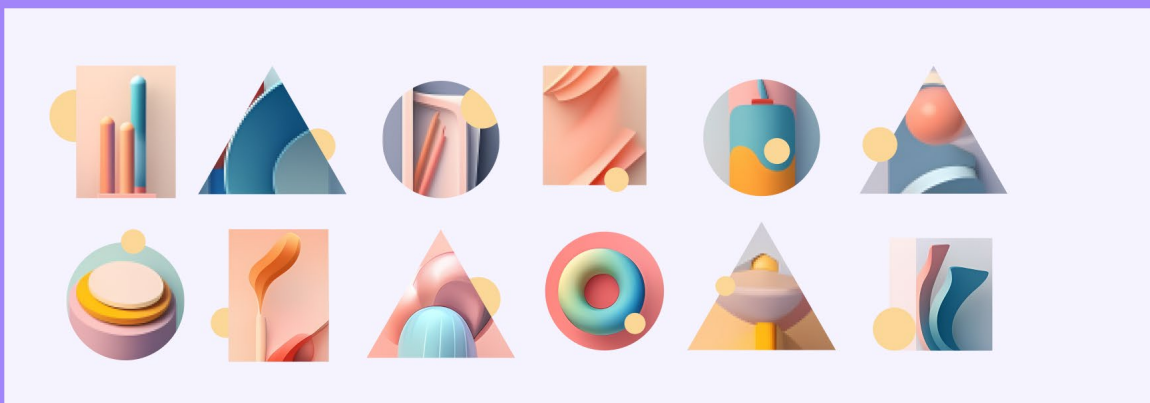**Yan Huang**

Supervisor V.Auricchio

Navigating AI in Service Design

Empowering Service Designers to Unlock AI's Full Potential in the Design Process

POLITECNICO DI MILANO

School of Design | M.Sc in Product Service System Design

Student Yan Huang | ID 963534 | 2020-2023
Supervisor V.Auricchio

Navigating AI in Service Design

Empowering Service Designers to Unlock AI's Full Potential in the Design Process

Index

List of figures & Table

Abstract

Keywords: Artificial Intelligence, Service Design, Design Process, Design Thinking, Toolkit Development, Exploratory Research

Artificial Intelligence (AI) is transforming the way we live, work, and interact with each other. In the field of design, AI has the potential to revolutionize the way we approach service design, enabling us to create more personalized, efficient, and effective services. However, the intersection between AI and service design is complex and multifaceted, requiring a nuanced understanding of the opportunities and challenges that AI presents. It is in this context that the prominence of a structured exploration into AI's potential in the service design process becomes imperative.

The core objective of this thesis is to dissect the nexus between AI and service design, contextualized through three central paradigms: AI's harmonization with the Service Design Process, its alignment with Design Thinking, and its interface with Service Designers. Emphasizing methodological rigor, this research employed exploratory methods to unravel the complexities of this intersection, navigating the nuanced interplay of theoretical considerations and pragmatic applications.

A key deliverable of this investigation is the "AIdea" toolkit, conceived to enable designers to holistically integrate AI into their workflows. Drawing from the primary research and informed by a series of iterative engagements, this toolkit serves as a vanguard for fostering a symbiotic relationship between AI technologies and the service design process. The overarching ambition of the "AIdea" toolkit is to equip service designers with a structured methodology, facilitating seamless and effective AI integration in service design endeavors.

Abstract(Italiano)

Parole chiave: Intelligenza Artificiale, Service Design, Processo di Design, Design Thinking, Sviluppo di Toolkit, Ricerca Esplorativa

L'intelligenza artificiale (AI) sta trasformando il nostro modo di vivere, lavorare e interagire. Nel campo del design, l'IA ha il potenziale per rivoluzionare il modo in cui affrontiamo la progettazione dei servizi, consentendoci di creare servizi più personalizzati, efficienti ed efficaci. Tuttavia, l'intersezione tra l'IA e il design dei servizi è complessa e sfaccettata, e richiede una comprensione sfumata delle opportunità e delle sfide che l'IA presenta. È in questo contesto che l'importanza di un'esplorazione strutturata del potenziale dell'IA nel processo di progettazione dei servizi diventa imperativa.

L'obiettivo principale di questa tesi è quello di analizzare il nesso tra IA e service design, contestualizzato attraverso tre paradigmi centrali: L'armonizzazione dell'IA con il processo di Service Design, il suo allineamento con il Design Thinking e la sua interfaccia con i Service Designer. Ponendo l'accento sul rigore metodologico, questa ricerca ha impiegato metodi esplorativi per svelare le complessità di questa intersezione, navigando nell'interazione sfumata tra considerazioni teoriche e applicazioni pragmatiche.

Uno dei risultati principali di questa indagine è il kit di strumenti "AIdea", concepito per consentire ai progettisti di integrare in modo olistico l'intelligenza artificiale nei loro flussi di lavoro. Basato sulla ricerca primaria e informato da una serie di impegni iterativi, questo toolkit funge da avanguardia per promuovere una relazione simbiotica tra le tecnologie di IA e il processo di progettazione dei servizi. L'ambizione generale del toolkit "AIdea" è quella di dotare i progettisti di servizi di una metodologia strutturata, che faciliti un'integrazione perfetta ed efficace dell'IA nei progetti di service design.

Introduction

00

Background

The burgeoning field of Artificial Intelligence (AI) has witnessed substantial growth and transformation, becoming a prominent area of focus across a spectrum of disciplines. As defined by Russell and Norvig (1995), AI encompasses intelligent systems capable of thinking and learning, an umbrella term covering a myriad of techniques ranging from neural networks, speech and pattern recognition to genetic algorithms, and deep learning. Historically, AI and machine learning have been forecasted as the most influential and disruptive forces in the imminent business landscape. Notably, a survey conducted by America's largest corporations ranked AI and machine learning as the preeminent game-changers (New Vantage Partners, 2017).

In the more recent years, we have seen significant strides in the domain of generative AI and Large Language Models (LLMs). LLMs encompass not only the widely recognized Generative Pre-trained Transformer (GPT) (Devlin et al., 2019), but also extend to various architectures. These applications range from natural language processing to different types of sequential data, including assembly language, protein sequences, and chess games. They are expected to unlock considerable potential across economically valuable use cases, potentially creating new work types (Acemoglu and Restrepo, 2018; Daniel Rock et al., 2022a).

Figure 1
To get a sense of how quickly model capabilities are progressing – consider the jump in exam performance between GPT-3.5 and GPT-4 (OpenAI, 2023b).From Tyna Eloundou et al., 2023, p2

Group	Occupations with highest exposure	% Exposure
Human α	Interpreters and Translators	76.5
	Survey Researchers	75.0
	Poets, Lyricists and Creative Writers	68.8
	Animal Scientists	66.7
	Public Relations Specialists	66.7
Human β	Survey Researchers	84.4
	Writers and Authors	82.5
	Interpreters and Translators	82.4
	Public Relations Specialists	80.6
	Animal Scientists	77.8
Human ζ	Mathematicians	100.0
	Tax Preparers	100.0
	Financial Quantitative Analysts	100.0
	Writers and Authors	100.0
	Web and Digital Interface Designers	100.0
	Humans labeled 15 occupations as "fully exposed."	
Model α	Mathematicians	100.0
	Correspondence Clerks	95.2
	Blockchain Engineers	94.1
	Court Reporters and Simultaneous Captioners	92.9
	Proofreaders and Copy Markers	90.9
Model β	Mathematicians	100.0
	Blockchain Engineers	97.1
	Court Reporters and Simultaneous Captioners	96.4
	Proofreaders and Copy Markers	95.5
	Correspondence Clerks	95.2
Model ζ	Accountants and Auditors	100.0
	News Analysts, Reporters, and Journalists	100.0
	Legal Secretaries and Administrative Assistants	100.0
	Clinical Data Managers	100.0
	Climate Change Policy Analysts	100.0
	The model labeled 86 occupations as "fully exposed."	
Highest variance	Search Marketing Strategists	14.5
	Graphic Designers	13.4
	Investment Fund Managers	13.0
	Financial Managers	13.0
	Insurance Appraisers, Auto Damage	12.6

Table 1
Occupations with the highest exposure according to each measurement. The final row lists the occupations with the highest σ2 value, indicating that they had the most variability in vulnerability-prediction. Exposure percentages indicate the share of an occupation's task that are exposed to GPTs (αα) or GPT-powered software (ββ and ζζ), where exposure is defined as driving a reduction in time it takes to complete the task by at least 50% (see exposure rubric A.1. As such, occupations listed in this table are those where we estimate that GPTs and GPT-powered software are able to save workers a significant amount of time completing a large share of their tasks, but it does not necessarily suggest that their tasks can be fully automated by these technologies. From Tyna Eloundou et al., 2023, p15

An article published in March 2023 examined the potential impacts of the GPT family of models provided by ChatGPT or the OpenAI Playground on the US labor market. Using a novel evaluation system, it gauged occupations based on their alignment with GPT capabilities, amalgamating both human expertise and classifications from GPT-4 (Table 1).The research (Figure 1) suggests that about 80% of the US workforce could have at least 10% of their tasks influenced by the deployment of GPTs, while nearly 19% of workers could witness at least half of their tasks being affected (Eloundou et al., 2023).

This is not the first instance of AI impacting society and particularly the service industry. The continuous integration and influence of AI in the design process have remained a crucial focal point of societal and designer interests. With its profound influence on human behavior, "digital" operating model (Iansiti and Lakhani, 2020), lifestyle, and work methods, AI stands at the forefront of the most significant transformations of the Anthropocene age (Cath et al., 2017; Coeckelbergh, 2013; Kile, 2013).

As I delved into the evolution and influence of AI on service design, I found that the initial focus was heavily centered on backend AI services but are still readily perceptible to users as a distinct category of AI-powered services. These assistants, embodied by entities such as chatbots or voice-controlled assistants like Apple's Siri, Microsoft's Cortana, Amazon's Alexa, and Google Assistant, engage with users through text-based and voice interactions (Jylkäs et al,2019) .

Simultaneously, the focus of AI assistant research has transitioned from technical feasibility (Chen et al., 2018; Yan and Zhao, 2018) and architecture (Hauswald et al., 2016) to value-oriented themes. Explorations into how various forms of AI assistants are perceived by users, given their new interactive modalities, have also been emerging. For instance, studies on the individual elements of AI assistants such as character design (Arafa and Mamdani, 2000) and the representation of emotions, empathy (Shi et al., 2018; Vögel et al., 2018; Yang et al., 2017) and social awareness (Zhao et al., 2016), contribute to a comprehensive understanding of user experience with AI assistants (Moussawi, 2018). Given the digital channels through which AI assistants function, it is simple to involve the user in early testing and feedback loops. The technical infrastructure and readily available tools for creating AI assistants encourage the collaborative creation of solutions with users (Lee et al., 2017) . Service designs adjusted through upgraded AI capabilities necessitate a reconstruction of the underlying design processes adopted by designers. What lays the groundwork for reframing design practice are the problem-solving capabilities inherent in AI. Such service design modifications, adjusted in response to the evolving AI capabilities, suggest that the underlying processes of designers also need to be reimagined.

On one hand, AI should play a significant role in assisting service designers during their design process, such as analyzing substantial amounts of data. Through AI, service designers can efficiently access vast amounts of data when part of the analysis is automated (Jylkäs et al., 2019) . Viewing AI as a tool that enables service designers to collaborate with it has become a strategic approach for some companies (Davenport and Bean, 2017).

On the other hand, service designers need to adjust their thinking and learning paths to better incorporate AI into their workflows. This adjustment necessitates that designers deepen their understanding of the logic behind AI technology (Jylkäs et al., 2019). A skilled service designer needs basic AI knowledge to create viable solutions that meet all requirements. Such knowledge facilitates understanding of the solution's technical scope and effective communication and inclusion with the technical team like AI experts and data scientists in the design process. This leads to an innovative reconfiguration of the AI-service design process.

Despite the consistent academic interest in enhancing the symbiotic relationship between AI and humans (Jarrahi, 2018), with the advent of a new AI era, there is a pressing need to delve into novel modes of collaboration. However, perspectives specifically addressing service design remain scarce.

Even though established guidelines for crafting and regulating AI systems exist (Chatila & Havens, 2019; European Parliament Committee on Legal Affairs, 2017), there is a conspicuous gap in research exploring the human-centric perspective of developing AI-enabled digital services (Cruickshank & Trivedi, 2017; Guszcza, 2018).

As AI and analytics are swiftly becoming indispensable elements of service systems, service designers are confronted with the need to comprehend the potentialities and benefits of embedding AI within service solutions. Despite this imperative, research that delves into the intersection of service design and AI is still in its nascent stages. This highlights a compelling opportunity for further investigation into the symbiosis of service design and AI technologies.

Not to mention that the AI advancements post-2023, epitomized by innovations like ChatGPT and Midjourney, have not only elevated technological prowess but also revolutionized the scope of interaction, increasingly focusing it towards text or voice-based communication. These shifts are set to bring about substantial changes. Therefore, the methods by which service designers integrate AI into their design workflows demand significant enhancement and refinement.

Research network visualization:

Prior to presenting the research network visualization, it's crucial to outline the methodology specific to this chapter, which aims to understand the current landscape of academic literature related to AI and service design.

A desk research approach was employed, focusing on using VosViewer as a tool to visualize existing scholarly work. While a deep reading of all 3,978 papers was not undertaken, the aim was to analyze metadata and keyword relationships among these documents to identify prevailing research trends and gaps. Databases such as Web of Science and Scopus were leveraged to curate a data set that is both comprehensive and relevant to the key terms: 'artificial intelligence,' 'service design,' and 'experience.' Through this approach, the chapter seeks to understand how extant literature is shaping the conversation around AI in service design and where further investigation might be needed.
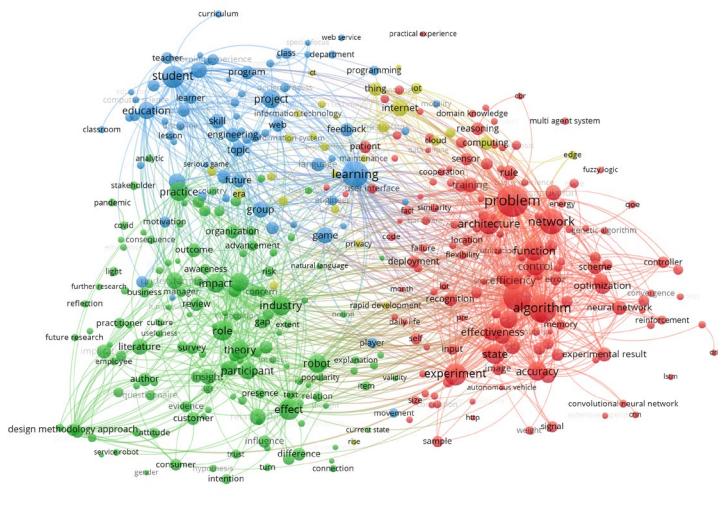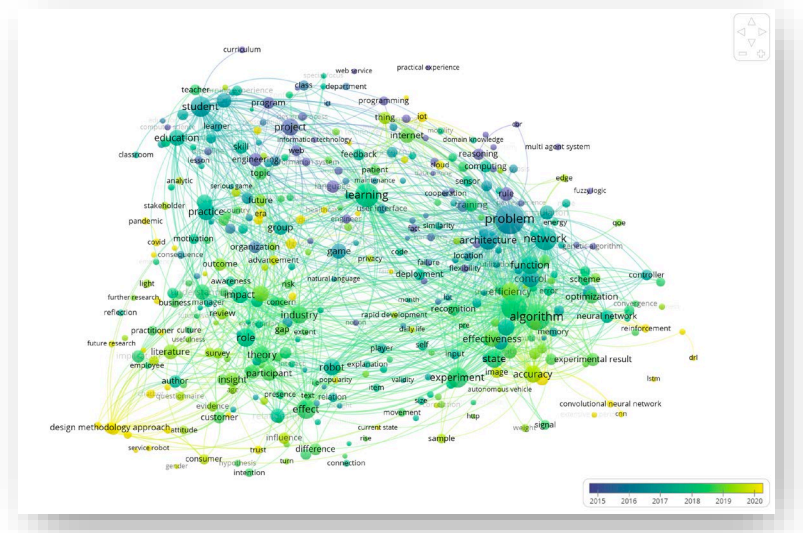
1. While current research predominantly explores how AI restructures relationships and learning methodologies and investigates AI's effect on various sectors and the roles of their players, there is a clear deficiency in studies specifically targeting service design or holistic workflow of service designers. Service design in the context of AI integration demands additional attention.

2. A bulk of studies has identified the learning-centric network as a critical point of focus, demonstrating that AI's role in theoretical learning and practical applications continues to evolve and innovate. It underscores the necessity for humans including service designers to understand and leverage the potential of AI in their design processes, a facet currently under-explored.

3. Although the design methodology approach is a noteworthy research direction, it is relatively uncharted. The scarcity of studies in this area contrasts with its demonstrated potential to impact theoretical learning and industry applications. This suggests an urgent need to examine how service designers can strategically incorporate AI methodologies into their workflows, a topic currently in its infancy.

4. The design methodology perspective is a burgeoning trend in the literature, with most associated studies being recently published. This emerging focus implies a shift towards understanding how AI technologies can be better integrated into design methodologies, resonating with the research gap identified. Furthermore, the recency of this research direction emphasizes the need for ongoing investigation, particularly regarding the incorporation of AI into service design processes.

In this thesis, I will delve into the intricate ways service designers can harness the full potential of AI within their design processes, employing a multifaceted research approach that encompasses a comprehensive literature review. The goal is to incorporate academic perspectives from various dimensions of AI, service design processes, design thinking, and the role of the service designer. Through both qualitative and quantitative research involving service designers, I aspire to offer an exhaustive understanding of the present scenario concerning AI's integration into service design. Additionally, this exploration seeks to shed light on the hurdles faced by designers and the avenues available for refinement. This thesis aims to bridge the current research gap and contribute meaningful insights to enhance the synergy between AI and service design.

Literature Review

01

This chapter explores the intricate relationship between AI and the field of design. Underscoring AI's disruptive force, the literature review meticulously integrates both broad overviews and specific case studies. Detailed sections will examine AI's influence on the (Service) Design Process, its integration with Design Thinking, and its collaborative potential with Service Designers, illuminating the nuances of each intersection and their implications.

Methodology for Literature Review

The methodology behind this literature review was systematically designed to ensure a comprehensive exploration of the complex intersection between AI and the field of design. To initiate the study, a narrow scope of desk research was conducted, focusing on high-impact papers that have previously explored web visualization and AI in the context of design. This initial investigation helped to map the broad outlines of the existing scholarship, highlighting key topics and recurring themes.

After identifying these preliminary key topics, a secondary phase of review was initiated to cluster these into overarching themes or findings. This involved the careful examination of a broader range of academic papers, industry reports, and case studies. Some initial key topics were merged, based on their coherence and interconnectedness, into more potent high-level findings. Others were integrated into these findings as subtopics, thereby enriching the overall structure of the review.

The iterative process led to the finalization of three core findings that serve as the backbone of this literature review (Figure 4).
These are:
1) AI with (Service) Design Process,
2) AI with Design Thinking,
and 3) AI with Service Designers.

These three categories were selected based on their recurrence in the reviewed literature, their relevance to the field, and the transformative potential of AI in shaping these aspects of design. They represent the synthesis of insights drawn from seminal works by Verganti, Iansiti & Lakhani, Jylkäs, and others.

