. Also, including legally approved content was a challenge, as the content could not be changed in any way.

The project ended in a PoC on a mobile app, with limited source data and conversation flows. The PoC showed that the use of legally approved content is possible to transform into an intuitive chat view and that this kind of assistant can provide concrete value to users when finding content quickly and easily any time. For the brand, this provides a new source to provide customer support to users and, through the conversation data, learn about the challenges they have with the product.

4.5. Case Study 5: Service Orchestrator

Project aim:	Orchestration of service offerings for individual needs of users
Done with:	On Group level
When:	2017–2018
Outcome:	Prototype
Involved roles:	Project management, product owner, strategic service design, design steering, user research, UX design, UI design, data analytics, data science
Used in publications:	V, VI, VII

The service orchestrator is a future-oriented concept of a personal AI assistant that learns about the habits and behaviour of a user and is able to proactively provide service solutions and suggestions based on the preferences of users, their current situations and their moods. The assistant was created as a smartphone application prototype to show key concepts of user journey and UX. This project was created to give inspiration and direction on how service ecosystems merge and connect at the

background of services and how an AI assistant can ease the life of users by making initial choices and orchestrating service input and content, reducing the input overflow of users.

The content definition of the assistant started with creating scenarios of future usage situations, utilizing methods from speculative design. Also, personas were created, and together with the scenarios, they functioned as a basis for the use of embodied design methods as role-play to better understand the usage situations and context. During the role-play, the team ideated solutions for the assistant content and possible user journeys.

Reflecting on the created user journeys, the conversation flows were created to replicate the wanted UX and assistant functionality. The assistant utilizes various forms of technology – such as facial recognition, contactless payment and Internet of Things connection – to reach the desired service offerings. As an orchestrator, the assistant is a channel for users to easily connect with a larger service ecosystem where service content and interfaces are merged to the meet the needs of the user.

As the assistant concept is future-oriented, the design of the UI was done rather openly – leaving out the current restriction of technology, which we can assume will be improved in the future. For the purpose of concretizing the value of the assistant, an interface was created on an existing device (smartphone) – even though in the future, the interface could be something different. Creating a mobile app made it possible to communicate the core idea of the assistant to stakeholders and possible users. The prototype gives a future orientation for the design and development of a personal assistant and shows the possibilities AI assistants may bring into the context of complex service ecosystems.

5. Summary of Findings from the Original Publications

The following seven sections summarize the findings from the original publications. For further details of the publications, please see "Original Publications" at the end of this thesis.

5.1. I. Humanizing an Organization through Digital Experiences

Bernadette Geuy, Rachel Hollowgrass, & Titta Jylkäs (2017). Humanizing an organization through digital experiences. *Proceedings of IASDR Conference 2017, Re: Research*, Cincinnati, Ohio, USA, 31 October–3 November, pp. 1529–1543. doi:10.7945/C2G67F

This article is a short paper that introduces the topic of humanizing an organization in the context of digital service ecosystems. The research asks the following questions: How can humanizing principles be codified and championed in ongoing UX design work on campus? What does "humanizing" mean and look like from a design perspective for digital experiences? The research data came from three use cases that were conducted through a large digital renewal project at the University of California, Berkeley. The data were analysed through open coding and content analysis.

Student information systems are an example of complex service ecosystems on a large scale. In this context, individual human needs are often lost and left unaddressed. A human-centred mindset is needed in an organization to provide services that can address human needs. In practice, this effort may appear as not only the adoption of design methods and tools to design services but also the adoption of a mindset, on the strategic level of the organization, aiming for change.

One of the key theories the research connects to is the augmentation of students' potential to act upon their own goals. To empower students to do so, the research argues the humanization of an organization happens at all levels of design maturity. The article introduces a maturity model for humanizing an organization through design, including the following four stages: (1) traditional IT focusing on service function, (2) UX design concerned with service experience, (3) service design focusing on an entire service ecosystem and (4) transformation design that can address complex problems and nudge and organization towards a change.

At all levels of design maturity, the context, needs and emotions of people involved should be well-understood and included in the design actions. As the article states, "with the human-centric skills, designers have the opportunity to support the transformational change from the operational level and to strategic level" (p. 10).

5.2. II. Humanizing Organizations – the Pathway to Growth

Andrea Augsten, Bernadette Geuy, Rachel Hollowgrass, Titta Jylkäs, & Marjukka Mäkelä-Klippi (2018). Humanizing organizations – the pathway to growth. *Proceedings of ServDes Conference 2018, Proof of Concept*, Milan, Italy, 18–20 June, pp. 1229–1242. Linköping University Press.

