Reuse of service concept elements for modular service design

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Abstract

Purpose – This research investigates the systematic reuse of service concept elements within modular service design, aiming to offer actionable insights into effective conceptualization of services and extending methodological underpinnings to enhance the approach of service design.

Design/methodology/approach – Employing a design science research approach, this study investigates the intentional and targeted reuse of service concept elements for modular service design. It develops four general design principles and applies them in a real-world context to demonstrate and evaluate the purposeful integration of service concept elements.

Findings – This research reveals the efficacy of reusing service concept elements for modular service design, highlighting the benefits of this approach in conceptualizing new services. It theorizes generalizable design knowledge by formalizing four design principles that allow to underpin the reuse of service concept elements.

Originality/value – This research contributes to service design literature by providing actionable insights into the systematic reuse of service concept elements, particularly within the framework of modular service design. We develop and test general design principles and, specifically, apply them for analytics-based digital services.

Keywords Modular service design, Reuse of service concept elements, Design science research, Analytics-based digital service

Paper type Research paper

Introduction

Service design has emerged as a multidisciplinary field of research that adopts a human-centered, systemic perspective on services to address service innovation systematically. Service design relies on various practices, methods, and tools to explore, conceptualize, and implement new service solutions to bring ideas for innovative service to life (Mager, 2009; Ostrom *et al.*, 2015; Stickdorn *et al.*, 2018). Service concepts formalize what should be done in service solutions, describe the potential benefits offered to customers and other stakeholders, and map out how they will be achieved (Goldstein *et al.*, 2002; Joly *et al.*, 2019). They are made up of individual service concept elements that specify resources (e.g. data sources), activities (e.g. technology applications), and actors (e.g. customer roles). Service concepts and their elements are the backbone for service designers' decision-making at all planning levels, and generating and specifying service concepts are key activities during service design (Patrício *et al.*, 2011). As an example, a manufacturer's vague idea of providing predictive maintenance services of its machines to customers must be specified in a service concept—detailing what data is to be used, how it is analyzed, how it is offered and delivered to customers, and how remuneration would be set up.

Surprisingly, the service design literature offers little insight into how service concepts can be systematically generated or refined to innovate services. Existing research pays close attention to human-centered, multi-actor, and participatory considerations during the early explorative activities of service design, for example, to help customers co-create their desired experiences (Teixeira *et al.*, 2012) or to identify latent customer needs (Saffer, 2010). However, the causal transition from exploring service opportunities to generating abundant service concepts seems predominantly left to "designerly" ways (Cross, 1982, p. 221), relying on service designers' individual experience or intuition. In the example above, this means that specifying the initial idea of a predictive maintenance service into a fully detailed service concept remains a highly intuitive process – the service designer cannot resort to systematic and structural support to detail all dimensions of a service concept. Despite the strategic priority of service research to stimulate and foster innovation (Ostrom *et al.*, 2015), the service design literature still fails to adequately reflect and guide organizational practice.

Thus, further theoretical underpinnings and generalizations are needed to deepen our understanding of service design and strengthen its role in shaping service innovations (Gustafsson *et al.*, 2020; Patrício *et al.*, 2018). Modular service design has recently been argued as a way to accomplish this (Tuunanen *et al.*, 2023). It applies modularization of services (Bask *et al.*, 2010a) to improve service design efficiency. Tuunanen and Cassab (2011) proposed modular variation and reuse of service concepts for this purpose, but did not yet offer a solution for how to accomplish this.

Consequently, the following question guided this research: How can existing service concept elements be reused for modular service design? To investigate reusing service concepts for modular service design, we followed the design science research (DSR) approach (Hevner *et al.*, 2004; Peffers *et al.*, 2007), which has recently also been promoted for service design research and the development of new constructs and methods (Teixeira *et al.*, 2017, 2019). More specifically, we used design principles to support formalizing the reuse of service concepts in modular service design. We first conducted industry interviews to identify problems related to using service concepts. Second, we developed design principles, applied them in an analytics-based digital service (Hunke *et al.*, 2022) called the "Design Board", and evaluated them empirically. Thus, this study contributes to the literature by proposing a novel way to reuse service concepts for modular service design by applying design principles.

The reuse of service concepts reflected in these principles reveals that, in practice, elements of new service concepts do not necessarily have to arise from scratch but may already be available to service designers in a modular form. These are *service concept elements* derived from, for example, previously generated service concepts—even ones that have moved toward market introduction and that circle back to similar explorational findings, such as similar customer experiences, desires, or needs. Based on the idea of "architectural innovation" from innovation management theory (Henderson and Clark, 1990, p. 9), we argue that actively considering reusing elements from previous service concepts, where appropriate, can effectively foster modular service design. In our example of the manufacturer aiming for its own unique predictive maintenance service concept, the service designer may benefit from reusing service concept elements like data structures, revenue schemes, or specific customer involvement.

However, previous studies predominantly applied modular reuse to improve the *efficiency* of service design (e.g. Tuunanen and Cassab, 2011). In contrast, to the best of our knowledge, this research is the first to formalize the reuse of service concept elements with the intent to enhance the *efficacy* of modular service design. While the ability to accomplish a task or goal with minimal effort, time, or resources (i.e. efficiency) is highly important, we argue that the literature lacks guidance of achieving desired results with an emphasis on quality and impact (i.e. efficacy) rather than just on efficiency. Furthermore, our study develops concrete design principles for modularizing at a service attribute level and develops and operationalizes generalizable design knowledge for this purpose a real-world setting. Thus, our study advances research on the conception stage of service design.

In the next section, we provide the relevant foundations for service design, including the pivotal role of service concept elements, and review related work on service modularization and modular reuse. Afterward, we provide an overview of the research methodology and introduce the problematization of service concept reuse and our interview findings. Next, we report developed design principles and build them into a digital service. Subsequently, we evaluate the efficacy of service concept element reuse and develop generalizable design knowledge. We then discuss our findings and their implications for service design research and practice and conclude with the limitations of this study and propositions of opportunities for future research.

Foundations and related work

As foundations, we will first look at service design and the role of service concept elements in it, and then at service modularity in general and its application to service concept elements.