By delineating the methodology used to derive these key findings, this literature review aims to offer not just a synthesis of existing scholarship but also a structured framework that future research can build upon.
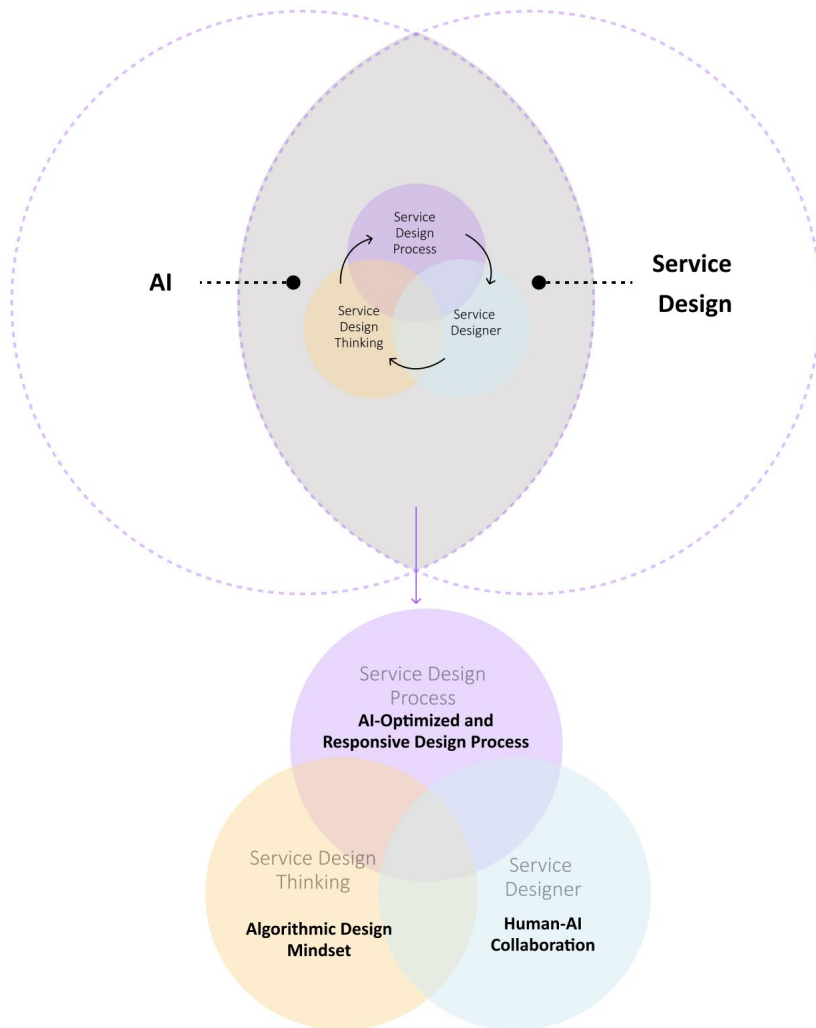
Literature Topics Method Mapping on AI & Service Design, providing a holistic view of the intersection between AI and Service Design, distilled from an expansive literature review. Made by author.

1.1 AI with (Service) Design Process

Traditional design process frequently encounters an array of restrictions, for example, individual user-centered solutions are neither pragmatically feasible nor financially justifiable. Thus, products and services are created for specific user groups, allowing for customization during production. Once a product was launched, the context would change—market conditions, technological opportunities, and user feedback offered insights for redesigning the product. However, due to the high costs and efforts associated with redesign, innovation would be deferred until a new product's marginal value exceeded the design cost, thereby commencing a new design cycle (Figure 3) (Verganti et al., 2020).

Figure 5
Design practice in the context of traditional human-intense operating models.
From Roberto Verganti et al., 2020, p9

With the advent of AI, the design process experiences a dramatic transformation. Traditionally, design activities heavily relied on human input, but AI has the potential to revolutionize this dynamic. Data collected can be used to inform AI systems, which exhibit problem-solving capabilities. When properly programmed, AI systems can autonomously generate tailored solutions for individual users without requiring human intervention (Iansiti & Lakhani, 2020).

Such technological advancements engender two principal effects: 1. Decoupling the problem-solving loop from the design process, and 2. Making the design process a real-time learning journey constantly updated based on user data (Verganti et al., 2020).

The majority of the design decisions, particularly during development, require less creativity and more of problem-solving skills. These so-called "problem-solving loops" (Figure 5) collect individual user data, which is then utilized by an AI engine to develop optimal solutions for the specific user at the exact moment it is needed. With the continuous collection of new data and the inherent learning capabilities of AI, these problem-solving loops constantly refine their predictions about user needs and behaviors, leading to increasingly better design solutions.

In such an AI-augmented milieu, the designer's role transitions from crafting solutions to architecting these problem-solving loops (Verganti et al., 2020). In essence, within the context of AI, designers shift their focus to crafting the structure of these problem-solving loops, leaving the solution generation to the AI engine.
This notion is corroborated by the AI-enabled services process outlined by Jylkäs, which showcases the initial transformations ushered in by AI in the service design process (Figure 5) (Jylkäs et al., 2019).
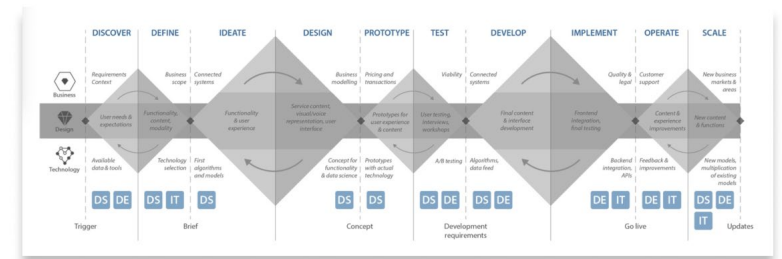
The imprint of AI in the service design process is reflected in the early incorporation of technology across various design phases—from data aggregation and analysis, to algorithm exploration during ideation, design stages, and actual prototyping and testing. The inclusion of AI necessitates numerous short iterative cycles, aligning seamlessly with the agile workflow protocols of DS, DE, and IT teams.

Both theories agree that AI is reshaping the way designers collaborate within the teams. AI expands digital automation into the realm of design. It can be used to accelerate traditional design tasks. For instance, Airbnb is developing an AI system that automates the translation of designer's mock-ups into software engineers' component specifications, based on standardizations and classifications of all design components (Saarinen, 2017; Schleifer, 2017). Also in Jylkäs' AI-service-design process emphasizes the need for collaboration among service designers and technical experts. Effective integration of AI into the service design process demands expertise in AI and requires the participation of data engineers, data scientists, and IT professionals throughout all stages. With most of these teams already using agile workflows, shorter cycles in the service design process can lead to easier integration with other organizational procedures (Jylkäs et al., 2019).

1.2 AI with design thinking

The significance of AI in the realm of design thinking is multifaceted and transformative. It goes beyond simple automation, reshaping our understanding of design (Verganti 2009, 2011a and 2011b). The integration of AI does not disrupt design thinking at its core; instead, it bolsters the principles that underpin it (Verganti et al., 2020).

One of AI's transformative influences is its ability to handle and process massive quantities of data. In the past, designers developed solutions with large user groups or customer segments in mind, resulting in designs that lacked the nuance of personalization. AI is equipped to bypass these constraints, crafting tailored solutions for each individual user. This represents a shift in design thinking: the more complex and detailed the user data, the more accurate are AI's predictions about individual behaviors, thereby augmenting the user-centric approach in design (Verganti et al., 2020).

AI has the potential to unlock creativity across various sectors and stakeholders, fostering innovation and challenging traditional confines. In addition, the self-learning algorithms that AI utilizes can extend learning and innovation beyond the development phase, pushing it further into the product lifecycle (Verganti et al., 2020).

As technology matures, the integration of AI in design thinking is no longer primarily a question of feasibility (Lungarella et al., 2007). Instead, the focus shifts to the methodology and rationale behind its usage (Jylkäs, 2020). Nonetheless, for specific industries or targets, the considerations of AI integration continue to be paramount from the very beginning (Verganti et al., 2020).

For years, academics have bifurcated design into two main categories. The first perspective views design primarily as a creative problem-solving process, a notion deeply embedded in the Stanford School and associated frameworks of design thinking (Buchanan 1992, Brown 2008 and 2009, Martin 2009, Kelley and Kelley 2013).

In contrast, the second standpoint perceives design as a process of problem framing, or more accurately, a sense-making activity. This viewpoint finds its roots in Krippendorff's definition that "Design is making sense of things" (1989), also resonating with later works (Krippendorff, 2006; Verganti, 2008 and 2009; Stigliani and Ravasi 2012; Jahnke 2013; Verganti and Öberg, 2013; Norman and Verganti 2014; Dorst, 2015). However, With the advent of AI, the problem-solving aspect of creativity is increasingly becoming automated. AI systems can process large amounts of data and provide efficient solutions. This paves the way for humans to focus on 'problem finding' and higher-order tasks of understanding context, behaviors, and nuances that define the problem space. This paradigmatic shift, engendered by AI, is fostering an evolution in design theories that emphasizes sense-making, thereby enabling service designers to craft solutions that are more aligned with the users' needs and perspectives (Verganti et al., 2020).

1.3 AI with Service Designers
A human perspective

The crucial role of decision-making in service design has been emphasized in numerous works, dating back to the 1980s, particularly associated with the works of Marketing Professor Valarie Lethal. This aligns with the perspective of other design professionals, who focus on the interactive processes occurring during service delivery (Satu Miettinen and Mikko Koivisito, 2009) . Poor service often persists due to managerial decisions that undervalue service as a part of value-adding activities. Understanding these decision-making models can enhance service design effectiveness. And The decision-making process in an organization frequently encounters three hurdles: uncertainty, complexity, and equivocality (Choo, 1991; Simon, 1982).

Artificial Intelligence: Manage Complexity

The strengths of AI lie in providing complex predictions from large data sets, surpassing human abilities in speed and cost (Verganti et al., 2020). Artificial intelligence is adept at analytical decision-making, extracting coherent analysis from extensive and complex data sets, thereby facilitating the management of complexity in decision-making processes (Jarrahi, 2018). As we enter an era where big data holds immense potential for innovation, it is critical to understand its characteristics. Big data is marked volume (huge amount of data), velocity (continuous stream of data) and variety (different types of data collected from various sources) (Anshari et al., 2016; McAfee and Brynjolfsson, 2012). These traits signify the intricate diversity and complexity of big data. In this context, the analytical capabilities of AI become particularly relevant. AI's analytical strength is ideally suited to harness and extract the latent value inherent in this massive data repository. AI can analyze and draw meaningful insights from these complex data sets, thus enabling designers as humans to make more informed, precise decisions (Waller and Fawcett, 2013). Additionally, by facilitating more accurate decision-making and predictive analysis, AI can help organizations identify profitable opportunities, streamline operations, and effectively manage risks.

Humans: Navigate Uncertainties and Decode Equivocality

However, humans demonstrate superior skills in navigating ambiguous and uncertain environments, making intuitive decisions that often bypass rational or logical reasoning (Jarrahi, 2018). This intuitive capacity equips humans with a holistic understanding (Jylkäs et al., 2019), enabling them to approach design solutions by amalgamating user needs, business requirements, and technical possibilities.

The uncertainty in real-world decision-making situations is far more complex and messy than predictable, calculated scenarios. In these circumstances, analytical thinking that AI is good at might often fall short (Campbell, 2016). Humans rely on intuition and tacit knowledge, where decisions 'feel' right despite the inability to articulate the exact reasoning behind them (Sadler-Smith & Shefy, 2004). The intuitive capabilities of humans are challenging for AI to mimic, particularly in situations requiring holistic and visionary thinking.

Addressing equivocality, which means denoting the existence of multiple, yet conflicting interpretations within a decision-making context (Weick & Roberts, 1993), especially in the presence of diverse stakeholders with conflicting interests, is another area where AI falls short. Convincing stakeholders to adopt a decision requires understanding and navigating intricate social dynamics, an area where AI capabilities are typically limited (Jarrahi, 2018).

Humans: Navigate Uncertainties and Decode Equivocality

Therefore, when it comes to the decision-making process, which involves uncertainty, complexity and equivocality (Koufteros et al., 2005), combining AI's analytical prowess with human intuitive skills appears to be the most balanced approach (Hung, 2003).
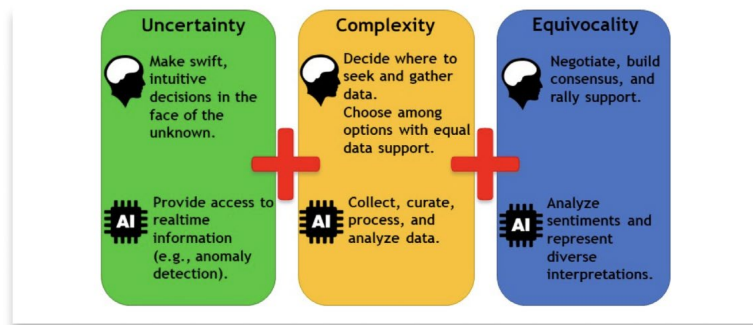
In the symbiotic decision system team of AI and service designers (Figure 7) , AI can alleviate the burden of repetitive tasks, thus enabling designers to focus on creative issues. For instance, during the development phase, practical problem-solving often takes precedence over creative thinking. This includes making decisions regarding the form of an object, the layout of the user interface, or the content displayed on a screen. With a multitude of specific issues arising in the design process, AI brings crucial problem-solving capabilities (Verganti et al., 2020).

As designers and AI seek this balanced approach, the role of the designer may shift towards leadership, with AI potentially aiding the development of greater analytical skills. To harness the full potential of AI, designers need to rethink how they approach problem-solving and consider how simple, repetitive tasks can yield complex solutions when performed at scale (Verganti et al., 2020).

Moreover, designers need to continually reassess their role and the role of stakeholders within the AI development process, retaining their crucial role as sense makers (Weick, 1995; 2). In the face of the growing impact of AI on service design, the practice must evolve, requiring designers to adapt their approaches, skills, and ways of thinking. The role of service designers has always been to embed design practice into existing organizational structures (Downe, 2020; Miettinen, 2017; Stickdorn et al., 2017).

Now, with the advent of AI, they must take on the additional task of making sense of AI outputs, maintaining their roles as essential interpreters and facilitators in the design process (Jylkäs, 2020).

Case Study

02

The influence of AI on service design is a rapidly emerging area of study. By blending AI with design thinking, service design processes, and service designers' workflows, we unlock exciting new possibilities that can revolutionize the field. One of the most compelling developments in this sphere is the advent of AI-assisted design tools, which are instrumental in reshaping the design landscape.

This case study focuses on QoQo.ai, a novel AI-based design tool that works as a plugin in Figma, a platform popular among designers. QoQo.ai primarily uses AI to generate text-based outputs that assist in various stages of the design process, from the discovery phase to defining user personas, journey mapping, and copywriting.

I chose QoQo.ai for this case study due to its innovative application of AI, specifically the emerging text-generation technology, to streamline the design process. By providing actionable data and editable design templates, it assists service designers in ideation support or insight generation. Despite the automation, QoQo.ai consistently emphasizes the need for a "human touch" in reviewing and confirming AI-generated outcomes, further reinforcing the essential role of service designers. The principle behind QoQo.ai is rooted in this synergistic relationship between advanced AI technology and human creativity, showcasing how AI can enhance, not replace, the human elements of service design.

Service Description

QoQo.ai is a cutting-edge plugin for Figma, a widely used design platform. This AI-assisted tool is designed to significantly enhance the user research and discovery phase in design processes (Figure 9). It caters to a broad spectrum of users, including design agencies, internal teams, freelancers, startups, and individual designers. QoQo.ai provides a range of services such as gathering insights from public data, creating meaningful designs, generating innovative ideas, and facilitating effective collaboration, all the while optimizing time and resources.

This chapter delves into the innovative integration of AI within service design, spotlighting the case of QoQo.ai, a revolutionary AI-plugin for Figma. By examining its multifaceted functionalities, this section elucidates AI's significant promise in enhancing designers' capabilities. Detailed segments dissect QoQo.ai's offerings—from its discovery tools to the importance of the human touch—providing a comprehensive view of its applications and implications in service design.

Case study: QoQo.ai

Figure 9
The main AI design functions and some interface steps
for QoQo.ai product. Collect by author.

AI Function Introduction

QoQo.ai leverages AI to augment and streamline critical facets of the design process. It generates Personas, facilitates Journey Mapping, serves as a Chat Assistant, and functions as a UX Copywriting Assistant. Additionally, it assists in creating Interview Discussion Guides and handling Research Data Privacy, all in response to designers' prompts. This makes QoQo.ai an intuitive, responsive tool in the design process.

AI Function Introduction

QoQo.ai's AI functionalities cover different stages of the design process:
Discover stage: QoQo.ai's chat function enables designers to brainstorm and explore ideas. It also provides product briefs that offer insights into potential risks and challenges, helping to integrate these factors early in the UX process. The User Interview function generates relevant questions based on research objectives, aiding in efficient insight collection.

Define stage: QoQo.ai's Persona feature assists in defining a user segment's motivations, frustrations, goals, and needs. Its User Journey Mapping function identifies areas where users may be struggling, thus promoting a deeper understanding of the user experience.

Design stage: QoQo.ai's UX Copywriting feature helps designers craft clear, concise, and effective text for their designs, leading to a seamless user experience. The Design Checklist function generates a list of items for consideration when designing a page, ensuring its user-friendliness and appeal.

Crucially, each function in QoQo.ai comes with a reminder that "AI results require a human touch - take a moment to check and confirm accuracy." This highlights the fact that while QoQo.ai assists in the design process, the designer remains the critical decision-maker.

Challenges and Opportunities

While QoQo.ai offers design teams the opportunity to streamline their process, it also poses certain challenges. The risk of over-reliance on AI for critical design processes and the potential loss of the human touch are areas of concern. However, these challenges also represent opportunities for growth and innovation. AI-assisted design can improve consistency, efficiency, and the capacity to explore new design avenues. The key lies in finding the right balance between AI automation and human creativity. One critical element of QoQo.ai's offering is the editable design templates it generates. These templates allow designers to directly modify the output in Figma, further emphasizing the critical role of the designer's touch in the final product.

Takeaways

QoQo.ai exemplifies the transformative potential of integrating AI into the design process. By saving time, increasing efficiency, and enhancing design capabilities, QoQo.ai opens up new possibilities for design teams. Despite potential challenges, such as maintaining design quality and ensuring user-centered designs, QoQo.ai underscores the value of AI as an aid to human designers, not a replacement. The insights offered by QoQo.ai, combined with critical human input, can pave the way for a more seamless, integrated, and effective design process.

Research Method and Results

03

This chapter delves into the methodology adopted to explore AI's role in service design. Highlighting AI's transformative potential, the research harmoniously combines quantitative and qualitative approaches. Detailed sections unpack the Service Design Tools Collection, Questionnaire Survey, Diary Study, and Workshop, offering insights into their execution and findings.

Methodological Rationale and Data Sources:

The research's primary aspiration was to demystify the intricate relationship between AI and service design. To achieve this, it was paramount not only to select the right methods but also to draw from the appropriate data sources and subjects to ensure comprehensive insights

1. Service Design Tools Collection: The foundational groundwork was laid by sourcing service design tools from the reputed "Service Design Tools" website. This was complemented by a desk research exercise to collate current AI design tools from various online platforms. This dual approach ensured a balance between established service design practices and emerging AI innovations.

2. Questionnaire Survey: The participants for the questionnaire were deliberately chosen from a wide spectrum. Spanning Europe and China, the subjects represented varied professional levels—from students to seasoned professionals. Furthermore, the inclusion of diverse design roles, such as UX designers and industrial designers, provided a panoramic view of AI's penetration and perception in design workflows.

3. Diary Study: Delving deeper into AI's practical implications, three distinct user types were engaged for the diary study. Students offered fresh perspectives, while working professionals either nascent in their AI integration journey or deeply involved in AI product design brought depth and practical insights. Their diverse AI involvement levels enabled the research to capture a granular understanding of AI's role across different stages of a designer's journey.

4.Workshop: The "AI-empowered Design" Co-creation Workshop was the culmination, drawing insights from the prior methods. With its hybrid format, it encapsulated both online and offline interactions from students and professionals spread across the UK and China. This setting facilitated collaborative envisioning, testing of current AI products, and co-creation of AI requirements tailored for various service design stages. This workshop was also instrumental in validating insights and setting the stage for subsequent synthesis and design definition.

At every stage, methodological choices were deeply informed by prior findings, ensuring that the research remained iterative and built upon its own discoveries. The diversified subjects—varying in geography, professional expertise, and design roles—provided the breadth and depth required to achieve a holistic understanding. In summary, the combination of methods and choice of subjects ensured that the research remained grounded yet visionary, illuminating the multi-faceted dynamics of integrating AI into the realm of service design.