This article investigates the challenges of rooting HCD principles in organizations. The research asks the following question: How can service design be utilized in humanizing an organization investigating human relations, design knowledge and capabilities? The research data consist of data collected through and during a conference workshop with 40 international participants. The workshop documentation, facilitator notes and debriefs, as well as participants feedback surveys, were analysed through coding in three cycles.

The workshop aimed to explore, test and validate a design framework for humanizing organizations developed by the authors. We acknowledge that humanizing an organization is a complex topic that includes several angles that should be further investigated in detail. This paper provides one way for examining organizations through the service design methodology and finding ways how human factors such as interaction, behaviour and values can be given higher attention in organizations.

The concept of using service design to humanize an organization investigates the human relations of the organization and provides ways for designing pathways towards sustainable and healthy growth. Human-centred activities in organizations should encompass both the view of customers and that of employees and go beyond implementing individual tools. Humanizing an organization nudges cultural changes in that organization.

The findings from the workshop indicate that "we are in a first discovery phase for the organizational realm in regard to service design in practice" (p. 1239). The framework presented in the paper provides a way to emphasize the role and relevance of design in developing organizations towards a more humanized entity.

5.3. III. Embodied Design Methods as Catalyst for Industrial Service Design

Titta Jylkäs & Essi Kuure (2018). Embodied design methods as catalyst for industrial service design. *Proceedings of DRS Conference 2018, Catalyst*, Limerick, Ireland, 25–28 June, Vol. 5, pp. 2962–2972.

This article investigates the value of embodied design methods in an industrial service design, asking the following question: How can embodied design methods support an industrial service design process? The research data include a case study of a co-creation workshop which was held with a team from the Volkswagen Group and the service design team at the University of Lapland. The workshop case is not related to any of the case studies presented in Chapter 4. The research data were analysed through coding in two cycles.

The research findings identify different layers of the usage of embodied design methods in an industrial context. Embodied design methods can help an industrial service design project team to humanize the process, with a strong customer focus. Embodied design methods can be utilized as a catalyst for the design process by producing large amounts of qualitative data through the embodied engagement in a workshop setting.

The understanding of service context becomes more experiential through embodied methods, which allows the project team and stakeholders to form a shared vision and goals for the service being created. When the results from co-creation workshops using embodied methods are systematically documented, they function as a base for further design development. In addition, embodied design methods can help teams to create a strategic positioning for their projects inside an organization through a reflection of workshop outcomes in the organizational context and culture. Especially in industrial projects, having a strong commitment from stakeholders inside an organization is vital for the continuation of a project.

5.4. IV. AI Assistants as Non-human Actors in Service Design

Titta Jylkäs, Mikko Äijälä, Tytti Vuorikari, Vésaal Rajab (2018). AI assistants as non-human actors in service design. *Proceedings of 21st DMI: Academic Design Management Conference, Next Wave*, London, UK, 1–2 August, pp. 1436–1444.

This article is a conceptual paper that explores the topic of non-human agency in service through a focus on AI assistants. The research asks the following questions: How can AI assistants affect a service encounter? And how should AI assistants be considered in a service design process? The research bases on a literature review.

The research demonstrates that AI assistants, as an example of a non-human actor, play a significant role in value co-creation in service encounters. In the article, we discuss the concept of humanness and the ownership of human attributes, arguing that the lack of human traits does not prevent a machine from having agency: "Our point of departure is that acting does not necessarily require a person – or an entity with human attributes – who practises one's agency" (p. 4).

When an AI assistant is considered as an actor in a service, it should have a clear purpose in the service delivery. This can be either in direct contact with customers or indirectly through backend service – for example, by supporting the human agent to provide the best possible service value to the customer. Often, in service systems, the agency of elements other than humans is underestimated; therefore, we argue that in service design, AI assistants should be considered as significant actors in service encounters. In doing so, the aspect of human-centricity may need to be extended.

The use of AI in services can change the way people are able to interact with services as well as reveal information that can help improve the service offerings. AI assistant as a direct customer interface creates service value in conversations with customers. In the backend of service, the AI assistant provides information and analysis which augments the abilities of human agents in customer service.

5.5. V. Designing with Artificial Intelligence – AI Assistants as a Gateway to Complex Service Ecosystems

Titta Jylkäs & Alexander Borek (2019). Designing with artificial intelligence – AI assistants as a gateway to complex service ecosystems. In Miettinen, S., & Sarantou, M. (Eds.), *Managing complexity and creating innovation through design.* New York, NY: Routledge. pp. 79–88.