Service design and the pivotal role of service concept elements

Service design has emerged as a key discipline and a promising approach for catalyzing service innovation (Ostrom *et al.*, 2015; Patrício *et al.*, 2018). Initially, the design of services was referred to as a phase of the new service development process, providing a set of tactical and functional activities for rigorous analysis and specification in developing new service offerings (Yu and Sangiorgi, 2018). Early work in this field was built on understanding services as output or intangible market offerings, whose development should be compacted and standardized to ensure quality and address service failure (Edvardsson and Olsson, 1996; Shostack, 1984).

Building on this notion, service design is positioned as a pivotal point in service innovation (Vink *et al.*, 2019). It is human-centered to form compelling value propositions that customers can transform into real value through purposeful use in their context (Grönroos and Voima, 2013; Vargo and Lusch, 2016). Service design is created by applying "designerly ways" for problem-solving, which refers to a professional service designer's way of thinking and practicing to frame and solve problems in a human-centered and creative way (Cross, 1982, p. 9). It is also inherently collaborative and multidisciplinary by incorporating competencies, methods, and techniques from different disciplines, such as operations management (e.g. to focus on service delivery systems), information systems (e.g. to integrate networked peer-to-peer collaborations), and marketing (e.g. to explore customer experiences; Joly *et al.*, 2019). With its holistic repertoire, service design cultivates a service (dominant) logic (Grönroos and Voima, 2013; Vargo and Lusch, 2016) and leads organizational transformation (Karpen *et al.*, 2017; Kurtmollaiev *et al.*, 2018)—reinforcing it as a priority for service research and practice (Ostrom *et al.*, 2015; Patrício *et al.*, 2018).

Service design iteratively passes through three principal stages [1]: *Exploration* aims to understand the needs, experiences, behaviors, and contexts of various stakeholders—customers, clients, or business partners—who will be involved in future service environments (Teixeira *et al.*, 2012). *Conceptualization* orchestrates these insights and translates them into service elements. Ideas are generated to envision future service solutions that enable customers to co-create value in their context (Patrício *et al.*, 2011; Blomkvist and Segelström, 2014). *Implementation* focuses on prototyping, testing, and operationalizing conceptual ideas (Stickdorn *et al.*, 2018). These three stages are usually repeated several times and are ongoing in organizations. Thus, they do not stop launching a service solution (and the respective end of a distinct service design project) but strive to repeatedly reflect on and challenge underlying intentions, assumptions, and arrangements. In our manufacturing example above, exploration could identify the desire of customers to avoid unplanned outages of machines; a concept for a predictive maintenance service would need to detail data, analytical methods, delivery and revenue models, while the implementation would then instantiate the service—for pilot customers and, ultimately, for a broader customer base.

In this study, we focus on the conceptualization stage. The creative and generative transition from understanding prerequisites to envisioning value-enabling service solutions is pivotal in service design. Patrício *et al.* (2011) suggested conceptualizing and envisioning future service solutions through staged service design practices to address the complex orchestration of people, technologies, and other resources. First, at the service concept level, service designers holistically define the intended value proposition and conceptualize the big picture of value-enabling solutions. Second, service system elements are orchestrated at the service system level to support specific customer activities to create mutual value. Third, the service encounter level details the touchpoints between the customer and the service provider.

Following this line of thought, the service concept lies at the heart of service design, providing the backbone for consistent decision-making (Goldstein *et al.*, 2002; Patrício *et al.*, 2011) and helping to secure approval and funding from higher management (Yu and Sangiorgi, 2018). It formalizes “what is to be done” and “how this is to be achieved” and provides a vehicle for service designers to mediate between desired customer experiences and managerial thinking (Goldstein *et al.*, 2002, p. 123). Designing (multiple) service concepts helps service design teams frame value propositions and elaborate alternatives for service activities, resources, or technologies that customers might value (Patrício *et al.*, 2011; van Riel *et al.*, 2013).

The literature provides numerous methods, tools, and techniques for visualizing, detailing, and refining individual service concept elements as the basis for downstream activities. For example, affinity diagrams provide a helpful technique for creatively exploring service concept elements through brainstorming (Teixeira *et al.*, 2017). Customer value constellation modeling portrays service concept elements from the customer’s point of view (Patrício *et al.*, 2011). Mapping tools, such as blueprinting, help to disentangle services in complex environments (Bitner *et al.*, 2008). Storyboards assist in refining service concept elements on a granular level for subsequent testing and evaluation (Goodwin, 2009). Researchers have also suggested actively considering integrating customers into service design as “experts of their experiences” to infuse the translation of user-related observations into service concept elements (Trischler *et al.*, 2018, p. 75).

However, the process of systematically generating and combining service concept elements has received relatively little attention in the service design literature. Visualization of service concept elements supports the conceptualization stage of service design to catalyze service designers’ mental models and to gain clarity, for example, by specifying underlying assumptions, beliefs, or inferences (Vink *et al.*, 2019). Customer involvement in co-design helps to tap outside-the-box knowledge (Trischler *et al.*, 2018). However, generating a service concept element is mainly left to the “designerly way” (Cross, 1982, p. 221), relying on intuition, appropriate interpretation, or experience. We attribute this issue to the general lack of operationalizable guidelines that rigorously explain the organizational and empirical practice of service design (Antons and Breidbach, 2018; Gustafsson *et al.*, 2020).

To increase impact and to successfully diffuse service design into business practice, further theoretical underpinnings are required (Patrício *et al.*, 2018). Our systematic approach leads us to methodologically investigate how to infuse the act of generating and combining service concept elements in modular service design. In the following section, we examine service modularity and draw references to its possible application in service design.

Service modularity and reuse of service concept elements

The concept of modularization originates from systems theory and has been developed to make an object's complexity more manageable by breaking the object down into its components (Simon, 1962). Although modularity is a well-known concept in industrial manufacturing and software engineering (Salvador, 2007), the modularity of services is still an emerging field of research (Dörbecker and Böhmann, 2013; Tuunanen *et al.*, 2023). The principle of modularization is seen as a means of enhancing service design practices and making service design more efficient (Tuunanen and Cassab, 2011). Service modularization offers the opportunity for the modular design of new services, in which reusing existing or established components forms a possible principle for approaching the design of new, innovative service solutions (Chai *et al.*, 2005; Dörbecker and Böhmann, 2013).

Ordanini *et al.*'s (2014) suggestion to compare combinations of service attributes with individual ones can be applied broadly to the service modularization literature. By examining how various combinations of service attributes influence the service experience, we can redesign services to more effectively meet customer needs and preferences. This includes considering combinations of attributes related to the architecture, scale, style, shape, and layout of the service, as well as its functional or aesthetic features (Sheng *et al.*, 2017).