Figure 10
Sequential Research Steps & Methodological Design in AI-Service Design Exploration.
Made by author

Outline structure of the Research Methods section:

I. Service Design Tools Collection
a. Comprehensive collection of current design tools
b. Matrix Mapping of Service Design Tools and Existing AI Tools:
c. Top findings

The collection of service design tools forms the foundation of this research. By gathering detailed information on the current tools used by designers throughout the design process, including explanations, steps, roles, and types, I establish a comprehensive understanding of the existing design landscape. This collection makes it possible to identify gaps and opportunities for effective integration of existing AI design tools. The matrix organization facilitates easy reference and comparison between traditional design tools and AI tools, facilitating a systematic exploration of their potential integration and sorting out the functionalities that can be combined.

II. Questionnaire Survey
a. Structure and Questions of the questionnaire
b. Analysis of 65 questionnaire responses
c. Top Findings

The questionnaire survey aims to gain insights into how designers currently utilize AI in their work environments. By including targeted questions related to the types of AI tools used, frequency of usage, stages of the design process where AI tools are applied, and specific tasks that can be improved or streamlined using AI, I gather valuable data on the practical application of AI in service design. The analysis of questionnaire responses provides quantitative insights that complement other research methods, offering a broader understanding of designers' current practices and perceptions.

Research Methods Overview

	Service Design Tools Collection	Questionnaire	Diary	Workshop
	-Collec tand analysis the service design tools	-The current state of designers utilizing AI in their work environments	Designers' daily journey of using AI tools	AI-empowered design process feedback
Participants Number:	N/A	65 people	3 people	28 people
Type:	Qualitative	Quantitative & Qualitative	Qualitative	Qualitative
Implement Method:	Online	Online(Google form)	Online(Google sheet)	Online & Offline
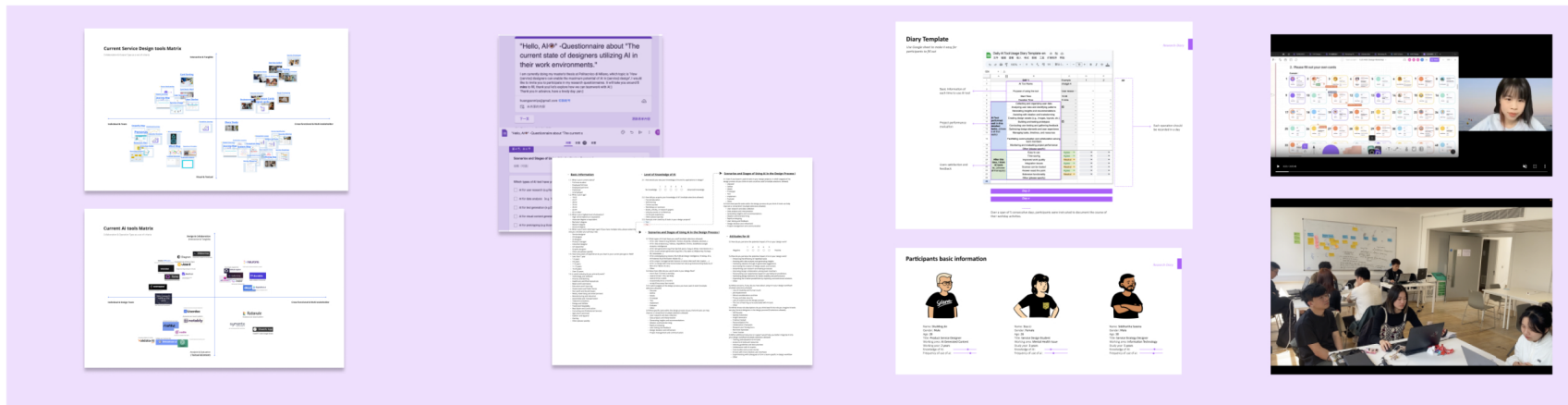
Goal:	To collect the existing service design tools systematically, compare with the current AI-design tools in a matrix. So to explore the potential integration.	To gain insights about how designers understand AI knowledge and their design requirements.	To explore how designers apply and cooperate with AI related tools into their daily workflow, as well as the feedback to the tool performance.	To encourage designers to share their perspectives by shaping their ideal AI-service design process and testing different AI assistants.

Figure 11
Research Methods Overview Chart. Made by author

39   40

III. Diary Study

a. Invitation of 3 designers to participate in study

b. Usage of digital diary templates to record AI tool usage

c. Documentation of usage details, tool performance, and feedback

The diary study provides an in-depth exploration of how designers incorporate AI-related tools into their design workflow. By inviting a select group of designers to participate and documenting their experiences using digital diary templates, I capture detailed usage details, tool performance, and feedback. This longitudinal study allows for a nuanced understanding of the benefits, challenges, and effectiveness of AI tools in different design contexts. The insights gained from the diary study contribute to the development of evidence-based recommendations for integrating AI in service design.

V. Workshop

a. Overview of the "AI-empowered Design" Co-creation Workshop

b. Hybrid format: virtual and in-person sessions (28 person in total)

c. Workshop Results

d. Top findings from the workshop

The workshop serves as a collaborative way to explore and illuminate the ways in which AI can be harnessed in the realm of design. By organizing the "AI-empowered Design" Co-creation Workshop, I provide an opportunity for designers to share their perspectives, exchange ideas, and collectively envision the future of AI integration in service design. The workshop format, combining virtual and in-person sessions, ensures broad participation and diverse perspectives. Key discussion topics, such as AI tools extending creativity, designing AI design assistants, AI-human collaboration, and future AI-driven workflows, foster deep insights and generate actionable recommendations.

3.1 The first research method: Service Design Tools collection

a. Comprehensive collection of current service design tools

all the service design tools available from reputable sources are collected. These tools are sourced from organizations like Service Design Tools (https://servicedesigntools.org/), which provides a comprehensive repository of service design tools. I summarized detailed information of all the service design tools, including the explanation, tips, steps to use, roles to join, tool types (Figure 12). And arrange them according to the steps of the design process (Figure 13).
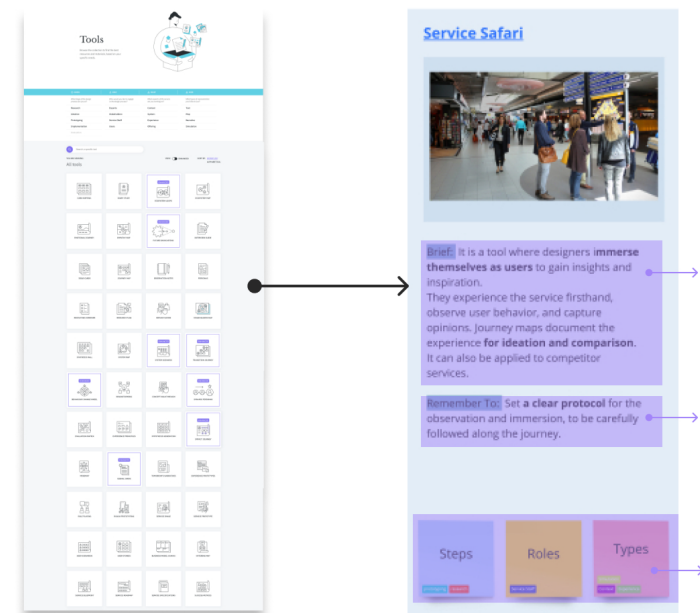
Figure 12

Service Design Tools: Curation & Prioritization from ServiceDesignTools.org

Made by author

Design Tools Map

Discover & Define — **Ideate & Design** — **Prototype** — **Test** — **Develop** — **Implement** — **Operate**
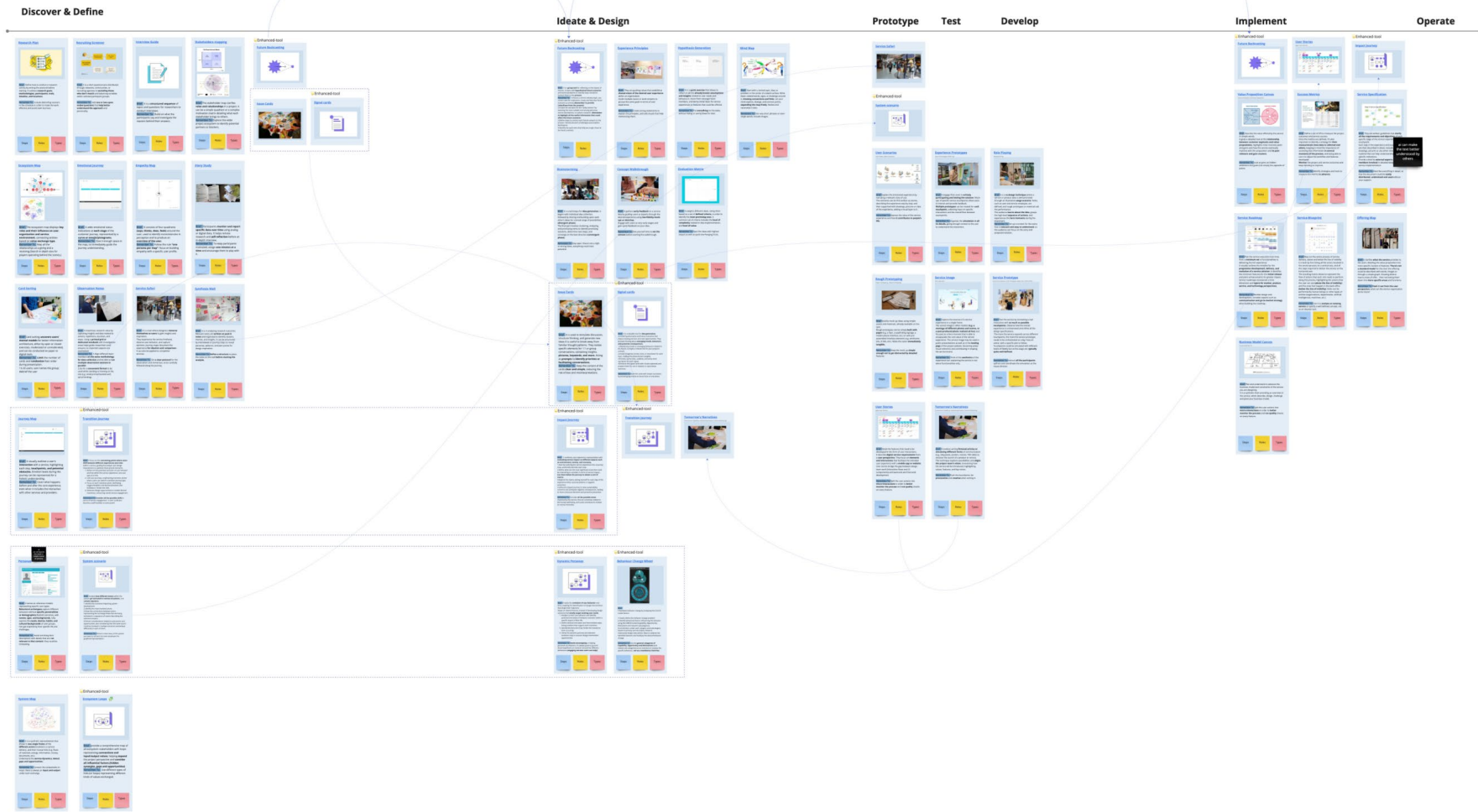
Figure 13
Service Design Tools Map: Structured Alignment with the Service Design Process
Made by author

b. Matrix Mapping of Service Design Tools and Existing AI Tools:

To investigate the integration potential of existing AI-design tools with service design tools, a matrix with a predefined set of criteria was created (Figure 14). This matrix aimed to assess the feasibility of combining AI-design tools with service design tools by considering two crucial dimensions: the number of operational roles involved and the type of data input required. The selection of these dimensions was based on the recognition that service design tools often engage multiple roles, and the ease of inputting data to AI tools depends on the available data sources. Thus, the dimensions of Involved **roles (Individual & Team; Cross-functional & Multi-stakeholder)** and **Type of data input for the tool (Visual & Textual; Interactive & Tangible)** were identified.

The data utilized for this matrix mapping exercise was sourced from an extensive review of current AI design tools available on various online platforms. By actively seeking out and collating a plethora of AI tool information, I amassed a robust dataset that reflected the evolving landscape of AI in design.

By mapping the service design tools and existing AI-design tools onto this matrix (Figure 15), the comparative analysis facilitated a comprehensive understanding of their compatibility and potential synergies.
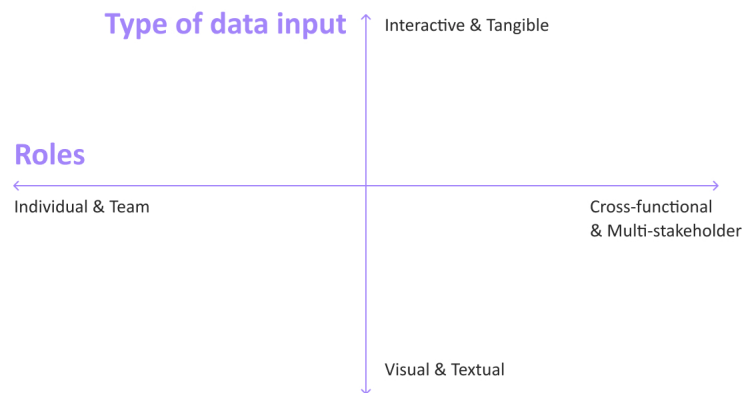
Current Service Design tools Matrix
Collaboration & Output Type as a set of criteria
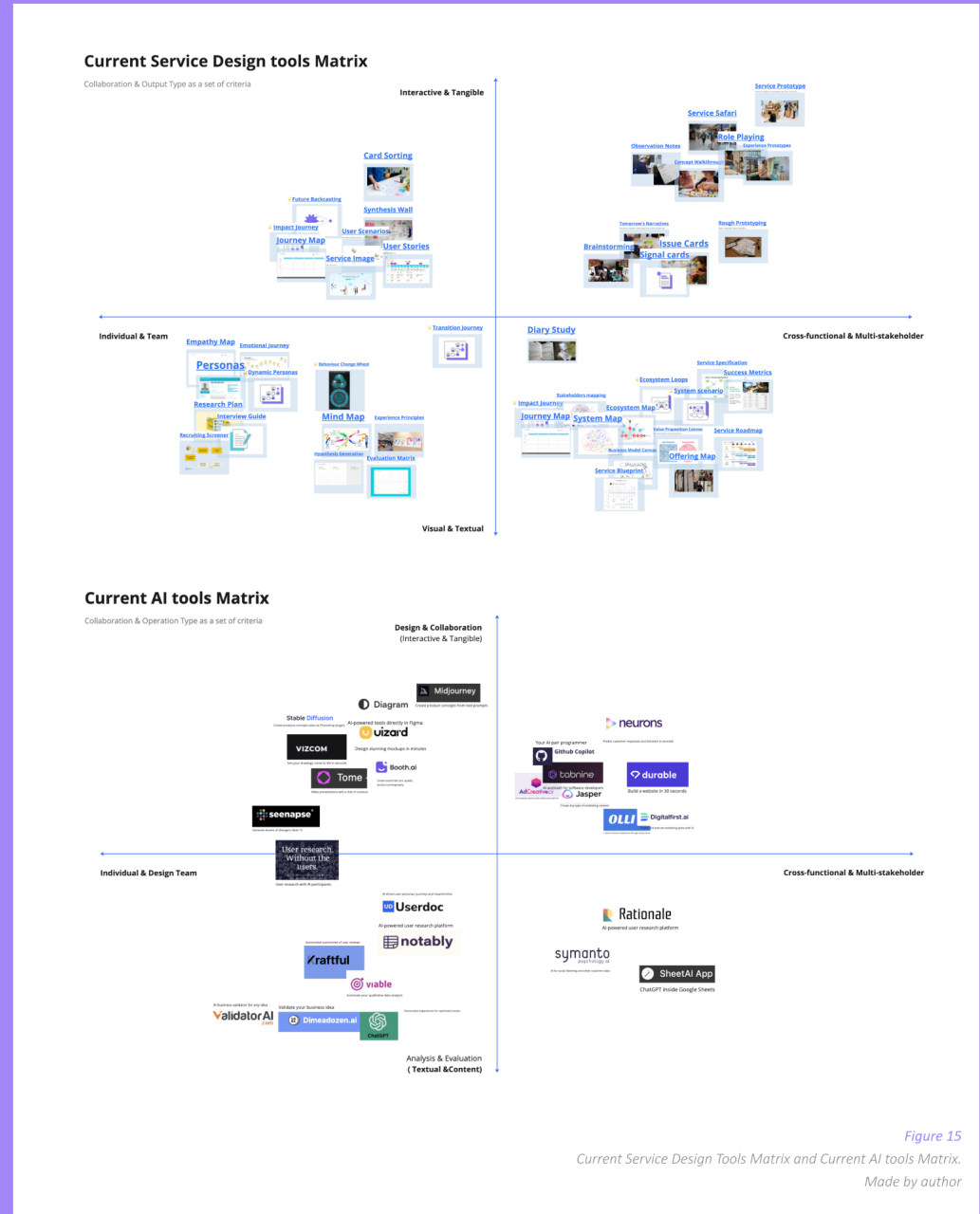
Current AI tools Matrix
Collaboration & Operation Type as a set of criteria

c. Insight summary

From Individuals to Interactions: For Existing service design tools demonstrate a diverse distribution, catering to a broad spectrum of needs, from aiding individual design teams to facilitating collaboration among multiple stakeholders across various levels of interaction.

Designer-Dominant Dynamics in AI-Assisted Design: AI design tools predominantly cater to intra-team assistance within the design process. Notably, the role of the designer remains paramount, even when AI-assisted co-creation tools are engaged. The designer continues to be the pivotal player, actively manipulating the input and output of AI tools to control the design process. Despite the assistance from AI, the designer's expertise and decision-making abilities are indispensable to ensure the success of the design outcomes.

Unleashing AI for Multi-Stakeholder Interactions: An increasing number of service design tools utilize interactive entities to engage multiple stakeholders, underscoring the demand for such tools among designers. However, the quadrant of AI-assisted tools for multi-stakeholder interaction is currently underrepresented, revealing an unexplored potential in this area. This gap presents an opportunity for the development of AI tools that can augment service design by supporting wider, interactive engagement with stakeholders.

AI Engagement Types for Design: The methodology I employed involved a thorough decomposition of the prerequisites inherent in service design tools, followed by a methodical alignment with the functional capabilities of contemporary AI utilities. This strategy aimed to elucidate the specific facets through which AI could augment design processes. This process accounted for multiple key areas of concern, including but not limited to, 'Automated Data Analysis', 'Ideation Support', and 'Prototyping & Simulation' (Figure 16). By undertaking this extensive matching exercise, the objective was to gain a nuanced understanding of how artificial intelligence tools can enhance and redefine traditional design mechanisms.