This article focuses on AI assistants and their role in complex service ecosystems, asking the following question: How is a design process for an AI assistant in automated service interactions in complex service ecosystems? And what are the success factors that can be applied in the design of an AI assistant? The research data for this article consisted of all five case studies (see Chapter 4). The data were analysed through content analysis.

The article demonstrates the change towards more complex service ecosystems that emerge through the advancement of technology, the rise of computing power and the connectivity of service entities. In such service ecosystems, AI assistants provide user-friendly access to the wider range of service offerings.

The research focuses on the design process of AI assistants and identifies seven stages: (1) content definition, (2) character design, (3) conversation flows, (4) UI

design, (5) prototyping, (6) testing and (7) implementation. Further, comparing the process to an industrial service design process, differences can be found. The research summarizes the unique aspects of designing AI assistants into eight success factors, which are considered as generic guidelines for AI assistant projects:

(1) Make sure the real customer needs are addressed, instead of being driven by the technology only. (2) Find the right balance between what is possible with the technology and what creates value for the customer. (3) Note that customer research at the beginning ensures the right direction, but it does not need to give all the answers yet. (4) Use PoCs and prototypes to communicate viability, feasibility and value for the customer. (5) Aim to go live at an early stage to ensure continuous feedback loop from customers. (6) Build the assistant piece by piece and add features incrementally while learning over time from customers. (7) Test the variables of the assistant with customers in a co-creation setting: the assistant content, logic of the conversation flows, perception of the assistant personality as a representation of the brand, tone of voice, combination of visual content and conversations, successful completion of the customer requests, customer acceptance and ease of use (8) Ensure specific skills are available to combine the right mix of skills in technical programmes and HCD: writers, developers, data scientists, service designers and UX and UI designers.

5.6. VI. From Hype to Practice – Revealing the Effects of AI in Service Design

Titta Jylkäs, Andrea Augsten, & Satu Miettinen (2019). From hype to practice – revealing the effects of AI in service design. *Proceedings of Academy for Design Innovation Management Conference, Research Perspectives in the Era of Transformation*, London, UK, 18–21 June, pp. 1203–1216.

The sixth article draws attention to the current application of AI in services, phases of the service design process with AI-enabled services and the work of a service designer. The research asks the following question: What are the implications of the change AI brings to the practice of service design? The research data consists of all five case studies (see Chapter 4) and seven expert interviews with designers. The data were analysed through coding with three cycles.

The research takes AI assistants as an exemplary form of AI application in the context of digital services. It introduces an extended diamond service design process model, including 10 phases which are extended from the research introduced in Article V (see section 5.5.). The model shows that the inclusion of AI and data analytics already has potential from the early phases – providing more information that provides more clarity for the design activities.

The findings show that aspects such as a lack of access to good-quality data and purposeful tools are hindering the application of AI technology in the creation of services. Currently, AI is mostly used in the backend of services, where it can augment the abilities of the service system through, for example, analysing data, doing service personalization and predictions and providing suggestions to support proactive service offerings.

The changes AI brings to the role of a service designer are related to the use of the technology in the design of service solution and the adaptation of AI in the design work itself. When AI is involved in a service design process, the role of a designer is as the sense maker to translate the requirements and available information through data into design solutions. In the process, some design tasks, such as creating variations on wireframes and prototypes, can also be automated through AI tools.

5.7. VII. Service Design Creating Value for Industrial Corporates through AI Proofs of Concept

Titta Jylkäs, Essi Kuure, Satu Miettinen (2019). Service design creating value for industrial corporates through AI proofs of concept. *Proceedings of Academy for Design Innovation Management Conference, Research Perspectives in the Era of Transformation*, London, UK, 18–21 June, pp. 620–628.

The seventh article focuses on the usage of PoCs for AI-enabled services in an industrial corporate setting. The research asks the following question: How does service design contribute to creating PoCs in industrial corporate contexts? The research data consisted of two workshop case studies which are included in case studies 1 and 5 (see Chapter 4). The data were analysed through content analysis and visual mapping.

The findings show that PoCs may provide value at several stages of the industrial service design process. In the ideation phase, PoCs are a form of concretizing ideas with low-fidelity proofs for the validity of the idea. This can be done, for example, with embodied design methods that make it possible to also concretize service experiences that may require technologies that are not yet available. In such situations, human-to-human role-play was seen as a more efficient way of exploring and ideating possibilities for service interactions.

In the example of creating PoCs for an AI assistant, the role of a technological PoC was seen as important to test the functionality of machine-generated conversations and confirm if the technological level and design expectations can be matched. A PoC with the actual technology provided a means of communicating the content to users and receiving their feedback in an early phase of the design process.