For example, a hotel might modularize its services by offering a variety of room styles and layouts, such as suites with different aesthetic themes or varying functional features like kitchenettes or office spaces, to cater to diverse customer preferences. Similarly, a digital service like Netflix could modularize its offering with different user interfaces, personalized content recommendations, and subscription plans that vary by the number of screens, video quality, and exclusive content access, thereby tailoring the service to meet the specific needs and preferences of different user segments.

In the literature, three key concepts have emerged from the attempt to theorize the application of service modularity and modular reuse in service design (Tuunanen *et al.*, 2012): Service systems are decomposed into independent *service modules*, which describe a system of coherent elements, the smallest units a service can be divided into (Voss and Hsuan, 2009). Service modules refer to a particular technology applied in a service solution to achieve the desired service experience or activities orchestrated for purposeful service provision. By building up a "library of elementary building blocks" (Aurich *et al.*, 2006, p. 1488), parts of a service system can easily be substituted, or new services can be designed by reusing existing service modules (Tuunanen *et al.*, 2012). To allow for the seamless composition of service modules, authors often define the interconnections and interdependencies between them and specify how they interact (De Blok *et al.*, 2010; Raddats, 2011). Tuunanen *et al.* (2012) linked these so-called interfaces to the concept of *service architecture*, which generally provides a generic integration schematic for combining service modules (Böhmann *et al.*, 2003). *Service experience* refers to the outcome of the personalization and customization of the service intended to match new customer demands through modularization (Tuunanen *et al.*, 2012). Tuunanen and Cassab (2011) argued that modularization increases perceived utility and likelihood of trial for enhanced service offerings. Especially for complex services that require active customer participation, the authors found that reusing standard service modules reduces users' anxieties and, at the same time, increases their efficiency—thus adding value to services.

Several benefits arise from the application of service modularization in service design. Reducing complexity offers a considerable advantage when designing new services by reducing the service system to smaller, more manageable components (Baldwin and Clark, 2000). In addition, modularization allows for faster and more cost-effective improvement by reusing service modules from other available services while allowing parallel work on different aspects of module design (Baldwin and Clark, 2000; Böhmann *et al.*, 2003). Böhmann *et al.* (2003) also pointed out that modularization can reduce operating costs, as using modules across multiple services may achieve economies of scale. Similarly, modularization enables the rapid and effective integration of service modules offered by third-party service providers and serves as the basis for outsourcing (Voss and Hsuan, 2009; Brax *et al.*, 2017). Furthermore, systematic decomposition may help to better understand an organization's current service architecture and identify key links between its modules (Voss and Hsuan, 2009).

However, only a few studies have tied practical approaches based on service modularity and modular reuse to the field of service design (Hunke *et al.*, 2021; Tuunanen *et al.*, 2023). Modular (re)design has been investigated as a management paradigm for coping with the increasing complexity of services and the required resource orchestration in socio-technical systems (Tsvetkova and Gustafsson, 2012; Beverungen *et al.*, 2018). Scholars have also discussed the benefits of modular perspectives on business models in manipulating core elements and their links for creating and evaluating alternative design options (Aversa *et al.*, 2015; Remane *et al.*, 2016). Others have considered service modularity to examine services at different levels of abstraction—the core offering, intra-firm organization, and inter-firm networks—to exploit opportunities for service innovation and inform decision-making during service design (Avlonitis and Hsuan, 2017).

Voss and Hsuan (2009) suggested that generic service architectures combined with a modularity perspective on services could support the decomposition of services into smaller units and inform more efficient service design practices. Their service modularity function, a mathematical model, measures the degree of modularity of individual services and the degree to which modules can be replicated across other services. With the increasing relevance of digital content, interfaces, or environments for value co-creation in services, researchers have also discussed the benefits of reusing sets of software, for example, from object-oriented programming, to help reduce customers' usability problems during service application (Gamma *et al.*, 1995; van Duyne *et al.*, 2002).

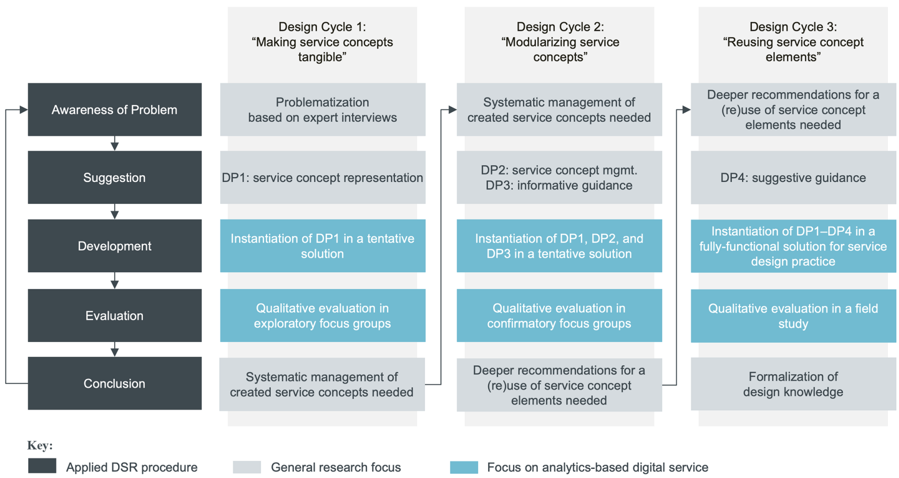
From a service design perspective, however, service modularity and the associated systematic, modular reuse of service elements thus far have been applied only to more *efficiently* implement and modify service processes (Bask *et al.*, 2010b). Recently, Tuunanen *et al.* (2023) argued that developing generalizable design principles is a way to modularize service design and that we should conceive novel methods that accommodate the discovery and recognition of such principles to promote the *efficacy* of service design: "These methods should also enable modularization at the service attribute combination (i.e. feature) level, thus resolving the complex problem of operationalizing service modularization in service design and, more importantly, how to show its benefits in terms of efficacy and efficiency" (Tuunanen *et al.*, 2023, p. 278). In this study, we respond to this call and develop design knowledge for the modular reuse of service concept elements. In the above example of a manufacturer seeking to design its individual predictive maintenance service, such elements of a service concept could relate, e.g. to familiar data structures, revenue schemes or specific customer involvement. This approach should enable "tinkering" (Aversa *et al.*, 2015, p. 160) with service concept elements and, thus, facilitate the generation of multiple service concept alternatives. Consequently, we create design knowledge to improve the efficacy of service design and the generation of service concepts through the modular reuse of service concept elements.