AI Engagement Types
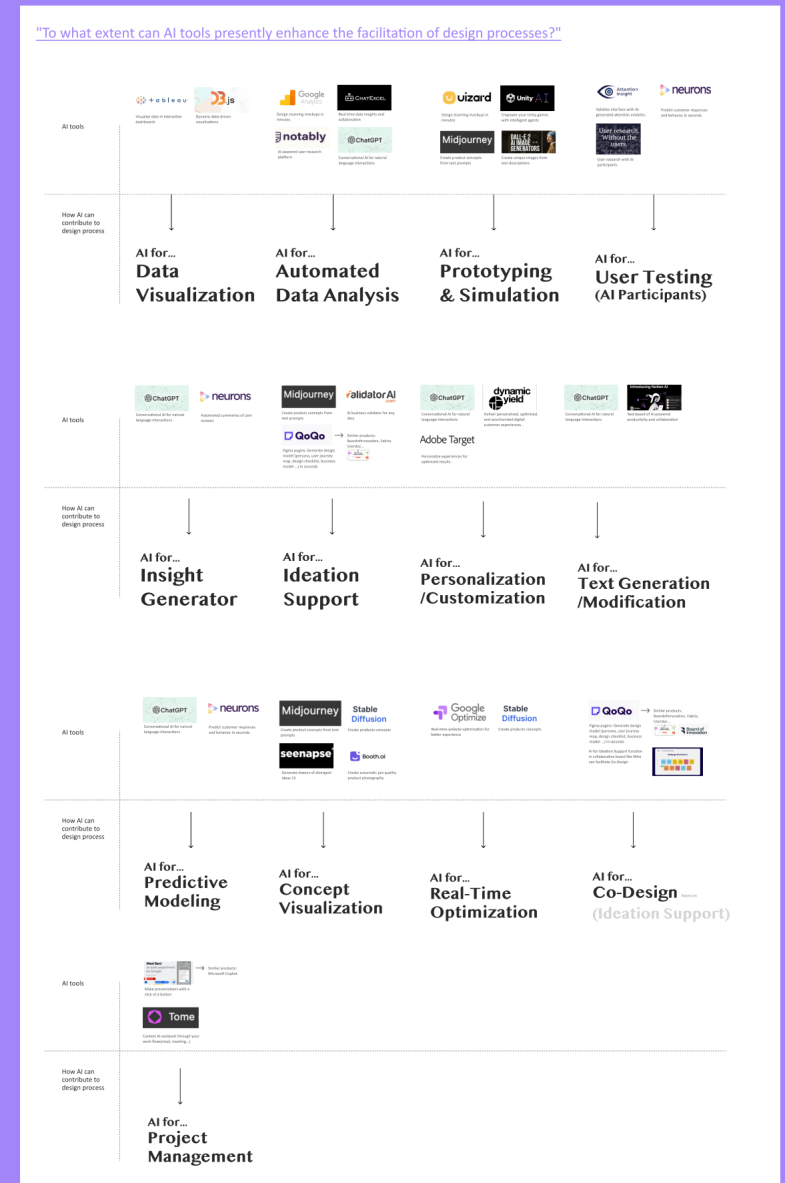
3.2 The second research method: Questionnaire Survey

a. Structure and Questions of the questionnaire

Aiming to gain insights into the perceptions and attitudes of designers from diverse backgrounds and experiences regarding the integration of AI into the design process. Specifically, the study focuses on exploring designers' perspectives on leveraging AI in various design process actions such as user research, data collection, data analysis, and interpretation.

To achieve this, a structured questionnaire consisting of 20 questions was developed, with an estimated completion time of 8 minutes. The questionnaire is divided into four chapters, covering

-Basic information
-The level of knowledge of AI
-Scenarios and stages of using AI in the design process
-Attitudes towards AI

-Basic information

1.1. What is your current status?
Full-time student/ Employed full-time/ Employed part-time/ Freelancer/ Unemployed

1.2. What is your age?
18-22/ 23-27/ 28-34/ 35-44/ 45-54/ 55-64/ 65 or older

1.3. What is your highest level of education?
High school diploma or equivalent/ Associate degree or equivalent/ Bachelor's degree/ Master's degree/ Doctoral degree

1.4. What is your work role/major type? (If you have multiple roles, please select the one you consider your primary role)
Service designer/ UX designer/ UI designer/ Product manager/ Industrial designer/ UX researcher/ Graphic designer/ Other job (please specify)

1.5. How many years of experience do you have in your current job type or field?
Less than 1 year/ 1-3 years/ 4-6 years/ 7-10 years/ 11-15 years/ 16-20 years/ Over 20 years

1.6. In which industry do you primarily work?
Technology and Software/ Finance and Banking/ Healthcare and Pharmaceuticals/ Retail and E-commerce/ Education and E-learning/ Government and Public Sector/ Non-profit and Social Impact/ Media, Advertising and entertainment/ Manufacturing and Industrial/ Automotive and Transportation/ Telecommunications/ Energy and Utilities/ Travel and Hospitality/ Real Estate and Construction/ Consulting and Professional Services/ Agriculture and Food/ Fashion and Apparel/ Gaming/ Other (please specify)

-Level of Knowledge of AI

2.1. How would you rate your knowledge of AI and its applications in design?

No Knowledge 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ Advanced Knowledge

2.2. How did you acquire your knowledge of AI? (multiple selections allowed)
Formal education/ Self-learning/ Online courses/ Workshops or seminars/ Books, articles, or research papers/ Industry events or conferences/ On-the-job experienceOther (please specify)

2.3. Have you ever used any AI tools in your design projects?
Yes/ No

-Scenarios and Stages of Using Ai in the Design Process I

3.1 Which types of AI tool have you used? (multiple selections allowed)
-AI for user research (e.g Remesh, Testion, EnjoyHQ, UXtweak, Dovetail...)
-AI for data analysis (e.g. Tableau, RapidMiner, Knime, DataRobot,Google Analytics Intelligence)
-AI for text generation (e.g.Chat Gpt-3/4, Jarvis, Copy.ai, Writer, Kuki,Notion AI...)
-AI for visual content generation (e.g.DALL-E by open ai, Midjourney, Runway Ml, Artbreeder...)
-AI for prototyping (e.g Uizard, Wix Artficial Design Intelligence, Firedrop, B12, AI-Powered Auto-Animatein Adobe XD...)
-AI for project management(AI features in Gmail, Microsoft 365 Copilot......)
-AI for co-design with internal and external roles (e.g brainstorming features of Miro AI or Notion AI, etc.)
-Other

3.2 About how often do you use AI tools in your design flow?
-more than 10 times a workday
-several times(1-10) a workday
-several times a week
-occasionally (once a month)
-rarely (Once every few month)

3.3 In which stage(s) of the design process you have used AI tools? (multiple selections allowed)
-Discover
-Define
-Ideate
-Prototype
-Test
-Implement
-Evaluate
-Other

3.4 What specific tasks within the design process do you think AI tools can help improve or streamline? (multiple selections allowed)
-User research and data collection
-Data analysis and interpretation
-Generating insights and recommendations
-Ideation and brainstorming
-Rapid prototyping
-User testing and feedback
-Design iteration and refinement
-Project management and communication

-Scenarios and Stages of Using Ai in the Design Process II

4.1 Even if you haven't used AI tools in your design projects, in which stage(s) of the design process do you think AI tools could be used? (multiple selections allowed)
-Discover
-Define
-Ideate
-Prototype
-Test
-Implement
-Evaluate
-Other

4.2 And what specific tasks within the design process do you think AI tools can help improve or streamline? (multiple selections allowed)
-User research and data collection
-Data analysis and interpretation
-Generating insights and recommendations
-Ideation and brainstorming
-Rapid prototyping
-User testing and feedback
-Design iteration and refinement
-Project management and communication

5.5 Which three role descriptions do you think best fit the role you imagine AI tools can play for/and designers in the design process?(3 selections allowed)
-Skill Booster
-Speedy Automator
-Insight Generator
-Creative Catalyst
-Personalization Pro
-Collaboration Champion
-Research and Testing Guru
-Real-time Optimizer
-Trend Tracker

5.6 What additional resources or support would help you better integrate AI into your design workflow? (multiple selections allowed)
-Training and education on AI tools
-Access to AI tools and resources
-Industry guidelines and best practices
-Collaboration with AI experts
-Case studies and success stories
-AI tools with more intuitive user interfaces
-Experimenting with colleagues to form a team-specific AI design workflow
-Other

-Attitudes for AI

5.1How do you perceive the potential impact of AI on your design work?

Negative   1   2   3   4   5   Positive
○ ○ ○ ○ ○

5.2 How do you perceive the potential impact of AI on your design work?
-Enhancing the efficiency of repetitive tasks
-Assisting with data analysis and generating insights
-Facilitating ideation through AI-generated suggestions
-Automating the creation of design assets and content
-Streamlining user research and testing processes
-Improving design collaboration among team members
-Personalizing user experiences based on user behavior predictions
-Optimizing design elements for better usability and performance
-Expanding the creative possibilities by exploring unconventional solutions
-Other

5.3 What do you think is the possibility that ai will replace the role of the designer?

Not at all possible   1   2   3   4   5   Extremely likely
○ ○ ○ ○ ○

5.4 What concerns, if any, do you have about using AI in your design workflow? (multiple selections allowed)
-Loss of creativity and human touch
-Job displacement
-Ethical considerations and bias
-Privacy and data security
-Lack of control over the design process
-The Cost of learning curve associated with AI tools
-Other

b. Analysis the results of 65 questionnaire responses

Section 1: Basic Information

The dataset (Figure 17) predominantly captures the perspectives of young professionals, primarily in the age ranges of 23-27 (53.8%) and 28-34 (36.9%). This younger age bracket, paired with the high percentage (76.9%) possessing a Master's degree, showcases a group at the forefront of contemporary education, likely more receptive to novel technologies and methods.

A concentration is observed in professionals at the beginning stages of their careers, with 44.6% having 1-3 years of experience. These early-career individuals majorly stem from the technology and software sector (36.9%), underlining the ever-growing influence of digital platforms in today's design realm.

The roles they occupy—primarily service design and UX design, each making up 30.8% —coupled with a notable representation from the gaming sector (13.8%), emphasize the evolving nature of service and UX design, now venturing into varied industries beyond its conventional domains.

It's noteworthy to mention the diversity of the questionnaire's recipients. This survey was disseminated amongst student alumni groups and diverse designer communities across Europe. Such a broad spectrum of participants reinforces the belief that the user selection is indeed eclectic, capturing a range of experiences and backgrounds. This diversity aids in presenting a more holistic view of the design landscape across different European contexts.

In a nutshell, the insights depict an emerging generation of designers, rooted in the digital age, poised at the cusp of design and technology, and ready to navigate and potentially reshape the modern design trajectory with innovative tools and approaches.

Section 2: Level of Knowledge of AI
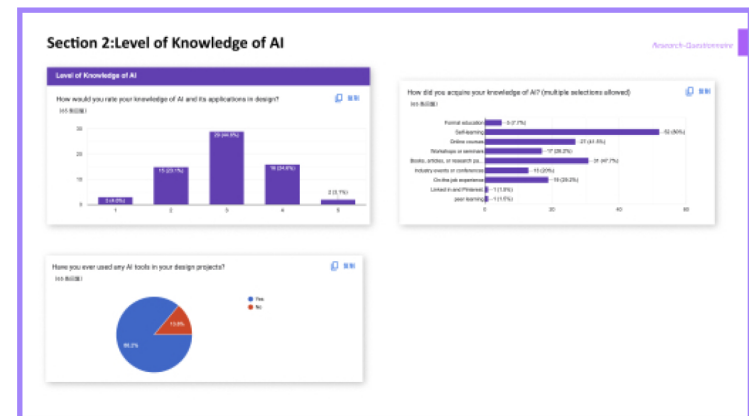
The data (Figure 18) reveals that a majority of respondents have a moderate level of AI knowledge(67.7% rate their knowledge of AI as "Basic knowledge" and "Intermediate knowledge"), mainly acquired through self-learning(80%). The reliance on self-learning indicates that formal education systems may not be adequately addressing the needs for AI education in design. Despite this, the majority(86.2%) have still incorporated AI tools into their design projects, suggesting a willingness to independently learn and adapt new technologies even when formal education may fall short.

Section 3: Scenarios and Stages of Using AI in the Design Process I

From the results (Figure 19),The prevalence of text generation (49 out of 56 respondents)and visual content generation tools (41 out of 56 respondents) amongst respondents suggests that AI tools offering generated, creative outputs have significant traction in design environments. However, more complex areas of design such as prototyping and project management see less AI usage, potentially indicating a lack of mature tools or a perceived higher barrier to entry in these areas. The fact that AI is used heavily in the discovery stage(78.6% of respondents) and the Ideate stage (60.7% of respondents)points to its value in research data collection and facilitates creativity, hinting at an opportunity for future tools to further facilitate the data-driven design.

Section 4: Scenarios and Stages of Using AI in the Design Process II
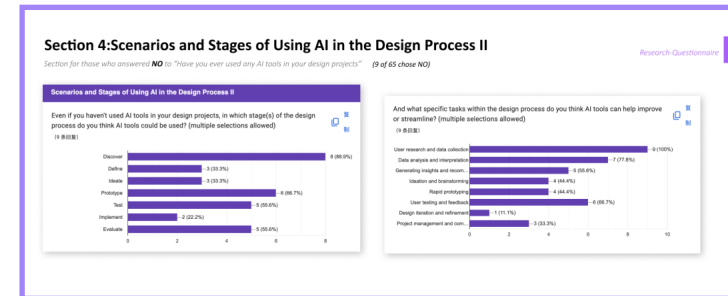
Figure 20
Questionnaire Results for Scenarios of Using AI (II)section . Made by author

Among the respondents who haven't used AI tools in their design projects (Figure 20) , the perception of AI's potential usefulness in the discovery stage and user research points to an understanding of AI's strength in processing large data sets, even among those who have not directly used such tools. This aligns with the findings in Section 3 and reinforces the opportunity for AI tools to play a significant role in data-driven design processes. However, Designers yet to incorporate AI in their workflow envision substantial potential for AI tools in later stages of the design process, such as Prototyping (6 out of 9 respondents), Testing (5 out of 9 respondents), and Evaluation (5 out of 9 respondents).On the contrary, the actual application of AI in these stages by AI-using designers is currently lower, with only 20 out of 56 respondents using AI in Prototyping, 13 out of 56 in Testing, and 7 out of 56 in Evaluation. This disparity suggests a discrepancy between the perceived potential and the actual application of AI tools in later stages of the design process, indicating an untapped opportunity for the expansion of AI tools in these areas.

Section 5: Attitudes for AI

Figure 21
Questionnaire Results for Attitudes for AI section . Made by author

From the results (Figure 21), The overall positive attitude towards AI's impact on design work contrasted with the skepticism about AI replacing the designer suggests that designers view AI as a tool to augment their work rather than a threat to their roles. However, concerns around privacy, loss of creativity, and ethical considerations indicate a conscious awareness of potential pitfalls of AI technology, which stakeholders should address to foster trust and encourage broader adoption. The preference for AI as a "Speedy Automator" and "Insight Generator" aligns with a view of AI as a helper rather than a replacement in the design process.

<u>Designers' AI Journey: Learning Paths & Resource Preferences</u>
The data also points toward a strong interest among designers in harnessing the potential of AI, and they are also actively seeking a variety of supports to better integrate AI into their workflow. Designers understand the necessity for both educational resources and practical tools to successfully integrate AI into their workflow. They also express a desire for industry best practices and AI tool access, demonstrating their eagerness to learn and adapt in an evolving design landscape. Furthermore, collaboration with AI experts is perceived as a significant step in bridging the gap between AI and design. This comprehensive outlook shows a proactive designer community ready to evolve with the incorporation of AI, but seeking guidance and resources to ensure the transition is smooth and effective.

c. Insight summary

Understanding the nuances of how service designers interact with AI is crucial to our research. Creating a persona, like Max (Figure 22), serves as a tangible representation of the collective data from our questionnaire. This not only makes the information more digestible but also allows me to empathize with and understand the needs and challenges of service designers in a more humanized manner.
Max's experiences and needs shed light on how to bridge the gap between AI and service designers, fostering collaboration and customization. He serves as a launchpad for discussing how AI can be effectively integrated into the design workflow, showcasing both the current state of AI utilization and the human touch required for successful application.

User Persona

Max
Senior Service Designer

"Design is about making life better through smart, well-planned services."

Age: 32
Gender: Male
Location: San Francisco, California
Working year: 9 years
Education: Bachelor's degree in Service Design, self-taught in AI tools
Company: A fast-paced, innovative design agency
Hobbies: Reading, Riding

Personality

Openness to Experience

Conscientiousness

Extraversion

Agreeableness

Neuroticism
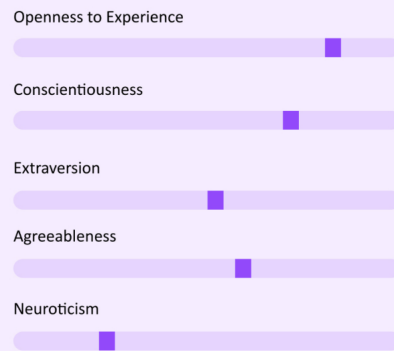
Work Information

Work Schedule:
Max usually works from 9 am to 6 pm but is often involved in brainstorming sessions that run late into the evening. He appreciates the flexibility his job offers and doesn't mind spending extra hours when he is immersed in a fascinating project.

Job Role: His work centers on creating seamless service experiences for clients across various industries. In addition to mentoring younger team members, he is responsible for leveraging emerging technologies, including AI, to enhance the design process.

Skills:

Design thinking ●●●●●	Data anlysis ●●●○○	User research ●●●●○
Journey Mapping ●●●●○	Synthesis ●●●●○	Programming ●○○○○

Work Process

Workflow:

Understand user's need → Research & Discovery → Define scope → Ideation → Prototype → Test &Feedback
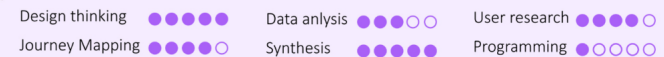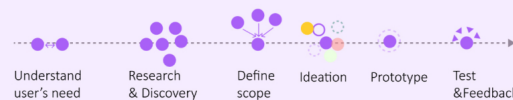
AI Tools Usage: Max frequently uses AI tools in his workflow, most often in the discovery and ideation stages. He sees immense potential for AI to streamline tasks like user research, data collection, ideation, and data analysis.

Attitude toward AI:

Attitude towards AI: Max views the integration of AI into design as a positive progression. He believes AI can enhance efficiency, assist with data analysis, and automate asset creation. However, he maintains that the role of a designer is not entirely replaceable by AI.

Concerns: Max is mindful of the challenges that AI can bring, particularly around privacy and data security, the potential loss of creativity, and ethical considerations.

AI's Role in the Design Process: In Max's vision, AI is a speedy automator, insight generator, and real-time optimizer. It's a tool that, when used correctly, can greatly enhance the design process.

Support Needed: Max is eager for resources that help better integrate AI into his design workflow. He values having access to AI tools, **industry guidelines, collaboration with AI experts, and insightful case studies.**

Figure 22
Persona Creation: "Max" - Humanizing Service Designers' AI Interactions.
"Max" personifies questionnaire insights, offering a tangible lens into the experiences and challenges service designers face with AI. Made by author

AI Self-learners:
The majority of designers acquired their knowledge of AI through self-learning, signaling a potential gap in formal AI education within the design field.
AI Augmentation over Replacement: Designers view AI as an augmentation to their work rather than a threat to their roles. They value AI's ability to automate tasks and generate insights but do not see it replacing the designer's role.

Prevalence in Creative Outputs:
AI's most prevalent use in design is in tangible creative outputs such as text generation and visual content generation. This suggests a high value placed on tools that can enhance or supplement the creative process.

Opportunities in Data-driven Design:
The consistent recognition of AI's value in the discovery phase of design and in user research indicates that AI tools could be further developed to support data-driven aspects of the design process.

Perceived Barriers to AI Integration:
Despite a generally positive attitude towards AI, concerns about privacy, loss of creativity, and ethical considerations signal potential barriers to broader adoption. The need for more accessible AI tools, industry guidelines, and AI expertise was highlighted as a way, to better integrate AI into design workflows.

3.3 The third research method: Dairy Study

a. Invitation of 3 designers to participate in study
With the intent to delve into the heart of designers' interactions with AI tools, we selectively invited 3 designers to participate in this longitudinal study. Here are their basic information (Figure 23).
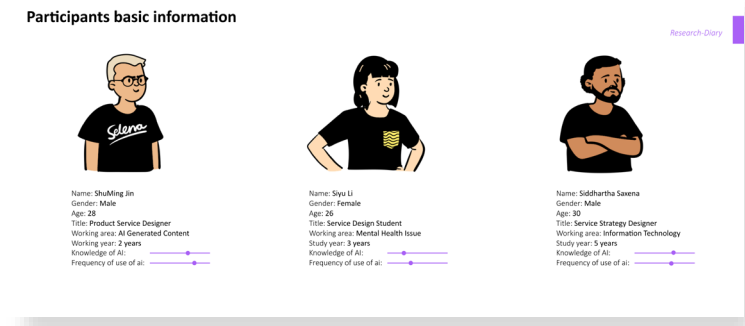
Figure 23
Basic information for diary study participants. Made by author

b. Usage of digital diary templates to record AI tool usage
The point of this research lay in the carefully structured digital diary templates (Figure 24). These templates were designed to capture the everyday journey of the designer as they navigate their tasks using AI tools. These templates were more than just logging tools - they were devised to gather both qualitative and quantitative data around the daily AI tool usage.
Participants recorded the name of the AI tool, its intended purpose, the start time, and the duration of usage, offering a clear timeline of the tool utilization. Additionally, they shared insights on how well the AI tool performed in specific tasks, ranging from data analysis to project management, shedding light on the tools' strengths and weaknesses in various design-related contexts.