In the context of industrial corporations, winning the support of partners and stakeholders is essential for the continuity of a project. After the workshop, the PoCs were used in internal communication in the organization to help other stakeholders understand the aims of the project and generate the support needed to gain management approval to continue the project.

6. Discussion

The discussion comprises the findings from the original publications, presented in Chapter 5, and considers them based on the theoretical framework of this research. The following four sections focus on the key themes of the findings.

6.1. AI Changes the Design of Digital Service Interactions

As the findings show, AI reshapes the service interactions by providing new forms of interaction, such as machine-generated conversations; creating different ways to portray content; allowing the use of a service through various channels, such as accessing an AI assistant (Figure 6) anywhere you go (e.g. through smart devices, home appliances and wearables). The change in service interactions creates not only new opportunities for the design of service experiences but also challenges such as narrowing the interaction only to text or voice, as compared to graphical displays that have been the norm (Allen et al., 2001). This has a tremendous effect on how service value can be delivered through AI-enabled service channels.

AI-enabled services are often a part of a larger, complex service ecosystem. AI can be either in the service frontend, directly affecting the UX, or in the service backend, augmenting the abilities of service providers and increasing the intelligence of the service system. Nevertheless, an individual service touchpoint, such as an AI assistant, has very limited impact in creating a holistic service experience if it is deployed in isolation from the rest of a service ecosystem (see Figure 6).

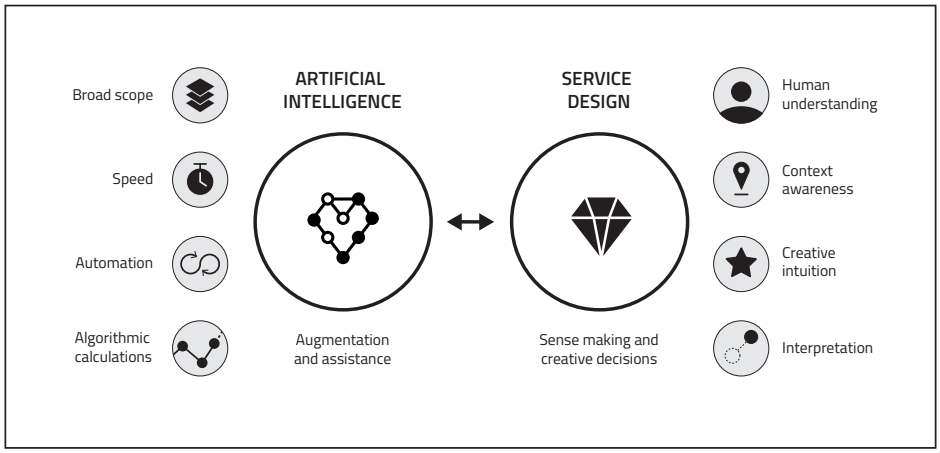

Figure 6: An AI assistant as a connection between the customer and the service ecosystem (from Article V).

Understanding the service ecosystem constructs, interdependencies between service components and interactions of services with each other is important for creating a service that can truly solve user challenges and create value both to the user and to the ecosystem stakeholders. Having a larger view of a service ecosystem – including the social structures, with rules and norms behind the service actors (Vink et al., 2019) – reveals where the gaps in value creation are and where AI may have an essential opportunity to improve the UX. Extending the service ecosystem with touchpoints such as AI assistants may, in the end, simplify the service ecosystem for the user when the content of the entire service ecosystem is brought to the user through one interface.

Service designers also need to acknowledge that technologies such as AI may change the behaviour of people and the way everyday activities are performed is changing. A situational, contextual and behavioural understanding of users is expanding the focus of designers beyond service interfaces. Even the emotional states and moods of users may affect how service interfaces are perceived and used. For example, getting updates on your car maintenance status while nervously trying to navigate through heavy traffic is not the right place nor time for the service content. The context and situation play an important role in how users perceive, accept and use AI-enabled services. This shows how well service experiences are bound to "spatio-temporal conditions" around the user (Lusch et al., 2016). The way organizations manage to implement AI-enabled services in the everyday rhythm and habits of people defines the success of the service.

When an AI-enabled service is a part of a larger ecosystem where data are collected from various sources, ML can be utilized more effectively across the entire service

ecosystem. As AI solutions require data to improve, a whole service ecosystem benefits from distributed data collection and centralized data analysis. Then, in addition to the collected behavioural and service usage data from a service, external data sources (such as social media feeds, media broadcasts, weather information and traffic flows) can help in understanding the context and situation where users are in contact with a service. Aiming for information being as comprehensive as possible for service use, may benefit service improvement drastically. The aspects of the context and situation of users can also influence how designers approach defining design problems and solving them, as Dorst (2019) defines, in co-evolution.