Research methodology

We follow the DSR approach (Hevner *et al.*, 2004; Peffers *et al.*, 2007), which seeks to formalize generalizable design knowledge typically based on design principles (Gregor, 2006; Gregor and Jones, 2007; Gregor *et al.*, 2020). Approaching service design research through DSR can also promote practical contributions by developing actionable, real-world solutions to prevailing problems that help evaluate the generated design knowledge. Thus, we followed Teixeira *et al.*'s (2017, 2019) example and adopted DSR as the research strategy. More specifically, we applied the five-step DSR process outlined by Kuechler and Vaishnavi (2008) in three consecutive DSR cycles.

Our study first elicited the high-level problems that our research clients had experienced with applying the service concept approach in service design. This problematization led us to understand the challenges related to using service concepts, which finally culminated in the realization that reusing service concept elements was the answer to the problem. During the three DSR cycles, we conceptualized this design knowledge into theoretically grounded design principles. In each cycle, tentative design principles were added and refined. Subsequently, we evaluated the design principles' feasibility, usefulness, and efficacy. The results of each DSR cycle informed the next and allowed for the gradual refinement of the design knowledge. The overall DSR process is summarized in Figure 1 and described in detail below.

In the first DSR cycle, we conducted 23 semi-structured interviews [2] to drill down on prevailing challenges of service concept use as a means of conceptualization during service design in practice. Table 1 depicts the participant demographics. Interview participants were selected based on purposive and snowball sampling involving service design experts across six organizations with at least two years of project experience in service design and covering diverse professional backgrounds related to service design. We analyzed the interviews using qualitative content analysis and inductively formed categories that reflect issues in service design practice (Ahuvia, 2001). We developed a problematization of service concept use based on the interviews and literature review findings. Next, purposefully reviewing the literature (Webster and Watson, 2002), we formulated a first design principle of "service concept representation" to make service



Source(s): Figure by authors

Figure 1.
Gradual development of design knowledge in a three-step design science research process

Participating organizations			Interviewee profile		
Alias	Industry	Employees	Expertise	Service design experience[a]	Interview duration [min]
Alpha	Information technology	>300,000	Data science	High	33:51
			IT-security	High	48:38
			IT-architect	Medium	39:48
			IT-strategy	High	53:41
			Client experience	High	53:30
			IT-strategy	Novice	35:13
			IT-strategy	Novice	53:41
			Data science, sales	Novice	68:39
			Internet of things	Novice	53:51
			Service architecture	High	68:39
			Internet of things	Medium	40:36
			Service design	High	25:12
			Sales	High	44:19
Beta	Energy	>25,000	Startup incubator	High	25:13
			Innovation mgmt	Medium	22:51
			Innovation mgmt	Medium	43:23
			Risk mgmt	Medium	28:31
Gamma	Industry automation	>15,000	Technology mgmt	High	36:05
			Innovation mgmt	High	36:05
Delta	Industry automation	>5,000	Controlling	Medium	26:11
			Industry automation	High	26:03
Epsilon	Chemicals	>100,000	Supply chains	High	1:00:21
Zeta	Polymer	>20,000	Internet of things	Medium	30:55

Note(s): [a]Service design experience: 2–5 years (novice), 5–10 (medium), >10 years (high)
Source(s): Table by authors

Table 1. Participating organizations ($N = 6$) and participant profiles ($N = 23$) for interview series in design cycle 1

concept elements equally tangible and explicit for all members of typically heterogeneous, multidisciplinary service design teams. We instantiated this design principle in a tentative service design solution and evaluated it in three separate exploratory focus group workshops [3] (Tremblay *et al.*, 2010).

The second DSR cycle began by reflecting on the results of the focus group interviews. We also reviewed literature that offered promising theoretical contributions, such as modular service design (Tuunanen *et al.*, 2012) or decisional guidance (Silver, 1991), to enrich our theoretical basis and extend our design principles. As a result, we formulated the design principle of "service concept management" to preserve and systematically access previously designed service concept elements and to allow their purposeful reflection for service design teams. In addition, we formulated the design principles of "informative guidance" to infuse decision-making during service concept element generation based on accessible, modularly decomposed service concepts of past designs. The extended tentative solution was evaluated in two separate confirmatory focus group workshops with practitioners from ongoing service design projects in practice.

In the third DSR cycle, we again reflected on the feedback from the participants of the two focus group workshops to revise our problem awareness. Following participants' suggestions to provide stronger guidance to service design teams for reusing appropriate elements of existing service concepts to stimulate their ongoing activities, we formulated the principle of "suggestive guidance". Ultimately, we instantiated all four design principles in a fully functional, web-based solution to enable their evaluation with service design practitioners. In the remainder, we demonstrate the functionality of this solution and evaluate its applicability, usefulness, and efficacy in reusing service concept elements in modular service design.

Next, we present the findings of the overall study outcomes. We introduce the problematization of the service concept reuse by our industry participants, followed by describing the developed design principles and their application in a digital service.

Recognizing the problems related to service concept use

We analyzed the interview data from DSR cycle 1 using the qualitative content analysis procedure (Ahuvia, 2001) (cf. Figure 2). The following presents the aggregation of the findings into three key problems our industry participants experienced with using service concepts.