Diary Template

Use Google sheet to make it easy for participants to fill out

Research-Diary

https://docs.google.com/spreadsheets/d/103gHsO-p7biTd244KmxmpfcmhmqTnzmoq93rXPTCdb8/edit?usp=sharing

Basic Information of each time to use AI tool

Project performance evaluation

Users satisfaction and feedback

Each operation should be recorded in a day

Over a span of 5 consecutive days, participants were instructed to document the course of their workday activities.

Figure 24

Diary study Template. Made by author

---

c. Documentation of usage details(Figure 25), tool performance, and feedback

Participant 1: ShuMing's Diary

Research-Diary

Name: ShuMing Jin
Gender: Male
Age: 28
Title: Product Service Designer
Working area: AI Generated Content
Working year: 2 years
Knowledge of AI:
Frequency of use of ai:

Participant 2: Siyu's Diary

Research-Diary

Name: Siyu Li
Gender: Female
Age: 26
Title: Service Design Student
Working area: Mental Health Issue
Study year: 3 years
Knowledge of AI:
Frequency of use of ai:

Participant s: Siddhartha's Diary

Research-Diary

Name: Siddhartha Saxena
Gender: Male
Age: 30
Title: Service Strategy Designer
Working area: Information Technology
Study year: 5 years
Knowledge of AI:
Frequency of use of ai:

Figure 25

Detailed Documentation of the Diary study. Made by author

d. Insights summary

Multiplicity of AI Tools: The study could reveal that designers often have to switch between multiple AI tool platforms to accomplish a task, indicating a need for more comprehensive tools that can handle various aspects of the design process.

Customization as a Key to Efficient AI Application: With varied satisfaction levels among designers, the development of adaptable AI tools that can be customized according to individual or project-specific needs could be beneficial. This would ensure that the AI tool meets varying needs, and enhance the quality of the design process, ultimately leading to increased user satisfaction.

Balancing Efficiency and Trust: While AI tools can improve efficiency, designers are concerned about their trustworthiness. As such, there's a need to strike a balance between functionality and credibility, ensuring that the AI tool not only optimizes the design process but also provides reliable and trustworthy results.

AI's Strengths in Data Analysis and Insight Generation: The current use of AI tools in the design process primarily focuses on data analysis, insight generation, and creativity enhancement. This aligns with the core strengths of AI, particularly in handling and making sense of vast quantities of data. Designers recognize these advantages and leverage them to enhance their design work. Further promotion of AI's capabilities in these areas could encourage even wider adoption and more innovative uses in the service design process.

3.4 The fourth research method: Workshop

a. Invitation of 3 designers to participate in study

Overview of the "AI-empowered Design" Co-creation Workshop

In order to explore and illuminate how AI can be harnessed in the realm of design.Also to gather how designers can leverage the power of AI into different steps of design process, me and another Service Designer from RCA organized a "AI-empowered Design" Co-creation Workshop on May 20, 2023. This event took place in a hybrid format—both virtually and in person at the Kensington Campus, Royal College of Art, London, SW7 2EU.

Unexpectedly, we received an overwhelming response with over 40 registrations. Ultimately, we were joined by 28 enthusiastic participants for the workshop sessions.

Key discussion topics include:

✅ AI Tools that Extending Creativity:

How can AI tools enhance creative concept generation?

✅ Design your own AI Design Assistant:

How to utilize AI to assist various processes in design?

✅ AI and Human Collaboration:

How AI can promote collaborative design outcome?

✅ Future AI-driven Workflow:

How tomorrow's designers can better adapt to AI trends?

Below (Figure 26) is the workshop Agenda& Step Introduction:

Icebreaker & Introduction: To initiate the session, we facilitated a creative identity card activity as an icebreaker for the participants. A review of current AI-design tools followed to ensure a shared understanding across the group.

Mapping the Design Process: Participants were individually tasked with visualizing their design process and associating AI tools with the corresponding design phases. This exercise resulted in 14 unique design journey maps, revealing the diverse ways AI tools are integrated into the workflow.

Crafting the AI-Design Process: Divided into groups, participants experimented with different AI tools across various design stages: Discover, Define, Design, Deliver. The goal was to identify the ideal AI assistant for each stage, stimulating a deeper understanding of AI's potential in service design.

Round Table Discussion: A vibrant discussion ensued, addressing topics such as the future AI design process, stakeholder engagement, and evolving design evaluation standards. The exchange of ideas yielded numerous intriguing insights, paving the way for future explorations.

b. Hybrid format: virtual and in-person sessions (28 person in total)

Upon concluding the workshop, we administered a follow-up survey to gather comprehensive feedback from the participants. The analysis of survey responses, along with group chat interactions, unequivocally indicated a positive reception of the workshop (Figure 27).

During the Hybrid workshop

28 designers with different backgrounds from 8 different design schools and companies

After workshop
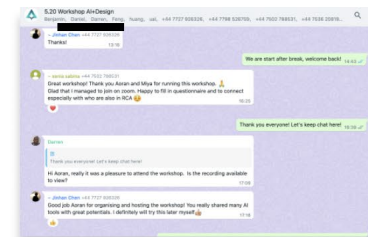
Feedback from the WhatsApp
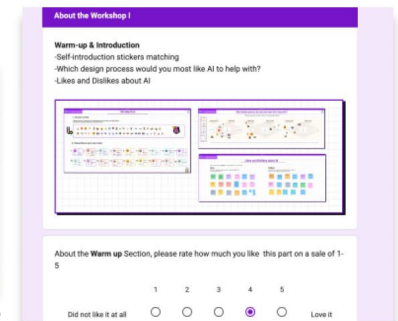
Follow up Questionnaire

Individual workshop journey take aways

Figure 27
Some highlights and take aways from the hybrid workshop.Made by author

c. Insight summary

The disparity between the perception and actual utility of AI tools in design is stark. Designers, while having a plethora of advanced AI tools at their disposal, frequently stick to known tools. The graphic (Figure 28) encapsulates this by juxtaposing AI Capability with Designer's Comprehension of AI Potential. The intersection, a mere fraction of AI's present capability, underscores the gap between AI's true potential and its limited application in design. This gap emphasizes the designers' limited understanding versus the actual scope of AI tools.

A segment within the Designer's Comprehension, denoted as the "Physical aspect of (participatory) design," represents unique, irreplaceable human facets of the design process, even as AI continues to advance.

The overall narrative suggests a profound disparity between the actual and perceived capacities of AI tools. The challenge and opportunity lie in bridging this gap, helping designers to not only comprehend but also harness the full spectrum of AI's transformative potential.

Designers' awareness vs. AI capability
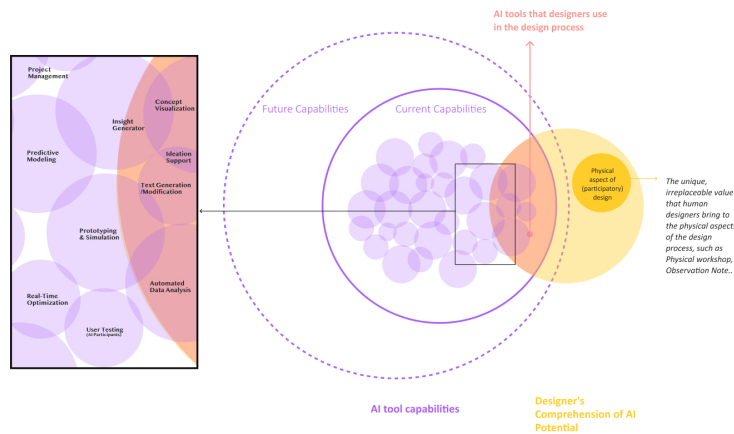
Idea AI assistant for each design step

Based on the outcomes of our workshop discussion, it's evident that designers have specific expectations for ideal AI assistants at various stages of the design process. These expectations, along with their corresponding workshop presentations, are outlined as follows (Figure 29) (Figure 30):

KEY FINDINGS IN DESIGN STAGE

Ideal DESIGN AI Assistant should be...

1. ACCELERATOR FOR DESIGNERS' INNOVATION

Designers should embrace AI as a powerful collaborative tool that enhances workflow, offers profound insights, and automates repetitive design tasks, freeing them to focus on more creative design challenges.

Designer D ,
Product Designer from RCA

2. PRECISE AI OUTPUT ASSISTANCE WITH HUMAN REVIEW & JUDGMENT

Although AI can provide precise design ideas, human expertise and judgment are still indispensable. Human judgment cannot be replaced by AI, designers play a critical role in the decision-making process, validating AI-generated outputs and exercising critical thinking.

T,
Product Owner from 0000.ai

KEY FINDINGS IN DELIVER STAGE

Ideal DELIVER AI Assistant should be...

1. INSPIRING DESIGNERS TO EXPLORE SYNTHETIC USERS & BUILD FUTURE SCENARIO

AI can predict issues and explore future contexts through scenario-based analysis and role-playing, inspiring designers to explore synthetic users and building a future design approach.

Designer X ,
Fashion Designer from RCA

2. INTELLIGENT PLATFORM PROVIDING TAILORED SOLUTIONS

Offer a clear and operational platform, guiding designers through various options for different types of answers, and providing specific advice tailored to the problem at hand. While accelerating information processing, the designer remains the key decision-maker, controlling the entire design process.

Designer K, Product Designer from London

Figure 30
Idea AI Assistant for Design and Deliver Stages, key findings from the co-design workshop. Made by author

The possibility of disrupting human thinking

However, few designers concerned that AI could disrupt their design practice, such as causing a disruption in traditional tasks such as image production, ideation, and concept design, possibly making these tasks obsolete or significantly altering the way they are performed.

Symbiotic system for AI and service designers (Figure 31)

1. The irreplaceable nature of designers in physical interaction:
In the discovery and co-creation stages of design, designers' physical interaction and empathetic understanding remain vital, as they provide insights and nuances that AI currently cannot emulate. Despite AI advancements, the demand for human-led design activities, like field observations and offline workshops, persists. These physical interactions, requiring designers' communicative expertise and socio-cultural understanding, underline the irreplaceable role of designers, even in an increasingly digital world.

2. The black box nature of AI is unpredictable potential:
Despite the ever-growing applications of AI, its operation remains a 'black box' mystery, even to experts. This ambiguous nature, comparable to the complexities of the human brain, encapsulates both the challenge and potential of AI. The uncertainty surrounding AI's internal processes doesn't undermine its evolution or application, but rather parallels our limited understanding of human cognition. As AI continues to advance, navigating its 'black box' nature will remain an ongoing exploration, mirroring our continuous quest to decipher the intricacies of the human mind.

3. Synergistic Interplay Between Designers and AI:
Designers and AI have the potential to form a powerful synergy, each leveraging their unique strengths to enhance the design process. Designers, with their critical thinking and intuitive decision-making, provide the human touch, creativity, and unique interpretations that AI alone can't replicate. However, this necessitates designers' understanding of AI workings. On the other hand, AI offers designers robust capabilities in analyzing complex information effectively, performing repetitive tasks, and generating predictive models. Yet, it's vital for AI to be user-friendly, clear, and integrated seamlessly into a designer's workflow. With such a collaborative approach, we can ensure an optimized design process, where AI's analytical prowess enhances the creative abilities of designers.
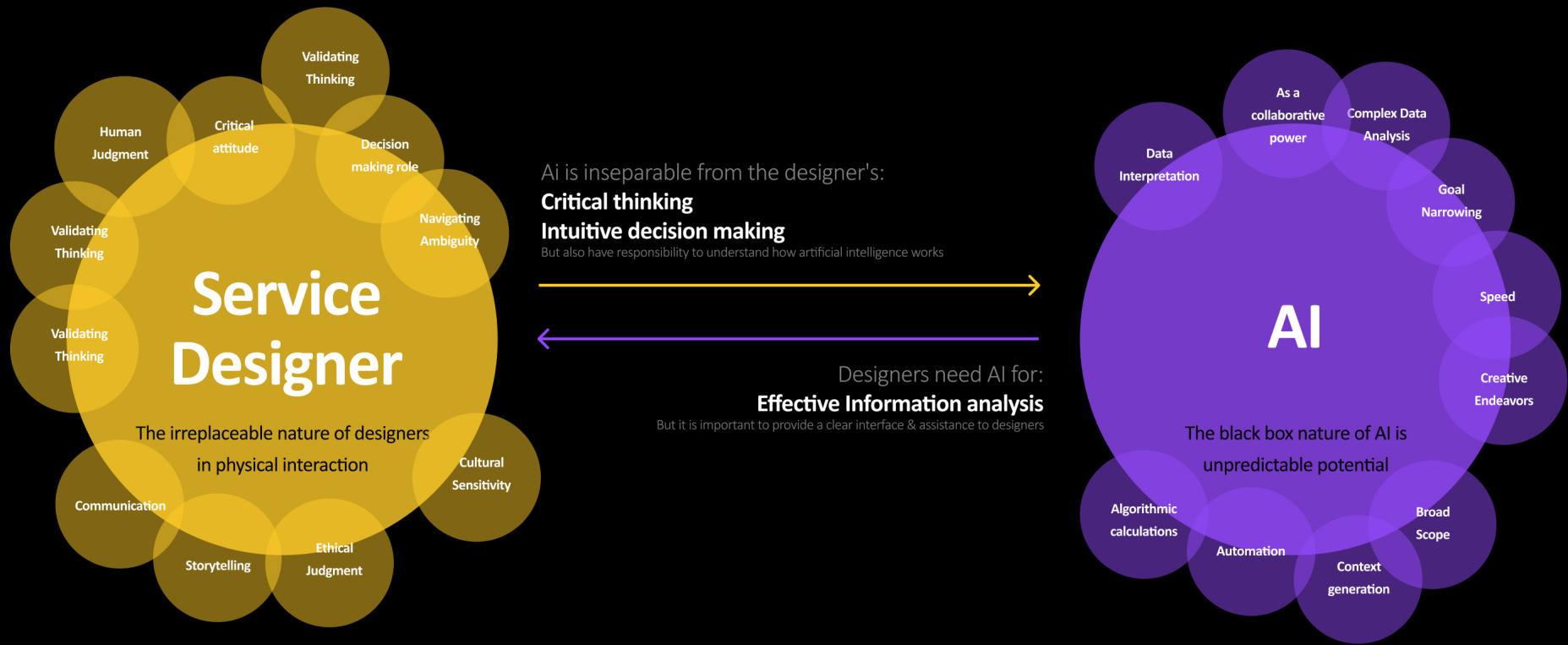
Validating Thinking

Critical attitude

Human Judgment

Decision making role

Validating Thinking

Navigating Ambiguity

Validating Thinking

Service Designer

The irreplaceable nature of designers in physical interaction

Communication

Cultural Sensitivity

Storytelling

Ethical Judgment

Ai is inseparable from the designer's:
Critical thinking
Intuitive decision making
But also have responsibility to understand how artificial intelligence works

Designers need AI for:
Effective Information analysis
But it is important to provide a clear interface & assistance to designers

As a collaborative power

Complex Data Analysis

Data Interpretation

Goal Narrowing

Speed

AI

Creative Endeavors

The black box nature of AI is unpredictable potential

Broad Scope

Algorithmic calculations

Automation

Context generation

Figure 31
Symbiotic system for AI and service designers. Made by author

Top Findings from the Research

04

Final Top Finding 1-Service Designers' Knowledge Gap and Independent Learning Drive

There is a significant gap between designers' understanding of AI's capabilities and its actual potential. Designers actively seek to bridge this gap through independent learning, signaling a demand for more structured and multidimensional AI learning paths within the design field.

Research data:

Current AI Engagement Types

From "Tools Collection" Step

Designers' awareness vs. AI capability
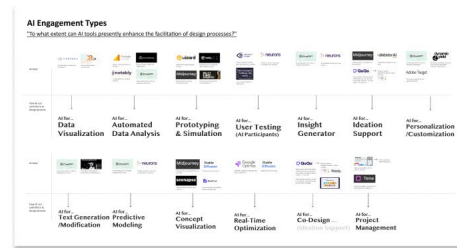
From "Workshop" Step

Medium level of awareness for designers and limited learning resources
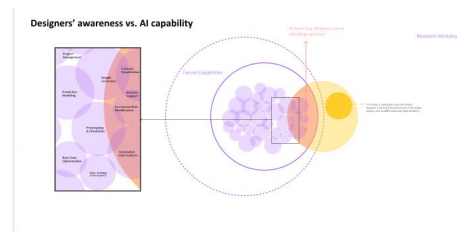
From "Questionnaire" Step

Gap between designers' knowledge and current AI tools' scope
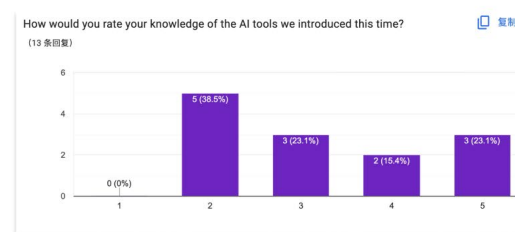
" Actually I never heard some of the AI tools that you introduced to me in the workshop..."--One of the participants from the workshop

From "Workshop" Step

Final Top Finding 2-Irreplaceable Human Strengths

While AI offers various advantages in service design, certain human strengths like critical thinking, intuition, and physical interaction cannot be replaced. Designers' unique skills and perspective continue to be critical to the success of the design process.

Research data:

Physical interactive service design tools
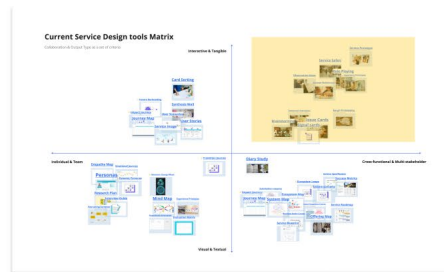
From "Tools Collection" Step

Service Designers' concerns about using AI in their workflow
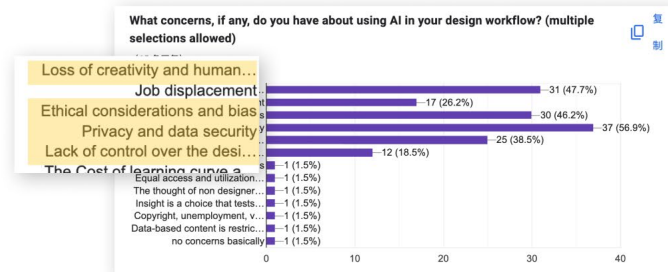
From "Questionnaire" Step

Human touch is needed for checking and confirming the results
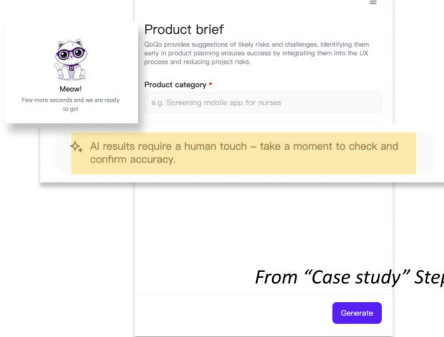
From "Case study" Step

" ...Our job as designers will always need the human touch. So whatever output we get, we have to put it to the test. We have to validate it...Human judgment is not going to be replaced at any point with AI..."

--Tamer, Founder of QoQo plat-from, said in the workshop

" ...this could be a good chance for future designers to pay more attention to physical touch and co-design offline workshops.we can leverage our advantage as designers who excel in communication.."