There is currently a lot of hype around AI, and many organizations have gotten inspired to start utilizing AI in their service systems. Still, including AI in a service just for the sake of having the technology is not a target in creating AI-enabled services. The components behind service systems, technology included, should be adapted to the purpose of the service, which can be defined with users in co-creation (Kristensson et al., 2008; Rönnholm, 2017). Understanding the fundamental human needs and the desired interaction with users can show that AI may not be the right solution to achieve the goal. To judge the purposefulness of AI integration for a service, service designers need to understand the functionality of AI technology at a general level.

This research has revealed that even though AI may create new digital forms of service interactions, it does not reduce the need for human-to-human interaction in services. There are many service situations that are more sensitive, difficult or complex for current AI to handle and where human interference is needed to provide the service value. On the other hand, there are also situations where human interaction is faster, more secure and reliable, and therefore, users prefer to interact with humans. This choice of service interaction in a multichannel service (Sousa & Voss, 2006) provides users with higher flexibility and comfort. While variations in service interactions between human and technology are numerous, a tendency to mix human-to-human interaction and human-to-machine interaction into the same service journey may show increasing popularity as the usage of AI becomes more common in customer services.

When a service has its foundation in a comprehensive understanding of users (including their needs, behaviour and situation) and the service context, the service interactions can be constructed from the available service modules that include digital channels, AI solutions and purely human-to-human encounters. This gives an opportunity for a collaboration between the AI system and human agents to provide the best service value. In a world where real-time data from users and the service context are available, the multichannel services become more situation-sensitive and the individual customer needs are addressed on the spot.

6.2. AI Assistants Perform as Actors in Digital Services

This research has considered AI assistants as examples of AI-enabled services. As introduced in the original publications, an AI assistant utilizes natural human language as text or voice as the means of interaction with users. Depending on the purpose, service scope and level of intelligence, an AI assistant can function as an important actor, and a service representative, in delivering service value to users.

Besides performing as an actor and as a conversational partner in service encounters, AI is often used in the service backend (Janarthanam, 2017). There, the impact of AI is more difficult for a user to recognize, but it is the backend intelligence that allows an AI assistant to perform in conversations with users. In the service backend, AI can, for example, collect information and provide analytics about user behaviour and service interactions. This type of information can be used for providing predictions, recommendations, optimization and personalization of situationally relevant service content (Agrawal et al., 2018; Campbell et al., 2020). These self-learning systems increase the accuracy and quality of a service without being in direct interaction with a user.

In AI assistants, the service content is stripped down to pure language, and therefore, the delivery of service value needs to be re-thought, as we are still mostly used to graphical interfaces. The way the content, the tonality of language, the mode of conversation and the character of the assistant are designed plays an important role in creating a desired UX. Service designers need to be able to transfer the customer experience and service content into intuitive conversations without reducing the value of the service. Here, mastering the design of conversations is crucial (Chefitz et al., 2018; Guzman & Lewis, 2020).

As the AI technology evolves, the value of service backend intelligence may provide higher value than the conversational interface itself. When the service ecosystems become more complex, an AI assistant creates value, for example, by orchestrating service tasks through multiple service channels in the ecosystem and automating processes on behalf of a user. The role of an AI assistant is to personalize service content for users by reducing the complexity of a service ecosystem through the selection of service content it considers most suitable for the user, depending on their needs and current situation.

Providing the generated analytics (e.g. through performance suggestions to human agents such as customer servants) also improves the quality of a multichannel service. Here, an AI assistant augments the abilities of a human agent in providing the service and, through the provided information, increases their ability to act in the service encounter with users. From the perspective of designing the UX of an AI assistant, both service frontend and service backend are equally important – as the backend functions also enable the experience in the end, even though it would not be directly visible to the user.

6.3. AI Needs to Be Human-Centred Rather than Human-Like

The research introduces the topic of humanizing. Coming from an organizational point of view, two of the publications (Articles I and II) discuss how a focus on human factors such as interactions, behaviour, values and culture is the basis for both service design practice and organizational transformation. Similarly, a service ecosystem consists of complex constructs that can benefit from the humanization of problem solving for service functions and growth. In service ecosystems, human factors may often be overlooked, as the focus is on system optimization and technological functionality. Therefore, the topic of humanizing digital service ecosystems requires looking at the individuals behind the technological solution: both the end users and the people providing those services.