First, our analysis of the interview data revealed insufficient communication in interdisciplinary teams as a challenge for the successful conceptualization of service solutions

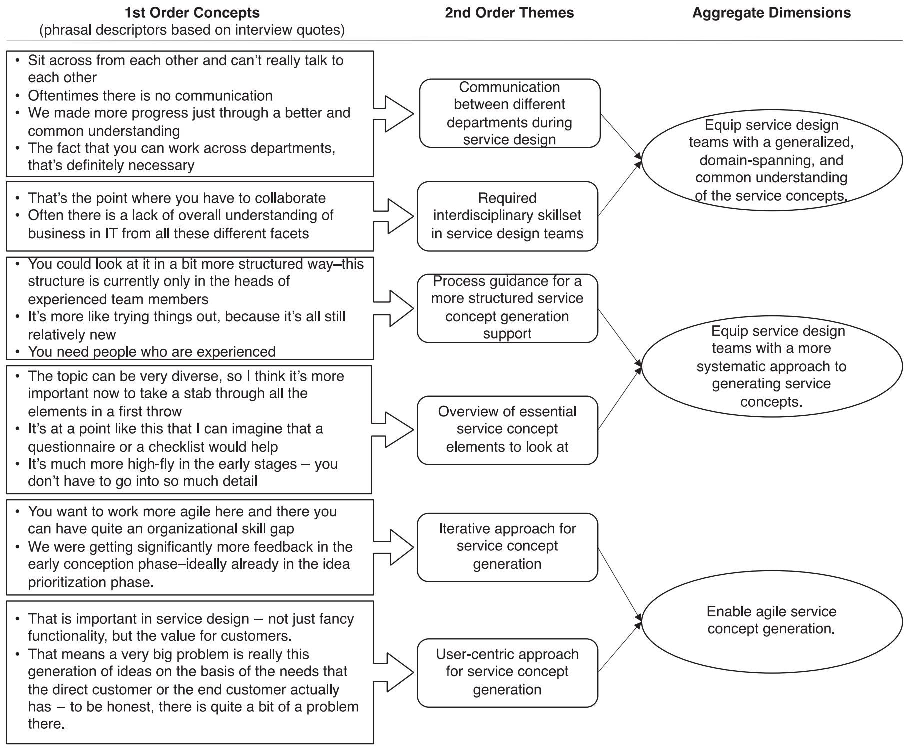


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Figure 2. Identified industry problems related to using service concepts

in service design. Service design practices are highly dependent on communication. However, communication between departments or hierarchies was considered insufficient, especially in cross-functional project teams. Interviewees reported that they typically "sit in a meeting, in a long meeting, in several long meetings where people sit across from each other and can't really talk to each other" (Interviewee 10). The reasons for this miscommunication are diverse. Although some respondents emphasized that the collaborative technique affects communication and work processes, most respondents pointed to differences in skills, expertise, and backgrounds as the main issue leading to miscommunication.

Service concept generation increasingly depends on expertise from multiple disciplines, such as computer and data science, marketing, and operations. The interviewees cited a constructive and engaging interdisciplinary skillset of service design teams as a critical prerequisite for the fertile generation of service concepts and successful service design outcomes. However, the interviewees drew attention to the fact that there is often no common understanding of the service concept under consideration among service designers from different domains. One interviewee stated that "people from mechanical engineering would not envision what you could actually do with analytics. . . . On the other hand, a pure data analyst would not understand the actual meaning of the data. . . . And that's the point where you have to collaborate" (Interviewee 10). Thus, concerning service concept use during service design, we articulated Problem 1 as follows: *Service design teams lack a generalized, domain-spanning, and common understanding of the service concepts*.

The second major problem is a lack of structure for generating service concepts. Service design has become increasingly established in practice as a systemic approach to innovation. However, the interviewees missed adequate guidance through generating service concepts, noting that "it's a lot of experimenting" (Interviewee 3). Many use cases encountered in service design projects are first-of-their-kind challenges. Service design teams often rely on individual, experienced service designers to contribute their tacit knowledge and intuition to generate new service concepts. As a result, the interviewees indicated that a predefined approach to generating service concepts, classifying solution ideas, and recommending possible solutions would significantly improve the conceptualization phase of service design. One interviewee described her current project in terms of conceptualization activities: "Especially at such a point, I can imagine that you could look at it in a bit more structured way. This [structure] is currently only in the heads [of experienced team members], who then go to the workshops, draw on the 'inventory situation' at the customer, and then develop purposeful and qualitative ideas" (Interviewee 8). This perceived lack of guidance for streamlining workflows and developing solution ideas led us to depict Problem 2 as follows: *Service design teams lack more systematic approaches to generating service concepts*.

Interviewees collectively agreed that service concept generation must be approached with more agile processes and methods. Being agile is critical "because you want to give input into the prototyping stream quickly. It can't be a classic stage-gate based 'waterfall' development in service design" (Interviewee 7). With the increasing importance of IT in services and the rapid-cycle practices associated with IT implementation, traditional product and service design approaches must be synchronized with shorter, more agile software innovation cycles. The interviewees highlighted the importance of "getting significantly more feedback in the early conception phase—ideally already in the idea prioritization phase" (Interviewee 12). Agile practices enable an iterative approach and feedback loops. Learnings from previous projects or design cycles can provide valuable input for current investigations. Service designers often focus too much on optimizing detailed functionality and neglect the big picture. Generating service concepts requires agile, short-lived workflow routines to synchronize interdisciplinary teams' operations and enable iterative approaches. Moreover, service designers should be encouraged to adapt their concepts to relevant stakeholder feedback. Therefore, we summarize Problem 3 as follows: *Service design teams lack approaches to enable adaptative service concept use.*

Next, we tackle those problems and provide concrete support for service design teams.

Developing and applying design principles

In this section, we describe how design principles were developed to tackle the identified issues related to using service concepts and how we applied them to a particular digital service ("Design Board") to evaluate the reuse of service concept elements.

Developing design principles

As reported above, the first problem we distilled from our industry interviews was the shared understanding of the service concepts. Service designers have learned to create visualizations to conceptualize services because merely relying on words can lead to oversimplifications and inadequate descriptions (Bitner *et al.*, 2008). The causal step taken during conceptualization, from providing evidence to envisioning possible future service solutions, is central to service design (Patrício and Fisk, 2013). External representations, abstract visual depictions that encode the essential information about the service solution (Goldschmidt, 1994) can help service designers express service concepts and, thus, favor their sensemaking process. Service concept representations serve as sharable objects of thought during service design to articulate insights and create persistent points of reference (Kirsh, 2010). Therefore, they strengthen interactive communication among service designers and improve collaboration and inferential reasoning (Goldschmidt, 1994; Kirsh, 2010; Blomkvist and Segelström, 2014). Accordingly, we formalize the design principle of *service concept representation (DP1)*: *Service concept element definitions must create a transparent and shared understanding*.