--One of the participants from the workshop

Final Top Finding 3-AI: The Data Whisperer -Leveraging AI for Data-intensive Tasks: AI's ability to handle complex

AI's ability to handle complex data effectively is a key strength that designers can utilize. AI can augment the design process at stages of data generation, collection, and analysis, enhancing efficiency and facilitating deeper insights.

Research data:
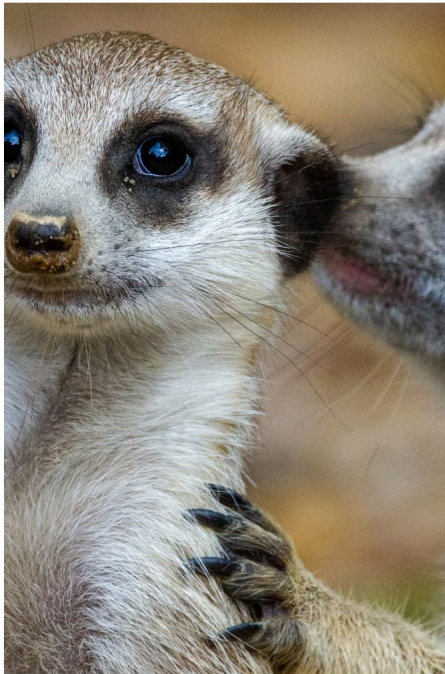
AI can perform well in data collect, analysis and generation tasks

From "Diary" Step

" ...So people do not want the creative process, or the creative part of the process to be replaced upon. they want is actually something to help them in the boring stuff, which is collecting insights and generating content and summarizing everything at the end when they finish. This is kind of like the boring part of courses......"

--One of the participants from the Diary

Service Designers applied AI in Discover, ideation steps for context generation tasks
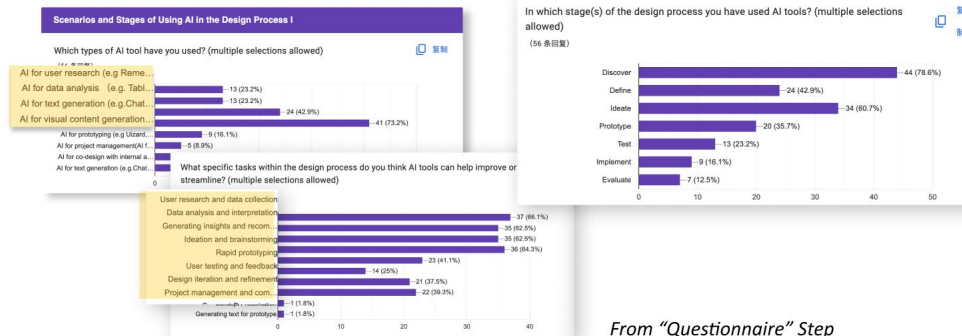
From "Questionnaire" Step

Final Top Finding 4-"The Perfect Harmony"-Human-AI Symbiosis for Multifaceted Decision Making

Service design involves various actors and decision-making processes. A human-AI symbiotic system can facilitate this, with AI providing robust data handling and analysis, and human designers ensuring empathetic understanding and effective stakeholder communication.
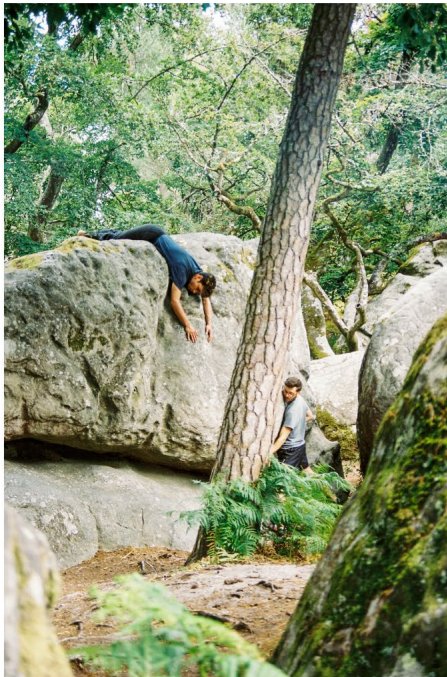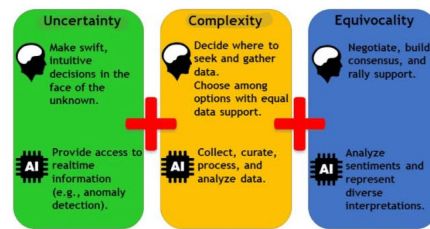
Research data:

Figure 6.Complementarity of humans and AI in decision-making situations, typically characterized by uncer- tainty, complexity, and equivocality by Jarrahi. 2018

From "Literature Review" Step

How service designers imagine their design process with AI

From "Workshop" Step

Figure 5: Service design process for AI-enabled services. Created by T. Jylkäs. 2019

From "Literature Review" Step

" ...So as designers, it's our job to collaborate, yes, and work with AI to enhance our workflow....Nothing different except that we can reach the output faster, that's all. So yeah, that's what I wanted to add......"
-Tamer, Founder of QoQo plat-from, said in the workshop

" ..So, you can use these tools not just for inspiration, but they can give you ideas and ways to understand a lot of things. ...."
-Daniel, participant the workshop

Final Top Finding 5- "Dancing with AI"- Designer Responsibility in AI Integration

Given the potential of AI in service design, it becomes the responsibility of designers to understand how AI works and to facilitate effective communication of AI processes and outcomes among stakeholders. This understanding is crucial for the seamless and ethical integration of AI tools in the design workflow.

Research data:

How AI and designers complement each other
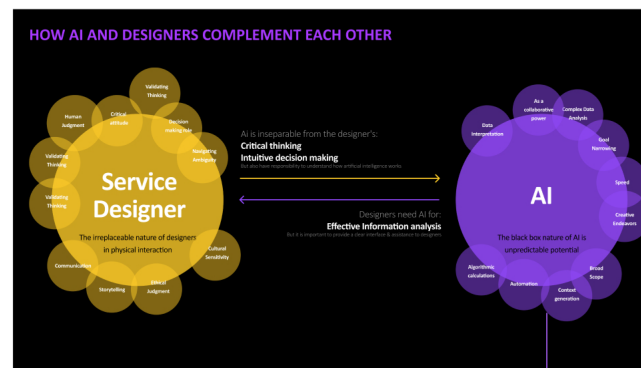
From "Workshop" Step

Unpredictable potential of AI

" Even the creator of the most complex systems knows there's an input and there's an output,......a huge similarity between AI systems and the human brain..."

-Tamer, Founder of QoQo plat-from, said in the workshop

" Also in Jylkäs' AI-service-design process emphasizes the need for collaboration among service designers and technical experts..."

From "Literature Review" Step

Final Top Finding 6- "Swiss Army AI: The Need for All-In-One Tools" Necessity for Comprehensive and Customizable AI Tools

The current design landscape requires multiple AI tools to accomplish tasks, indicating a need for more comprehensive and customizable AI solutions. Tools that can adapt to individual or project-specific needs would ensure a smoother, more efficient design process.

Research data:
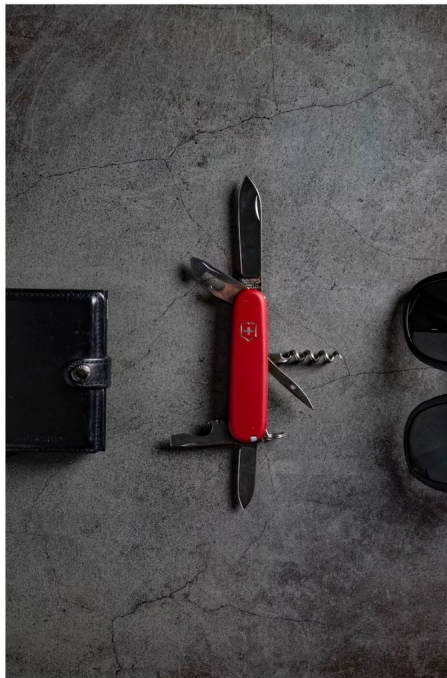
Switch between multiple AI tool platforms to accomplish a task

Adapt AI tools according to individual or project-specific needs, Customization as a Key to Efficient AI Application

From "Diary" Step

Each stage requires different ideal AI assistant, necessitating a team-wide dialogue to align these needs.

From "Workshop" Step

Final Top Finding 7- Harmonizing the AI Orchestra:Balancing Trust and Expanding Stakeholder Engagement

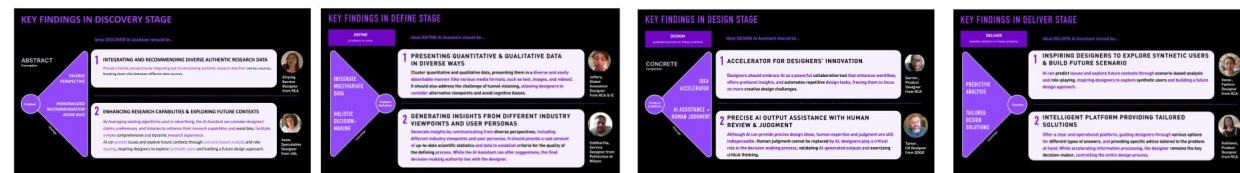As designers value the efficiency AI tools offer, their concerns about trustworthiness and ethical implications loom large. To strike a balance between functionality, credibility, and ethical considerations, there's an untapped potential for AI tools fostering wider stakeholder engagement. Developing such tools would not only address existing trust concerns but also fill a gap in the service design process, truly harnessing AI's potential.

Research data:

Service Designers' concerns about using AI in their workflow

From "Questionnaire" Step

Vital for stakeholders to grasp AI's contribution to the service design process, banishing the cloud of uncertainty.
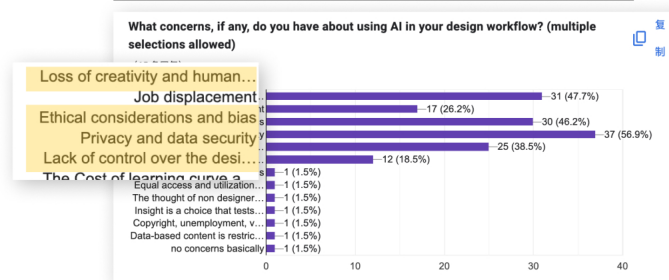
From "Questionnaire" Step

AI could disrupt the design practices, balancing the AI engagement is the key

" ...HoweverI certainly think AI could disrupt my design practice in that it may render certain task redundant such as image production, ideation, concept design. ...."
    --One of the participants from the workshop

Design Definition & Concept Proposal

05

This chapter explores the intersection of AI technologies and service design, highlighting designers' incomplete grasp of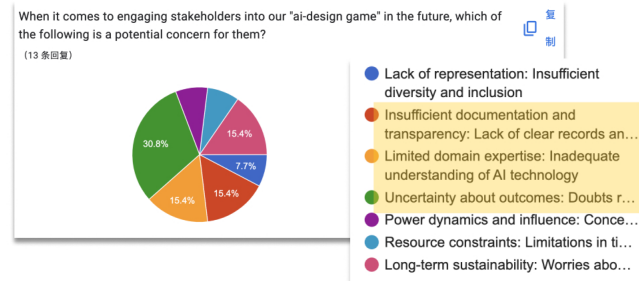 AI's capabilities. Addressing this disconnect, we introduce 'AIdea,' an AI-Enabled Service Design Toolkit. Designed for both designers and stakeholders, 'AIdea' seamlessly integrates AI functionalities into service design workflows. Subsequent sections detail the toolkit's components and its transformative potential in design ventures.

In the burgeoning landscape of AI, where context generation services like ChatGPT continue to break new ground, the opportunity for AI to augment design processes is tremendous. However, it's observed that designers' understanding of AI currently remains at a moderate level. There's a conspicuous lack of a systematic platform to learn AI skills, thereby necessitating a multi-faceted learning path. This path should offer clarity, provide hands-on experience, and facilitate communication within design teams and extra stakeholders.

Interestingly, while designers' understanding of AI's potential may be underdeveloped, their awareness of the specific ways AI can enhance each stage of the design process is astutely clear. They have a well-defined mental map of where they would like AI's help in their workflows. However, a gap still exists between designers' perception of AI's capabilities and its actual potential, and this gap must be addressed to optimize AI's utility in design.

Moreover, as the needs of designers vary widely across different projects and contexts, especially with stakeholder involvement, there's a call for a customizable approach to how AI assists. It's also important to consider designers' awareness of AI's limitations, such as the lack of a holistic view of the design process, potential data leaks, and ethical concerns. Therefore, it's crucial to have open discussions about integrating AI into the design workflow, with stakeholders included as beneficiaries of the design output.

In essence, a facilitative link is needed to enable service designers and stakeholders to understand the range of AI skills and to collectively decide how best to weave AI into the design workflow through an interactive session. This link should promote mutual understanding, foster collaboration, and offer customization opportunities for AI's role in the design process.

This realization paves the way for the concept proposal **'AIdea,'** aiming to create an all-encompassing, inclusive, and efficient engagement with AI in service design.

Name: AIdea- AI-Enabled Service Design Toolkit
Introduction:'AIdea', is an AI-Enabled Service Design Toolkit designed to facilitate the integration of AI functionalities into the service design workflow. The toolkit promotes a cooperative and interactive approach, engaging both service designers and non-designer stakeholders. The AIdea toolkit provides a conducive environment for participants to understand the AI skill scope in a relaxed yet effective way. This interactive process encourages stakeholders to discuss and align AI capabilities with the specific service design process and tools.

When to Use It: AIdea is best used at the start of the design process, specifically during the project kick-off workshop. This initial stage is crucial for setting the tone and direction of the entire project.

Participants: The participants should be a mix of service designers, AI specialists, and other stakeholders such as project managers, users, or clients.

Ideal Environment Setup: The setup should preferably be a large room or space with a big table to accommodate all participants and the cards. A pinboard or large wall area could also be useful for visual mapping.

Toolkit Introduction

The AIdea toolkit includes one design journey map and three card categories: AI Engagement Type Cards, Service Design Tool Cards, and Issue Cards.
Design Journey Map: This map outlines the flow of the service design process. It is put on the table first, providing a structure for the session and allowing participants to visualize how the tools and AI functionalities will play out in different stages of the process.
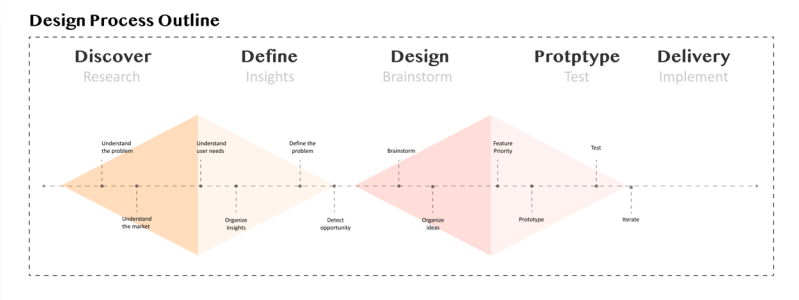
Figure 32
Design Journey Map from the AIdea Toolkit. Made by author

96

Concept Proposal

AI Engagement Type Cards(Figure 33):

On the front, these cards detail a range of AI functionalities that can support the design process. The back side presents real-world examples of AI platforms that offer the corresponding function.

Issue Cards(Figure 33):

These cards bring potential challenges and issues to the forefront, specifically those that might occur when incorporating AI into the design process. They serve as guiding prompts for meaningful discussion on crucial topics such as data privacy, ethics, bias, and transparency.
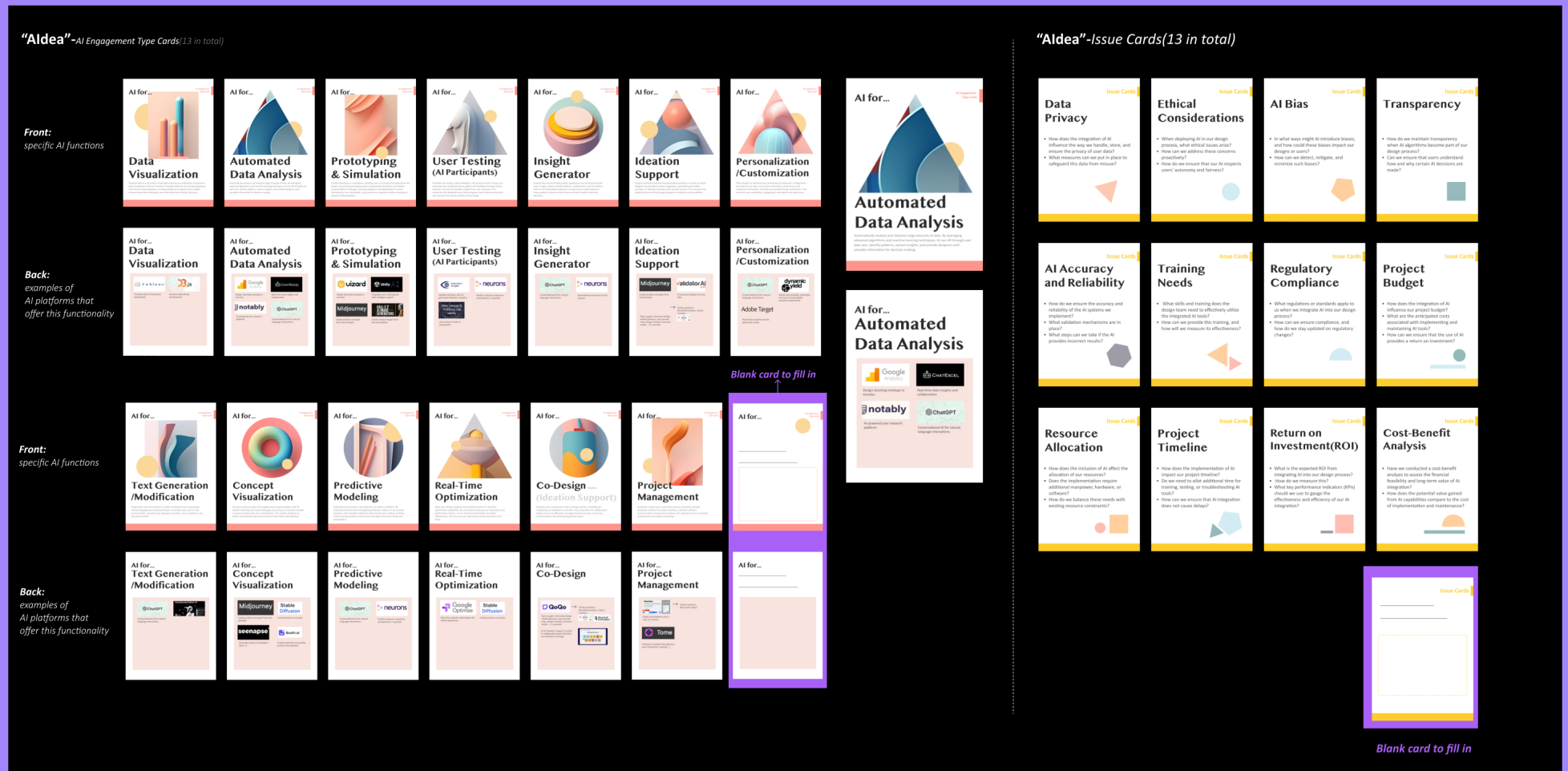
Figure 33
AI Engagement Type Cards and Issue Cards from the AIdea Toolkit. Made by author

Service Design Tool Cards(Figure 34):

Each card outlines a service design tool, its role in the design process, and the type of tool on the front. The back side suggests potential AI Engagement Types that might be integrated with the specific tool.

Figure 34
Part of the Service Design Tool Cards from the Aldea Toolkit. Made by author

99

100

Usage Scenario

**Steps that Using the AI-Enabled Service Design Toolkit:**

Setting Up: Begin by arranging the service design process flowchart and Service Design Tool Cards on a large table, with the cards facing up(Figure 35).