Humanizing refers to actions that take the humans in their centre, whether it is within an organization or in a service ecosystem. In AI-enabled services, the aspects of humanization should also be looked at through the term of humanness; however, what does it mean for a service to be humane? Often, this translates into being human-like, which depicts translating the characteristics of humans into something artificial, such as an AI-enabled service. Especially with services such as AI assistants which aim in conversational interactions that are as natural to humans as possible, the boundaries of humanness may become unclear. When an AI assistant behaves like a human and appears like a human, it is difficult for users to know if they are interacting with a human or machine. This raises concerns on the ethics of the service, especially if users are purposefully misguided (Dignum, 2018; Gordon, 2019). In the Anthropocene, this blurry boundary between humans and machines is more common, and it is also a challenge for the responsible creation of AI-enabled services (Dignum, 2017a).

The findings indicate it may not be meaningful or even beneficial for an AI-enabled service to replicate human-like features. Features such as a 3D avatar that looks like a human may easily end up in the uncanny valley[12] and make the interaction with the assistant uneasy for users. Rather, going beyond the superficial human-like features, such as appearance and behavioural traits, into the core values of humanness, such as morality and ethics, gives a substantial ground for an AI-enabled service.

Focusing on human values in the design of AI-enabled services can be understood as striving for human-centredness. Service design should always focus on the core of human needs, if not even on human dignity (Buchanan, 2001b). No matter how technological a service is, it is still created for people. This can be realized, for example, by investing in human-centred research at the beginning of a service

12 Uncanny valley refers to "the phenomenon whereby a computer-generated figure or humanoid robot bearing a near-identical resemblance to a human being arouses a sense of unease or revulsion in the person viewing it" (Lexico Dictionary by Oxford).

design process and making sure to get feedback from users along the entire design process.

Another important aspect to foster human-centred AI comes from the considerations of privacy. It should be clear which type of data is essential for an AI-enabled service to train and function properly and if the use of personal data can be avoided to respect the privacy of users. The aspect of privacy arises also while users interact with a service: Which type of data is collected and who can access it? Showing the use of technology and data transparently is essential in building trust with users, which is fundamental for all services; without trust, there are no users.

When designing AI-enabled services, a human-centred approach should be in the core actions of the design and development team. All the team members have their values and views of the world, and those can easily transfer into the service solutions causing unintentional bias, discrimination and the exclusion of users if not being cautious. Already, the selection of data to train the algorithms gives a foundation for the AI system and specifies who the service targets and which user groups may be excluded (Smith, 2019). For example, if a facial recognition system is only trained with images of Caucasian men, it will have difficulties in recognising people of any other origin and/or gender (Buolamwini & Gebru, 2018). It is difficult to get rid of one's unconscious prejudices, but this is one of the ethical issues that a service designer should actively address when designing AI-enabled services. As Broussard (2019, p. 67) expresses it, "Computer systems are proxies for the people who made them".

Besides the aspects of privacy and inclusion, the broader impact of a service should be addressed when creating AI-enabled services. Usually, the scope of a service and the number of users give direction on what the impact of a service is to individual users, the service system and the providing organization. If a service fundamentally changes how people behave in a certain context, it also has an impact, from a larger view, on society (Kile, 2013). This may be difficult to predict. However, at least, different scenarios should be considered, and legal experts should be consulted to find out the responsibilities of the service provider. Even though service designers are used to working with large service systems, the impactful side of an AI system extends the design considerations even beyond a larger service ecosystem.

As it seems, the human-centred focus of AI systems expands from individuals into large constructs, even to the societal level. To navigate this scope, it benefits a service designer to have a clear understanding of their own stance: What are the values that guide their actions as a service designer? What are the cultural traits that are reflected in their decisions? And which of their decisions affect the performance and impact of the service system? If one is truly being human-centred in creating AI-enabled service, one should be able to start from separating their own presumptions from the understanding of users. With the human-centric skills, service designers have the ability to construct complex service solutions to support the transformational change the solutions may bring.

6.4. AI Assists and Augments the Practice of Service Design

The effect of AI in the practice of service design is twofold. As seen before, AI is becoming more often an element of service solutions which service designers are designing. On the other hand, it is more common to have AI as a part of the service design process as well. This way, the technology has an effect on both the design artefact and the design practice. Even when the design artefact does not incorporate AI technology, AI may still be part of the design process and vice versa. Still, the findings show that designers do not yet have set process models for working with AI.

The service design process model (Figure 5) introduced in Article VI demonstrates that the benefit of utilizing AI already comes at the early stages of the design process. Having structured data that consist of both quantitative and qualitative data allows faster data analysis through ML. Having a growing database also allows users' continuous learning and the discovery of new design challenges. Technologies such as computational models of human behaviour can help in forming a comprehensive understanding of users (Banovic et al., 2018). This can also result in creating digital user segments and persona profiles that are constantly updated and can be used to reflect and test design ideas and solutions. This way, a digital user testing process – for example, with early prototypes – becomes faster, especially in situations where real users are difficult to reach.