Second, our industry participants problematized the need for a more systematic approach to apply the service concept approach. The literature has argued that the key benefit of deliberately integrating reflective thinking into group work is that it surfaces tacit knowledge (Daudelin, 1996). In service design, the creation of service concepts embeds service designers' contextual knowledge, experiences, and justifications. This embedded information is essential for subsequent service design projects, such as learning why certain decisions were made, or service features were chosen in previous service concepts (Heisig *et al.*, 2010). However, team setups are project-based and typically temporal during service design work. As a result, the design rationales for service concepts tended to vanish and become untransparent over time, especially for service designers who had not been involved in the original generation process. Then, time-consuming "detective work" (Heisig *et al.*, 2010, p. 508) is often required to individually recover the design rationales of previous concepts to reevaluate them and possibly guide decision-making during the generation of a new service concept—evidently limiting the expected benefits (Lin, 2021).

Thus, a structured approach to enable deliberate reflection of previous service concepts and reuse of their design rationale would stimulate the generation of new service concepts with tacit and untapped experiences. Service designers frequently resort to visual representations to explicate service concepts, and many different methods and tools support these practices (Stickdorn *et al.*, 2018). However, there is still a lack of formalized practices that use the multitude of visual representations created during conceptualization (Blomkvist and Segelström, 2014). The persistence of these service concept representations and the knowledge they can contribute to documenting these (intermediate) results for future service design projects is still severely limited (Lin, 2021). Therefore, service design practices that promote the reuse of service concept elements should rely on a repertoire in which previously generated service concepts can be preserved and made available to service designers to reflect upon. Accordingly, we formalize the design principle of *service concept management (DP2)*: *Provide the means of preserving and accessing previously designed service concept elements*.

Finally, two activity patterns generally appear during a service design process: *Divergent* thinking activities search for opportunities and generate multiple disparate solutions candidates. *Convergent* thinking activities reduce and refine options and find concrete solutions to a given problem (Guilford, 1956). Based on our industry interview results, we argue that an adaptive approach to service design requires both activities and relies on their successful interplay, but requires different cognitive reasoning and, thus, different types of decision support (Stickdorn *et al.*, 2018).

Previous research indicates that ideas contributed by others stimulate task-relevant knowledge and make it accessible for finding solutions (Santanen *et al.*, 2004; Nijstad and Stroebe, 2006). In service design, this can be achieved during service concept creation by exposing service designers to stimulating ideas, such as previously crafted service concept elements, that provide interesting insights into sustaining the iterative process of knowledge retrieval and idea generation (Nijstad and Stroebe, 2006). Moreover, suppose the stimulating ideas are diverse, originating from different industries or customer contexts. In that case, they are likely to increase the diversity of idea production (Nijstad and Stroebe, 2006)—thus promoting divergent thinking, which often depends on cues. Therefore, for divergent thinking to occur, providing service designers with pertinent information to enhance their judgment seems helpful, which Silver (1991, p. 107) referred to as “informative guidance”. Accordingly, we formalize the design principle of *informative guidance (DP3)*: *Require structured access to previous service concept elements to support their divergent thinking through informative guidance*.

In contrast, convergent thinking reduces and refines the multitude of ideas generated toward a coherent solution. Specific recommendations to the user for elaborating on service concepts seem helpful in supporting this step during service design. Silver (1991, p. 107) described this support as “suggestive guidance.” Based on previous service concepts and related experiences, recommendations could be formulated, such as which service concept elements are still missing or how certain elements should be elaborated upon. Such recommendations could promote convergent thinking in service design and enforce a “building on the ideas of others” approach [4], which is pivotal for fruitful service concept creation (Penin, 2018, pp. 239–240) (Problem 3). Accordingly, we formalize the design principle of *suggestive guidance (DP4)*: *Provide means to guide shaping and refining service concepts by supporting the orchestration of appropriate key elements*.

Figure 3 depicts the application of these design principles for reusing service concept elements and modular service design.

Applying design principles to a digital service

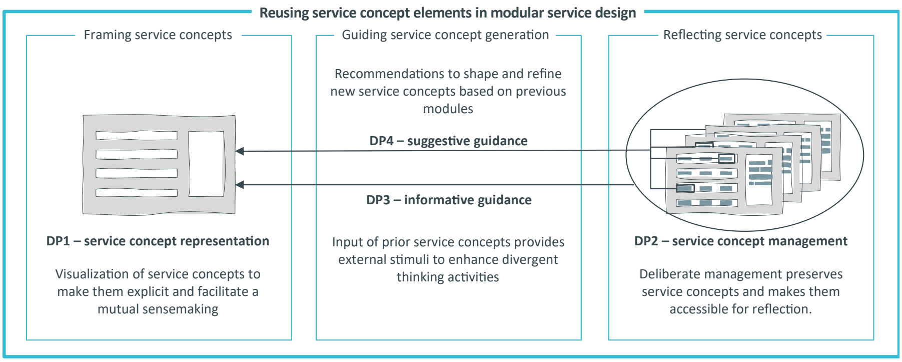
Next, we depict how we applied the design principles to design a digital service—our “Design Board”. This digital service builds on data and analytics (Hunke *et al.*, 2022) as conceptual key components to create novel value propositions (Schüritz and Satzger, 2016; Satzger *et al.*, 2022) – thus, providing an ideal domain to evaluate the developed design knowledge for the reuse of service concept elements. In Figure 4, we illustrate the use of the service for a real-world use case of hearing-aid provider “Cochlear” that targets the development of an analytics-based digital service for self-adjustments of their devices [5].

We used drop-down menus to provide an intuitive way to select and deselect characteristics to describe, define, and revise service concepts abstractly, exemplified in Figure 4 with the “Create New Service” feature. This approach provides a modular perspective. It empowers service designers to systematically define initial fragments of top-down service concepts based on outcomes from previous exploratory service design activities. In the illustrated "Cochlear" example, the description would identify a particular cluster of service concepts that centers around "providing data-based recommendations".

To apply the service concept management design principle (DP2), we created a repository for completed service concepts and their elements. We added functionality to store, retrieve, and edit them based on their taxonomic illustration (see the "Service Concept Repository" feature in Figure 4). Each service concept element is represented within this repository with a summary card, which includes a brief description of the potential value proposition and a corresponding taxonomic representation (based on Hunke *et al.*, 2022). To build a more comprehensive repository for our prototype, we also created overview cards of service concepts successfully introduced in the market. This repository contained 95 individual representations of service concept elements across 11 industries. We used the service concept repository as a vital source of inspiration to apply the design principle of informative guidance. We used a summary card gallery to give users lightweight access to the repository (see Figure 4 bottom left). The functionality for the selective filtering of the summary cards allowed us to provide users with suggestions for improvements or alternatives when actively formalizing new service concepts (Liu *et al.*, 2020).