Figure 35
Toolkit Set up of AIdea toolkit.Made by author
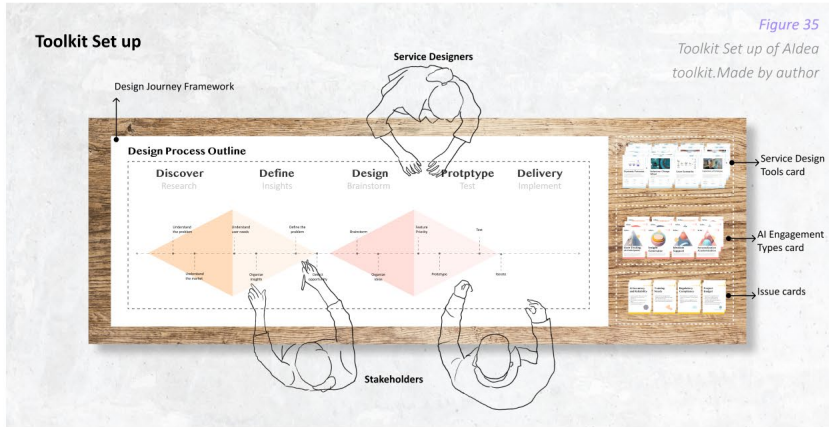
Exploration Phase: Lay out the Service Design Tools Cards face up. Service designers and stakeholders discuss which tools to utilize at each step and place the respective card on the corresponding design phase(Figure 36).

Figure 36
Exploration Phase of AIdea toolkit.Made by author
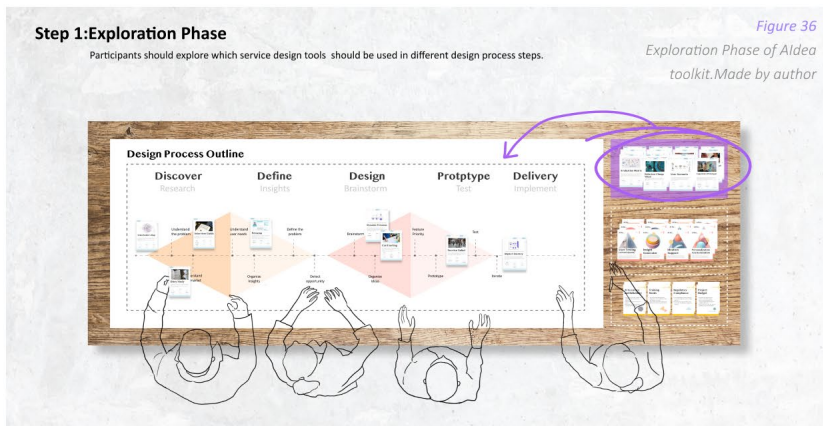
Matching Phase: After placing all Service Design Tool Cards at their corresponding stages, turn the cards over to reveal the recommended AI Engagement Types. Take out the corresponding AI Engagement Type cards, placing them alongside each tool card. Here, discussions should be centered around the most appropriate AI Engagement Types for each tool.(Figure 37)

Figure 37
Matching Phase of AIdea toolkit.Made by author
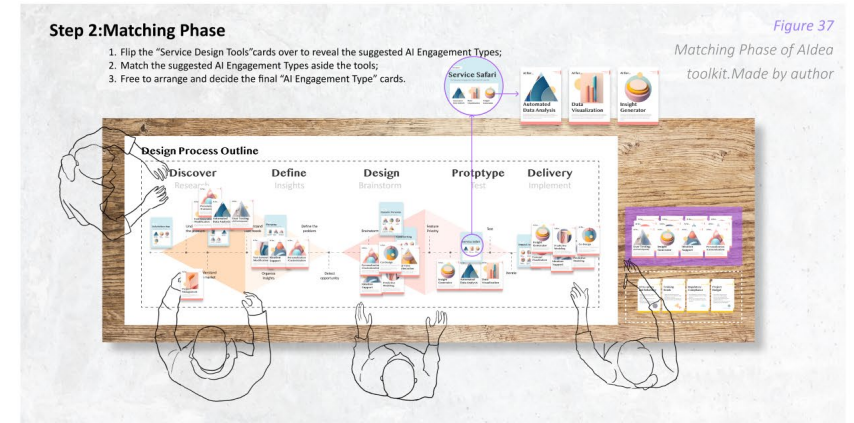
Selection of AI Tools: Following the discussions, each AI Engagement Type card is turned over to reveal the corresponding AI tools. The service design team selects suitable AI tools to add to their workflow, ensuring that they align with existing capabilities(Figure 38).

Figure 38
AI Selection Phase of AIdea toolkit.Made by author
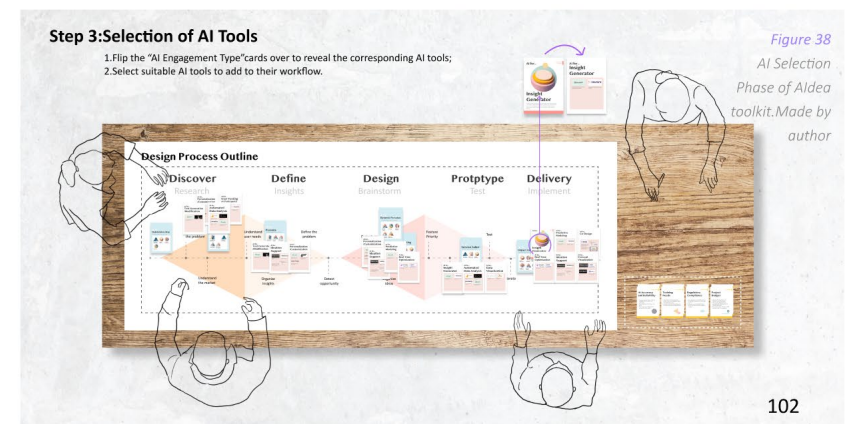
Issue Discussions: To address potential concerns about integrating AI into the workflow, such as data privacy and ethical considerations, use the 'Issue Cards'. These cards help structure deeper discussions on relevant topics(Figure 39).
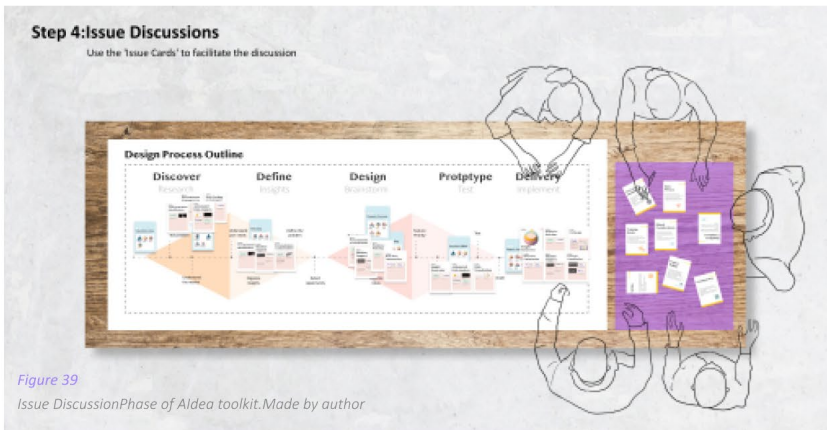
Finalization: After a comprehensive review and necessary adjustments, the final map serves as a shared project blueprint. This blueprint provides clarity and direction for all involved in the project, ensuring the optimal integration of AI into the design process(Figure 40).
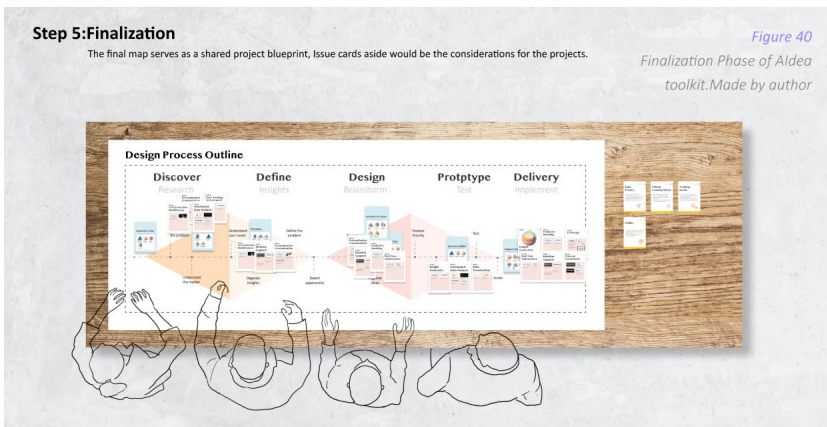
User
Testing

06

In this chapter, we embark on a hands-on evaluation of the 'AIdea' toolkit's functionality within service design contexts. Structured as an interactive workshop, the test aims to scrutinize the toolkit's practicality, its potential in addressing design challenges, and its impact on workflow efficiency. This assessment not only validates the toolkit's efficacy but also offers insights into how AI can transform traditional service design processes. The subsequent sections detail the test's design, execution, and pivotal findings.

Test Objectives

The primary objective of the test section was to evaluate the usability and applicability of the AIdea toolkit in the service design process and understand how it impacts the workflow of service designers. It was aimed at exploring whether the toolkit addresses key pain points of service designers, like handling data-intensive tasks, and if it enhances their efficiency. Also to gain insights into how well stakeholders could interpret the toolkit's functions, whether it provided clarity on the AI-service design process, and if it helped stakeholders have a better grasp of AI's potential in service design. The objectives directly align with the research question, which investigates the role and effectiveness of AI tools in the service design process. The insights derived from the tests are crucial for validating the thesis hypothesis and evaluating the potential of AI tools in this context.

Test Design

The test was structured as an interactive workshop where participants were asked to engage with the AIdea toolkit and apply it to a specific service design process.
It included the following steps:
Concept Introduction: The session was initiated by introducing the participants to the toolkit, its purpose, and its capabilities. A comprehensive explanation of its different features and how to utilize them in the service design process was also provided.

Toolkit Application: Post the introduction, participants were asked to apply the toolkit to a specific service design scenario. This hands-on experience aimed to offer a firsthand understanding of the toolkit's functionality and potential impact on the service design process.

Analysis: Participants were tasked with analyzing the service design process both before and after the implementation of the AIdea toolkit. This comparative analysis was intended to highlight the difference the toolkit made in terms of efficiency, productivity, and insight generation.

By following this approach, it was possible to engage the participants in a practical examination of the toolkit, evaluating not just its usability, but also its potential impact on their work processes and outcomes. This test design, thus, allowed the gathering of actionable insights about the toolkit's performance in a real-world service design scenario.

Test participants information

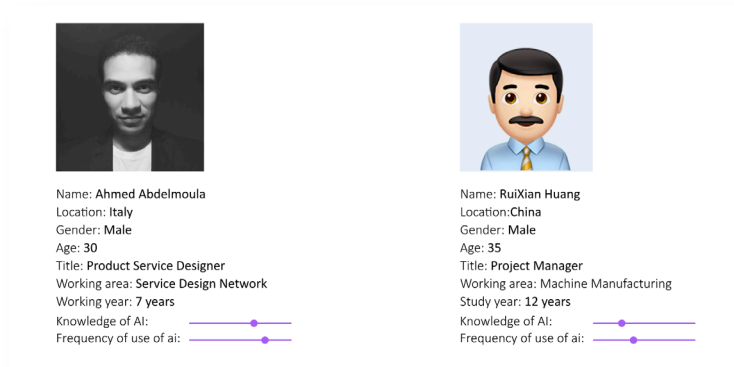Here(Figure 41) is a brief user profile of the test participants in two different roles (Ahmed and RuiXian).

Figure 41
Test participants information. Made by author

Test Feedback

Test user's name: Ahmed
Test Role: Service Designer

Findings according to the topics:
Usability and Design: A Double-Edged Sword
Ahmed found the AIdea toolkit to be highly intuitive and particularly relevant to his expertise in service design. The instructions were straightforward, and the toolkit was effective in elucidating how AI can seamlessly blend into the service design process. However, he emphasized the need for the toolkit to clarify the distinction between the creative and analytical phases of the design process, as each may necessitate different types of AI support.

Toolkit Components: Clarity with Room for Improvement
Ahmed scored the 'AI Engagement Type Cards' and 'Service Design Tool Cards' at 7 out of 10. While he appreciated how these components illuminated AI's role in service design, particularly during content generation and analysis, he highlighted a gap: the toolkit doesn't sufficiently distinguish the functionalities useful for creative phases from those beneficial for analytical tasks.

Value and Impact: AI as a Data Transformer
According to Ahmed, the AIdea toolkit significantly impacted his approach to handling data-intensive tasks in service design. He specifically pointed out its utility in the initial phases of user research and the final stages of data analysis. However, he emphasized that while AI is helpful, it cannot replace the human touch required in the creative aspects of design.

Suggestions for Improvement: Transparency and Training
Ahmed raised two significant concerns:
- The toolkit should clearly emphasize the varying impact of AI tools in different stages of the design process.
- Designers need comprehensive training to fully understand how to deploy the toolkit in an end-to-end design workflow, including cost implications.
- To develop a digital version of the AIdea toolkit, as recommended by Ahmed, in order to enhance online collaborations and ensure seamless integration with prevalent digital design platforms.

Future Use: Optimism Amidst Reservations
Ahmed expressed enthusiasm for the AIdea toolkit, declaring his intent to both use it himself and recommend it to peers. However, he noted that for the toolkit to transition from a promising concept to an indispensable asset, it needs to cater to the entire spectrum of the service design process, from research and ideation to implementation and analysis.

Test user's name: RuiXian
Test Role: Project Manager

Findings according to the topics:

Usability and Design: From a non-designer's perspective, the toolkit's layout and instructions were remarkably accessible. The decision to use visual aids, specifically cards, to describe and guide the process made it much less daunting than anticipated. This approach transformed what could have been a complicated process into an intuitive experience. The guidelines were lucid, well-structured, and provided a step-by-step guide to each phase of the service design process, further enhancing the toolkit's ease of use.

Toolkit Components: Two components of the toolkit, namely the 'AI Engagement Type Cards' and 'Service Design Tool Cards', proved to be particularly useful. These elements effectively deconstructed the typically intricate concepts related to AI and service design tools. In doing so, they made our engagement with these topics much more manageable, contributing to more fruitful and focused discussions.

Value and Impact: By using the toolkit, it is possible to contribute significantly more to the design discussions than we initially anticipated. The structure and guidance offered by the toolkit enabled us to propose new ideas, discuss potential challenges, and provide valuable insights into aspects of the design process that stakeholders had previously overlooked. This level of active participation fostered a more collaborative environment, proving highly beneficial for the overall process.

Suggestions for Improvement:
- While the toolkit was generally easy to understand, he suggest the addition of a glossary or reference guide for more complex AI terms and jargon. This feature could provide non-technical stakeholders with a quick reference point during discussions, ensuring everyone involved can follow and contribute to the conversation effectively.
- There is a potential for a digital interaction version of the AIdea toolkit, which would complement and possibly integrate with prevalent design platforms.

Future Use: Without a doubt, the toolkit shows enormous potential for wider application. Its ability to demystify the often complex and technical aspects of AI, while simultaneously promoting inclusive and constructive discussions, is truly commendable. He strongly believes in its value and recommends its adoption in service design processes, particularly those incorporating AI elements.

Summary of Insights

Tests with Ahmed and RuiXian confirmed the AIdea toolkit's usability and efficiency in the service design process. It augments data handling and boosts efficiency, benefiting designers and stakeholders alike.

Areas for enhancement encompass differentiating creative from analytical phases, offering more AI functionality examples, and tackling data privacy and AI bias issues. Both testers suggested a glossary for AI terms to widen accessibility and expressed a keen interest in a digital version of the toolkit. This digital adaptation would not only meet the modern demands of the design landscape but could also align and integrate with existing design tool platforms.

Despite some areas for growth, the toolkit's positive ramifications were evident. It fosters a deeper understanding and proficient application of AI in service design. Incorporating this feedback will solidify AIdea's position in the evolving service design domain.

Conclusion

07

1. AI-Service Design Potential

The confluence of technological advancements with service design has laid the foundation for an expansive realm rich in opportunities and intricacies. This master thesis delves deep into this intersection, unveiling the diverse roles AI can assume. From enhancing design capabilities and altering the dynamics of designer and stakeholder interactions, to pioneering holistic frameworks like AIdea, the research stands as a beacon, highlighting the transformative potential of AI in redefining the contours of service design.

2. AI and Human Symbiosis

With the growing ubiquity of AI, understanding its implications within the service design arena became a central theme of this research. The findings spotlight a prevailing knowledge gap between designers and AI's capabilities. This chasm underscores the necessity of initiatives like AIdea that actively bridge this divide. Encouraging designers and stakeholders to contemplate AI engagement, AIdea places the myriad possibilities of AI-augmented design at the forefront of discussions. This not only urges designers to familiarize themselves with AI skills and effectively weave them into the service design narrative but also offers a tangible springboard for project discussions with stakeholders. In this symbiotic relationship, AI augments human qualities, and designers, equipped with both design acumen and an understanding of AI, can realize more holistic and impactful outcomes.

3. Data Management with AI

In our data-saturated epoch, AI's prowess to meticulously analyze and extract meaningful insights from voluminous data sets is an invaluable asset. For service designers, this isn't just a tool, but a compass, guiding them towards richer, more nuanced insights. By harnessing AI during data-heavy stages, designers can cultivate more informed design decisions and craft enhanced user-centric experiences.

4. Ethical Concerns

The interplay of AI and service design brings with it a suite of challenges, extending beyond the realms of technicality and creativity. Ethical considerations loom large in this matrix. The research accentuates the imperative for designers to traverse this domain with heightened sensitivity and responsibility. As custodians of both innovative technology and user trust, it is incumbent upon designers to ensure that the AI integration is not merely cutting-edge but also firmly rooted in ethical tenets that champion human rights, well-being, and overarching values.
"AIdea's Journey: Reflecting on Its Tangible Roots and Envisioning a Digital Future"

5.AIdea's Journey: Reflecting on Its Tangible Roots and Envisioning a Digital Future

The AIdea toolkit, as introduced in this thesis, emerged as a tangible instrument, a conscious choice after reflecting on both its immediate advantages and constraints. Through my explorations and subsequent user feedback, it became evident that the eventual direction for AIdea would be its incarnation in a digital space. Today's design landscape, defined by online co-design interactions, emphasizes the potential of a digital version of AIdea, not only for its ability to streamline interactions but also for its seamless integration with renowned service design platforms like Service Design Tools. Transitioning AIdea into a digital realm isn't merely a notion of modernity but a strategic vision to empower designers in choosing the appropriate AI engagement type during diverse design phases.

In this regard, I've designed several platform interfaces that capture my envisaged direction for AIdea's digital progression, as demonstrated in Figure 42 and Figure 43, vividly illustrating the potential for AIdea's digital evolution. Although I've designed only a few basic pages, they aptly demonstrate how AIdea might evolve as a digital product. Retaining some of the interactive elements from its tangible format, such as choosing from a stack of cards or flipping the 'service design tools' card to reveal the relevant AI engagement type, these designs prioritize user simplicity. They sidestep unnecessary complexities, ensuring the user interface remains transparent and intuitive. Teams can effortlessly navigate through clear, sequenced steps, building a bespoke AI-design process tailored to their needs. Moreover, this digital approach champions online collaboration, accommodating participants from anywhere, and unmistakably aligns with the trajectories of future design trends. These interfaces serve as initial blueprints, charting AIdea's anticipated transition from its current tactile origins to a holistic digital design ecosystem.