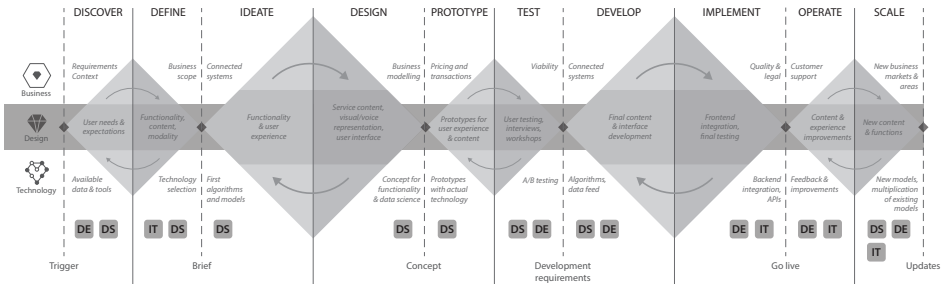

Figure 7: The service design process created by T. Jylkäs for AI-enabled services (Jylkäs et al., 2019).

AI can not only provide smarter tools to support research and analysis but also automate tasks in ideation, prototyping and testing and in the refinement of design solutions. As an example, the first sketches made by a designer can be automatically digitalized through visual recognition and transformed directly into polished vector illustrations (Jain et al., 2018). When a digital design style guide is accessible as a basis for new design solutions, generative design can be used to create a large number of design iterations (for example, for UI layouts) and test them against the digital

personas to make an early selection of design versions that will be taken to the next phase for changes and further testing with real users. The aim is to reduce mundane tasks and give the designer time to focus on the core challenges of the service solution.

When AI is also part of the design solution, the findings show (Article V) that starting to use AI early in the process allows fast iterations and shorter process steps. A realistic understanding of the possibilities of AI with regard to the design challenge defines clear boundaries for the entire design process. AI should only be used where it adds value to the service. Being able to incorporate the technology in service solutions in a purposeful way is a crucial task for service designers. This means designers should also have an understanding of what can be realistically done with AI to achieve good service quality.

When AI technology is more complex or needs more time to develop and cannot be adopted in the design process from the beginning, methods such as embodied design can help in concretizing the abstract technological topic of AI-enabled services (Article VII). Embodied design methods base on bodily movements and experimentation as a part of learning and designing (Blomkvist, 2014; Miettinen et al., 2014). As the findings show, PoCs made through embodied methods such as role-play make the intangible topic of AI concrete and helps the development team and users to communicate and collaborate more effectively with regard to the service solution. Embodiment helps to humanize a service process with strong user focus and supports the utilization of the so-called soft data produced through the embodied engagement in the design process. Human-to-human design methods may show the most potential when the design team is aiming to get into the roots of the user needs.

When a service strategy is aiming towards solutions that are not possible to be realized with current technology, or when the available data are not enough to appropriately train an AI system, it makes sense to break the concept down into pieces that start from the essential capabilities that over time collects more data and trains the AI towards the desired solution (Desouza et al., 2020). This allows incrementally creating the AI solution and building up new features over time when the intelligence improves. Here, as Desouza et al. (2020) have described, ensuring the necessary capabilities and prioritizing the development of intelligence that serve the essential functions of the service gives a solid ground for further service development. This type of gradual design process, which has short- and long-term goals for a service, differs from a traditional service design process. Here, strategic service design skills and transformation design can support the process (Margolin, 2015; Sangiorgi, 2011).

The findings also show (Article VI) that the team creating AI-enabled services may require different areas of expertise, as compared to the design of other types of digital services. As service designers are often connectors between different disciplines and the facilitators of collaboration (Sangiorgi & Prendiville, 2017; Stickdorn et al.,

2017), they need to know where the knowledge gaps are and, therefore, who should be involved in the team. For example, in addition to design experts, data scientists, data engineers, IT experts and software developers represent the core of the team. When dealing with conversational interfaces, screenwriters and copywriters may bring essential skills and knowledge into the team. Also, areas such as law, ethics and data security are equally important when creating AI-enabled services.

The findings show (Article VI) the first implications of change AI brings to the practice of service design. In total, AI and service design have a complementing effect on each other. AI plays a supporting role, augmenting the abilities of a designer. This shows, for example, as providing access to a larger amount of data and performing analysis and calculations. AI also speeds up the service design process by creating design variations and powering fast test iterations as well as through automating mundane design tasks and generating creative content based on set design parameters. AI can, through ML, provide suggestions for design decisions based on content orchestration and predictions. Still, the designer remains the sense maker in the middle of all the provided suggestions and available content (Figure 8).