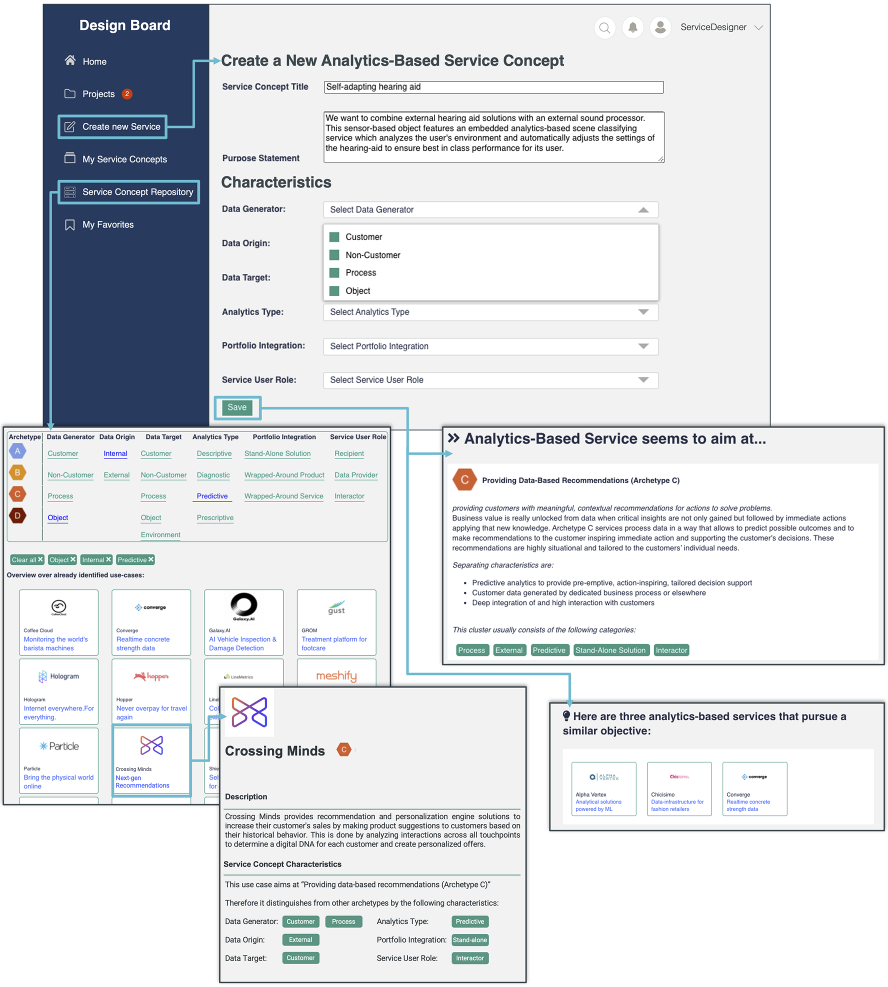
To apply the design principle of suggestive guidance (DP3), we created a recommendation algorithm that suggests appropriate modular configurations and missing elements for service concepts that service design teams are actively working on. First, we established an ideal representation of all service concepts in the repository. We divided them into groups with similar goals and characteristics based on the prevailing taxonomic configurations of service concept elements. Each group was represented by one instance, a generic and ideal representative service concept called "archetype." We computed the most similar archetype to identify missing elements in the new service concepts in the graphical user interface (see DP1).

Furthermore, the prototype recommended improving the current state of the service concept. More specifically, based on a comparison of this service concept and its corresponding ideal archetype referral it suggested service concept elements to attain proven configurations (see Figure 4 middle right). To achieve this, we dichotomized the representation of service concepts. Each service concept element of the predefined taxonomy representation (see DP1) was represented by one if it was observable and null if it was not. Based on these dichotomous data, we used the simple matching coefficient s to measure the



Source(s): Figure by authors

Figure 3.
Schematic composition of applying the developed design principles for reusing service concept elements to support modular service design



Source(s): Figure by authors

Figure 4.
The "Design Board"—an analytics-based digital service

similarity between a newly entered service concept and a service concept archetype (Sokal and Michener, 1958). Among the similarity measures applicable to binary variables, we chose the simple matching coefficient over measures such as, for example, the Russel/Rao index (Rao, 1948) or the Jaccard coefficient (Sneath, 1957) because it simultaneously considers both the presence and absence of service concept elements and, thus, fits the substantive interpretation of our data:

$$s = \frac{\textit{number of matching service concept elements}}{\textit{total number of service concept elements}} = \frac{n_{00} + n_{11}}{N}.$$

The value of s ranges between 0 and 1, with a value of 1 indicating complete similarity and a value of 0 indicating complete dissimilarity. The coefficient considers mutual presences n_{11}

(i.e. when a service concept element is present in the newly entered service concept and the service concept archetype) and mutual absences n_{00} (i.e. when a service concept element is absent in both) and matches and compares them to the total number N of service concept elements of the predefined taxonomy.

Thus, after the details of a service concept were entered, the prototype "recognized" the best suited service concept (it anticipated the intended purpose that the newly entered service concept may be intended to serve). On this basis, the prototype could provide service designers with in-depth knowledge regarding this archetype (e.g. typical service concept elements) and suggested which elements were important for this type of service. In addition, the Design Board provided the three most similar services and their descriptions from the repository, which allowed the service design team to obtain more details, thus enabling the reuse of service concept elements. For our "Cochlear" case, this allows to identify similar service concepts even outside of the own industry, here, e.g. in the marketing or fashion retail domains (see Figure 4 bottom right).

Evaluating service concept element reuse and developing generalizable design knowledge

A tight coupling of design–evaluation iterations characterizes DSR, and design researchers are encouraged to strengthen the rigor of their contribution through multiple evaluations (Venable *et al.*, 2016). Evaluations are essential to developing generalizable design knowledge rather than solutions for a specific use case, scenario, or environment involved. Bearing this in mind, we conducted three evaluations and continuously focused on enabling service designers to achieve a more effective conceptualization phase by reusing service concept elements. Using various data sources collected throughout these evaluations, like interview transcripts, explicit service concepts as workshop outcomes, and observations obtained during workshops, we derived empirically based evidence for the impact that results from the application of these solutions. Below, we describe these findings according to the design principles to develop design knowledge (Gregor, 2006; Gregor and Jones, 2007; Gregor *et al.*, 2020). While focusing on analytics-based services (Hunke *et al.*, 2022) to narrow down our evaluation scope within each DSR cycle, we argue that – by zooming out and reflecting our evaluation results in general terms – the developed design knowledge is generalizable to any service and applicable to service design in general.