Envisioned interface design: AIdea Toolkit landing page
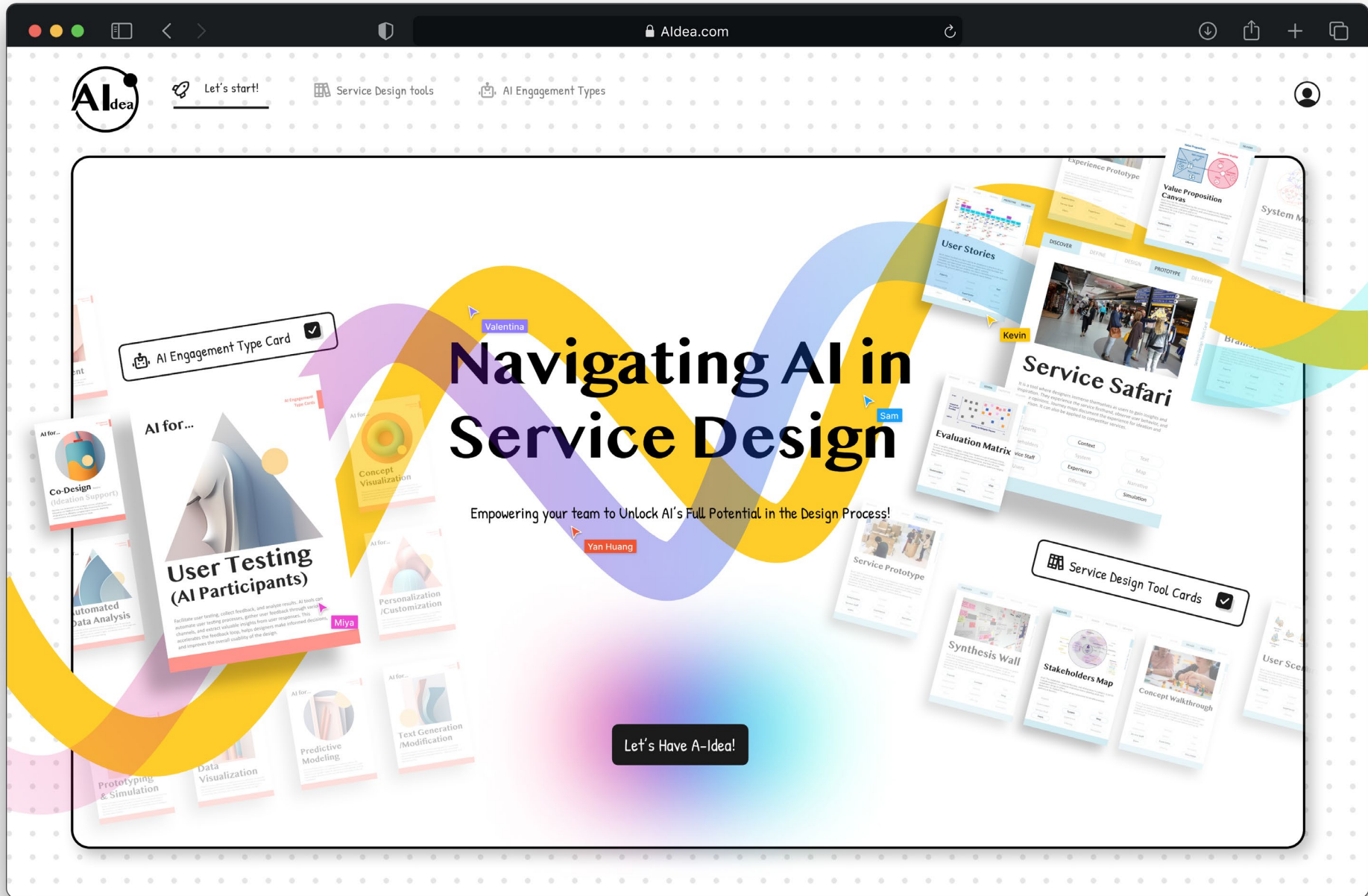
Figure 42
AIdea Toolkit digital product landing page demo. Made by author

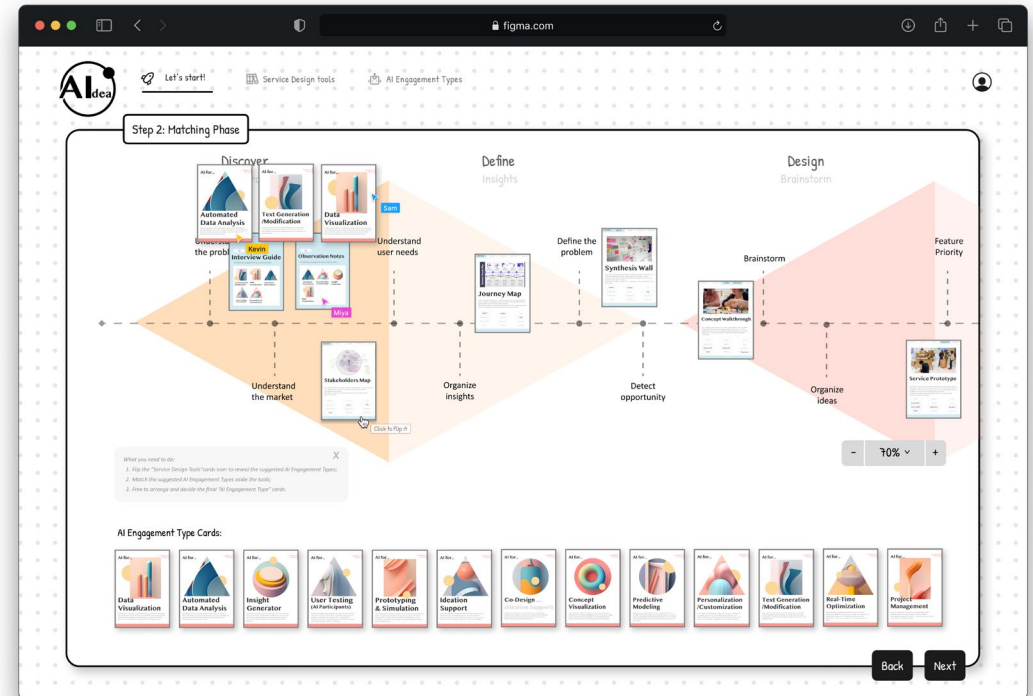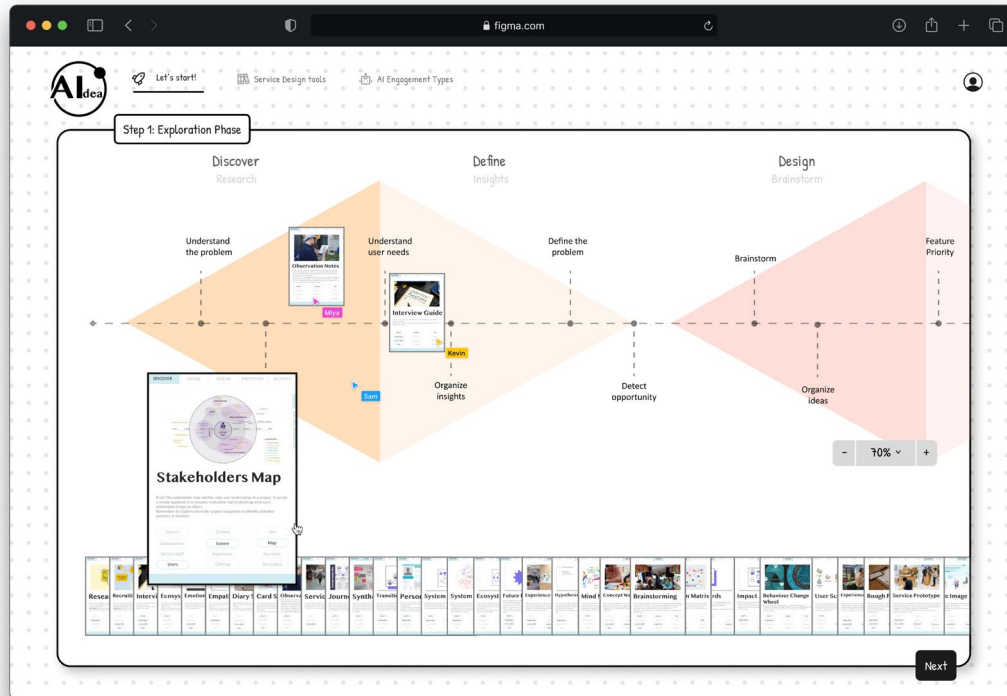# Envisioned interface design: AIdea Toolkit co-creation page

While my reflections and the consistent feedback from users champion the benefits of a digital AIdea, the choice to start with a tangible format was deliberate and strategic for this thesis. The tactile nature of the physical toolkit facilitated swift prototyping, immediate user engagement, and quick feedback loops, proving invaluable for the foundational stages of this research. However, it's worth acknowledging that time constraints and the inherent limitations of this thesis meant that the exploration remained anchored to its physical beginnings, even as the horizon pointed towards a digital pivot. This is not to undervalue the physical toolkit; it served as the critical first step, laying the groundwork and providing tangible insights that will undoubtedly influence its digital evolution.

6. Limitations of the Study:

Throughout this thesis, diligent efforts were made to ensure comprehensive and insightful exploration into the integration of AI within the service design process. However, like any academic endeavor, this study was not without its constraints. Firstly, the time frame restricted the depth to which certain facets, especially practical testing of the AIdea toolkit, could be delved into. The choice of a physical toolkit, although deliberate and beneficial for immediate prototyping, inherently restricted the reach and adaptability that a digital version might have offered. The research predominantly relied on specific groups for feedback, such as workers, students, and industry experts. This selective demographic might not encapsulate the entire spectrum of potential users, possibly limiting the universality of the findings. Additionally, the rapid evolution of AI technologies means that the landscape is in constant flux; the findings, while relevant now, might require regular updating to stay pertinent. Lastly, while ethical considerations were emphasized, the vast and evolving realm of AI ethics might need even more exhaustive exploration in future iterations. These limitations, while acknowledged, also pave the way for future research and iterations, ensuring that the exploration of AI in service design remains dynamic and evolving.

References

08

- Abbasi, A., Sarker, S., & Chiang, R. H. (2016). Big data research in information systems: Toward an inclusive research agenda. Journal of the association for information systems, 17(2), 3
- Acemoglu, D. and Restrepo, P. (2018). The race between man and machine: Implications of technology for growth, factor shares, and employment. American economic review, 108(6):1488–1542.
- Acemoglu, D. and Restrepo, P. (2022a). Demographics and automation. The Review of Economic Studies, 89(1):1–44.
- Arafa, Y., & Mamdani, A. (2000). Virtual personal service assistants: Towards real-time characters with artificial hearts. In Proceedings of the 5th international conference on Intelligent user interfaces (pp. 9-12). Association for Computing Machinery, ACM.
- Brown, T. 2008. Design thinking. Harvard business review 86(6): 1-10. Brown, T. 2009. Change by design: How design thinking transforms organizations and inspires innovation. New York: Harper Business Press.
- Buchanan, R. 1992. Wicked Problems in Design Thinking. Design Issues 8(2): 5-21.
- Cath, C., Wachter, S., Mittelstadt, B., Taddeo, M., & Floridi, L. (2017). Artificial intelligence and the 'good society': The US, EU, and UK approach. Science and Engineering Ethics. https://doi.org/10.1007/s11948-017-9901-7
- Chatila, R., & Havens, J. C. (2019). The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems. In M. I. Aldinhas Ferreira, J. Silva Sequeira, G. Singh Virk, M. O. Tokhi, & E. E. Kadar (Eds.), Robotics and Well-Being (Vol. 95, pp. 11–16). Springer International Publishing. https://doi.org/10.1007/978-3-030-12524-0_2
- Chen, W., Yu, Z., & Fong, S. (2018). How to build a chatbot: Chatbot framework and its capabilities. In Proceedings of the 2018 10th International Conference on Machine Learning and Computing (pp. 369-373). Association for Computing Machinery, ACM. doi:10.1145/3195106.3195169
- Cheryl Simon. (1982). Earth Sciences. Science News, 121(25), 408–408. https://doi.org/10.2307/3966661
- Choo, C. W. (1991). Towards an information model of organizations. The Canadian Journal of Information Science, 16(3), 32-62.
- Coeckelbergh, M. (2013). Pervasion of what? Techno–human ecologies and their ubiquitous spirits. AI & SOCIETY, 28(1), 55–63. https://doi.org/10.1007/s00146-012-0418-y

- Cruickshank, L., & Trivedi, N. (2017). When your toaster is a client, how do you design? Going beyond human centred design. The Design Journal, 20(sup1), S4158–S4170. https://doi.org/10.1080/14606925.2017.1352914
- Davenport, T. H., & Bean, R. (2017, March 31). How P&G and American Express are approaching AI. Harvard Business Review. Available at https://hbr.org/2017/03/how-pg-and- american-express-are-approaching-ai
- Davenport, T., & Bean, R. (2017). Big Data Executive Survey 2017. Executive summary of findings. New Vantage Partners.
- Dorst, K. 2015. Frame Innovation. Creating New Thinking by Design. Cambridge: MIT Press.
- Downe, L. (2020). Good services: How to design services that work. BIS Publishers. European Parliament Committee on Legal Affairs. (2017). Report with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL)) (No. A8-0005/2017). European Parliament. https://www.europarl.europa.eu/doceo/document/A-8-2017-0005_EN.pdf
- Eloundou, T., Manning, S., Mishkin, P., & Rock, D. (2023). Gpts are gpts: An early look at the labor market impact potential of large language models. arXiv preprint arXiv:2303.10130.
- European Parliament Committee on Legal Affairs. (2017). Report with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL)) (No. A8-0005/2017). European
- Guszcza, J. (2018, January). Smarter together: Why artificial intelligence needs human-centered design. Deloitte Review, (22), 35–
- Hauswald, J., Laurenzano, M. A., Zhang, Y., Yang, H., Kang, Y., Li, C., . . . Mars, J. (2016). Designing future warehouse-scale computers for Sirius, an end-to-end voice and vision personal assistant. ACM Transactions on Computer Systems (TOCS), 34(1), 2:1-32.
- Hung, S. Y. (2003). Expert versus novice use of the executive support systems: an empirical study. Information & Management, 40(3), 177-189.
- Iansiti, M. and K. Lakhani. 2020. Competing in the Age of Artificial Intelligence. Cambridge, MA: Harvard Business Press.
- Iansiti, M. and K. Lakhani. 2020. Competing in the Age of Artificial Intelligence. Cambridge, MA: Harvard Business Press.
- Jahnke, M. 2013. Meaning in the Making: Introducing a Hermeneutic Perspective on the Contribution of Design Practice to Innovation. Gothenburg: University of Gothenburg.

- Jarrahi, M. H. (2018). Artificial intelligence and the future of work: Human-AI symbiosis in organizational decision making. Business horizons, 61(4), 577-586.
- Jylkäs, T., Augsten, A., & Miettinen, S. (2019). From hype to practice: Revealing the effects of AI in service design. In Academy for Design Innovation Management Conference: Research Perspectives in the Era of Transformations (pp. 1203-1216). Academy for Design Innovation Management.
- Kelley, D. and T. Kelley. 2013. Creative Confidence: Unleashing the Creative Potential within Us All. New York: Crown Publishing.
- Kile, F. (2013). Artificial intelligence and society: A furtive transformation. AI & SOCIETY, 28(1), 107–115. https://doi.org/10.1007/s00146-012-0396-0
- Koufteros, X., Vonderembse, M., & Jayaram, J. (2005). Internal and external integration for product development: the contingency effects of uncertainty, equivocality, and platform strategy. Decision sciences, 36(1), 97-133.
- Krippendorff, K. 1989. On the Essential Contexts of Artifacts or on the Proposition that "design is Making Sense (of Things)". Design Issues 5(2): 9-38. Krippendorff, K. 2006. The Semantic Turn: A New Foundation for Design. Boca Raton: CRC Press.
- Lee, S. S., Lee, J., & Lee, K. P. (2017). Designing intelligent assistant through user participations. In Proceedings of the 2017 Conference on Designing Interactive Systems (pp. 173–177). Association for Computing Machinery, ACM.
- Lungarella, M., Iida, F., Bongard, J. C., & Pfeifer, R. (2007). AI in the 21st Century – with historical reflections. In M. Lungarella, F. Iida, J. Bongard, & R. Pfeifer (Eds.), 50 Years of Artificial Intelligence (Vol. 4850, pp. 1–8). Springer Berlin Heidelberg. https://doi.org/10.1007/978- 3-540-77296-5_1
- McAfee, A., Brynjolfsson, E., Davenport, T. H., Patil, D. J., & Barton, D. (2012). Big data: the management revolution. Harvard business review, 90(10), 60-68.
- Miettinen, S. (2017). Introduction to industrial service design. In S. Miettinen (Ed.), An introduction to industrial service design (pp. 3–14). Routledge.
- Miettinen, S., & Koivisto, M. (2009). Designing services with innovative methods. Savonia University of Applied Sciences. Verganti, R. 2009. Design-driven innovation – Changing the rules of competition by radically innovating what things mean. Boston: Harvard Business Press.
- Moussawi, S. (2018). User experiences with personal intelligent agents: A sensory, physical, functional and cognitive affordances view. In Proceedings of the 2018 ACM SIGMIS Conference on Computers and People Research (pp. 86–92). Association for Computing Machinery, ACM.
- Norman, D.A. and R. Verganti. 2014. Incremental and Radical Innovation: Design Research vs. Technology and Meaning Change. Design Issues 30(1): 78-96.
- Rock, D., Chin, C., Salomons, A. M., and Seegmiller, B. (2022a). New frontiers: The origins and content of new work, 1940–2018. Technical report, National Bureau of Economic Research.
- Russell, S. J., & Norvig, P. (1995). Artificial intelligence: a modern approach.
- Sadler-Smith, E., & Shefy, E. (2004). The intuitive executive: Understanding and applying 'gut feel'in decision-making. Academy of Management Perspectives, 18(4), 76-91.
- Shi, Y., Yan, X., Ma, X., Lou, Y., & Cao, N. (2018). Designing emotional expressions of conversational states for voice assistants: Modality and engagement. In Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems (p. LBW557). Association for Computing Machinery, ACM.
- Siegel, R. (2016). 20 Years Later, Humans Still No Match for Computers on the Chessboard. NPR. org.
- Stickdorn, M., Hormess, M., Lawrence, A., & Schneider, J. (2017). This is service design doing. O'Reilly.
- Stigliani, I. and D. Ravasi. 2012. Organizing thoughts and connecting brains: Material practices and the transition from individual to group-level prospective sensemaking. Academy of Management Journal 55(5): 1232-1259.
- Verganti, R. 2011a. Designing Breakthrough Products. Harvard Business Review 89(10): 114-120. Verganti, R. 2011b. Radical Design and Technology Epiphanies: a new focus for research on design management. Journal of Product Innovation Management 28(3): 384-388.
- Verganti, R. and A. Öberg. 2013. Interpreting and Envisioning: A Hermeneutic Framework to Look at Radical Innovation of Meanings. Industrial Marketing Management 42(1): 86-95.
- Verganti, R., Vendraminelli, L., & Iansiti, M. (2020). Innovation and Design in the Age of Artificial Intelligence. Journal of Product Innovation Management, 37(3), 212–227. https://doi.org/10.1111/jpim.12523
- Vögel, H.-J., Süß, C., Hubregtsen, T., Ghaderi, V., Chadowitz, R., Conradt, J., . . . Müller, S. (2018). Emotion- awareness for intelligent vehicle assistants: A research agenda. In 2018 ICSE'18: SEFAIAS Workshop on Software Engineering for AI in Autonomous Systems (SEFAIAS) (pp. 11–15). Institute of Electrical and Electronics Engineers.

- Waller, M. A., & Fawcett, S. E. (2013). Data science, predictive analytics, and big data: a revolution that will transform supply chain design and management. Journal of Business Logistics, 34(2), 77-84.
- Weick, K. E. (1995). Sensemaking in organizations (Vol. 3). Thousand Oaks, CA: SAGE.
- Weick, K. E., & Roberts, K. H. (1993). Collective mind in organizations: Heedful interrelating on flight decks. Administrative science quarterly, 357-381.
- Yan, R., & Zhao, D. (2018). Coupled context modeling for deep chit-chat: Towards conversations between human and computer. In Proceedings of the 24th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining (pp. 2574-2583). Association for Computing Machinery, ACM.
- Yang, Y., Ma, X., & Fung, P. (2017). Perceived emotional intelligence in virtual agents. In Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems (pp. 2255–2262). Association for Computing Machinery, ACM.
- Zhao, R., Sinha, T., Black, A., & Cassell, J. (2016). Automatic recognition of conversational strategies in the service of a socially-aware dialog system. In Proceedings of the 17th Annual Meeting of the Special Interest Group on Discourse and Dialogue (pp. 381–392). Association for Computational Linguistics.