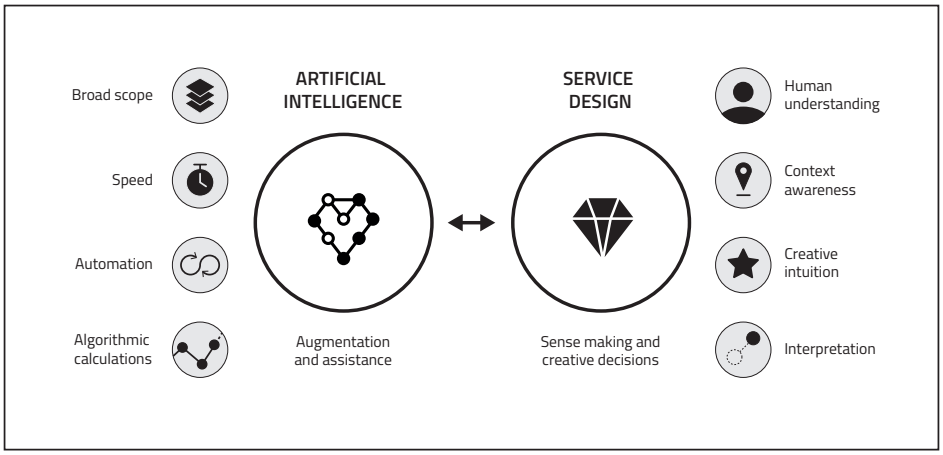

Figure 8: AI and service design complement each other in the design of digital services.

What AI lacks is the ability for interpretation. It does not have creative intuition – which is the strength of designers, being able to create design solutions that stand out and have their own identity. Service designers have the understanding of humans and their behaviour and the ability to use the collected user data to form the user needs that a service can address. Service designers curate and filter the information they get through various channels, also through AI, and make decisions that make sense in the context of the service. This type of context awareness is also what AI, so far, cannot provide.

AI can be seen as an assistive and augmenting ability that helps service designers in their work. Through new ways of working, service design and AI complement each other. What remains as a service design skill also in the future is the flexibility of utilizing the service design methodology and tools in all types of design challenges, no matter if with or without AI. It is also the creative mindset that allows service designers to find ways of addressing new types of service interactions that AI makes possible. Service designers remain as the voice of the users, the sense maker of provided information, the curator of content and the interdisciplinary facilitator for co-creation translating the user and business needs into service solutions.

7. Conclusions

This research has demonstrated the importance of the merge of service design and AI in designing AI-enabled services. The findings have revealed that the effect of AI is both on the design of services that include AI elements and on the practice of service design where AI assists and augments the design practice.

Each of the seven publications has provided answers to its research question(s) (see Chapter 5) that support(s) answering the main research question: *How is AI affecting the practice of service design and the design of digital services?* Chapter 6 provides answers to the research question through the following key claims:

- AI changes the design of digital service interactions
- AI assistants perform as actors in digital services
- AI needs to be human-centred rather than human-like
- AI assists and augments the practice of service design

This research has provided a practice-based view on the use of AI in the design of services and in service design practice in general. The combination of service design and AI may have an important role in practice when the involvement of AI technology increases. As this research has demonstrated, such new undiscovered field requires a thorough examination from the view of ethics and impact on individuals, organizations and society. In addition, how may service design assist in unravelling these aspects of AI? This opens a possible avenue for future research.

As the implementation of AI in digital services is still rather narrow, another future research aspect is the scalability of AI-enabled services. What are the modules and building blocks of AI-enabled services? Are there standard elements that can be re-utilized in different service contexts? And how are service ecosystems formed and enabled through AI capabilities?

Another aspect relates to the delivery of service value: What kind of role do AI-enabled services take in service delivery in the future? What is the role of language in service value co-creation between users and technology? How do AI-enabled services relate to other digital services? How does human-human interaction relate to HMI in service delivery? Is human-human interaction becoming more exclusive when HMI enabled by AI is becoming more common? And what level of autonomy can be given to AI-enabled services?

This research has given a first look at how AI affects the practice of service design. Nevertheless, further research on this aspect should also be done. Some further

research questions could include the following: What is the value of AI in a service design process? How is the value of AI measured in service design? What are the best practices of working with AI in a service design process? And do service designers need to specialize in AI to successfully include the technology in service solutions? These are yet to be answered.

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