For the design principle of *service concept representation* (DP1), we found that service designers appreciated a predefined, high-level visualization of a service concept and its elements to zoom in and out in their project focus and to understand how to reuse the service concept elements. Service design teams used our unifying representation of service concepts to gain a structured, high-level overview (i.e. zooming out) without having to go into the technical details of a specific implementation (too early). Moreover, this overview enabled them to selectively zoom in on different aspects of a possible service concept to set priorities for the modular service design.

Both practices were achieved through a shared understanding among team members underpinned by a visual representation of the service concept. Participants noted that these practices led to a better understanding of how to reuse the service concept elements and how to communicate this during the conceptualization phase. "We talked to [potential] customers in advance and had a rough idea of where we wanted to go. However, it was unclear to me what [service concept elements] we needed. This was a good way to sharpen our understanding" (Interviewee 2). In addition, participants highlighted that creating consistent visualizations of service concepts "seems to be a good way to communicate with management because you usually need some kind of one-pager there" (Interviewee 3). However, some participants also noted that predefined templates should be used with caution. They do not relieve the service designer from creative "outside-the-box" thinking, as one could quickly tend to "think only in categories" (Interviewee 1).

Regarding the design principle of *service concept management* (DP2), we were surprised that the participants appreciated the ability to seamlessly save service concepts during their workflows and recall them later, either consciously revising them or presenting them to others. Digging deeper into this observation, we learned that the participants greatly valued the insights and knowledge in the (preliminary) service concepts they had created and wished to retain them as inputs for subsequent workshops or projects. In other words, our participants appreciated reusing the service concept elements for modular service design.

However, we also observed that the integrated documentation procedures seemed insufficiently developed, and photo logs or PowerPoint slides (e.g. summarizing workshop outcomes) were described as state-of-the-art to store results. The processing and level of detail "typically depends a lot on the colleague doing it," leaving room for later uncertainty, such as "fair enough, but how did he mean that again?" (Interviewee 1). The senior project manager at PremiumParts, a manufacturer of process automation parts, summed it up the best: "If we develop a new product tomorrow, meaning hardware, we have endless documentation processes. One engineer can retire, and the next one can still track in detail when which screw was added, what the test results said about it, etc. . . . In service design projects, it is a workshop and documented results in a PowerPoint. But that is because people just do not know what to document in a meaningful way, how and where, . . . and I think that is why it just happens so little" (Interviewee 1). A lack of proper documentation practices and the respective management of (intermediate) findings thus ultimately led to a situation in which they are no longer available for reflection and, in case of doubt, are lost for the company. He also stated: "In our last project, only the people who were there from the beginning know how the final service came about. I was there from the beginning. However, apart from that, no one else knows what triggered this service. Originally, there had been a completely different idea, but many lessons learned led to a small, but important component of it being rolled out. However, there is no documentation about this whole discovery process. That is known by those who were there, by no one else" (Interviewee 1).

As our solution does not require any additional measures for documentation, seamlessly sustaining and managing service concept elements was perceived as quite valuable for their reuse and modular service design in general.

We also note that the *informative guidance* (DP3) design principle complements existing service design practices. Participants welcomed the opportunity to draw on service concept elements that had been created or ones that described services successfully implemented in the market. During the study, we repeatedly noticed that participants were eager to reuse service concept elements linked to successful digital services, sometimes even from distant industries. For example, PremiumParts referred to Outfittery's ordering services for clothing or to Amazon's Prime Service.

In line with this reuse approach, providing alternative service concept elements (in the form of summary cards), we offered food for thought and exemplary cases for the (re)use of service concept elements during the workshop sessions. PremiumParts participants, for example, were stimulated by such suggestions and then discussed suitable additional data sources to create a more appealing service for their customers. Participants confirmed that access to previous service concept elements "encourages to drill a bit deeper for additional ideas" (Interviewee 3) and helped them "to self-realize that maybe we still need this and that and the other" (Interviewee 1) while developing ideas. Feedback from participants during on-site workshop sessions, such as "ah right, we had something like this before" (Interviewee 2) also indicated that our reuse approach tapped service designers' tacit knowledge while creating new service concepts. As a result, additional opportunities for the original service idea could be incorporated, and divergent thinking was noticeably strengthened.

Although our solution provided access to reuse previous service concept elements for inspiration, these were not necessarily always applicable or suitable for future service design challenges. Bearing this in mind, we observed that novice service designers tended to design new service concepts primarily based on summary cards rather than using them as an impetus for their creative thinking. One participant stated, "Indeed, I only thought in categories and . . . did not consider if anything else would fit" (Interviewee 4). This approach would ultimately lead to unreflective decisions and possibly hinder the search for creative, divergent ideas. Therefore, future solutions should seek to counteract this.

We made two noteworthy observations concerning the design principle of *suggestive guidance* (DP4), instantiated as a recommendation algorithm that guides service designers in designing and refining their service concepts. First, we found that participants considered that mapping their idea to a generic service archetype helped guide them. A participant stated, "This is actually very interesting information for me [. . .] that is exactly what captures the idea actually" (Interviewee 1). After having initially entered a service concept with the key features it had in mind, we found that the service design team used the high-level description of the matching archetype and its associated key elements as guides (a sanity check, so to speak) for their subsequent converging elaborations.

Second, we observed that participants used the solution's suggestions on reusing service concept elements of similar services as welcomed input to discuss refinements of their current state of the service concept. In one instance, participants discussed (and eventually agreed to revise) which analytics application would suit their service idea. Originally, considerations of what type of analytics the service should be built on did not seem to play a critical role. One participant addressed this dynamic in the following debriefing: "Quite often, when you embark on something you [as a service designer] have never done before, there is automatically a certain hurdle. But when we see, look, [the company has] done this before, it worked like this, and like that, I could imagine that this lowers the hurdle a bit to engage in that type of solution again" (Interviewee 1).

Overall, we found empirical evidence emphasizing the potential benefits of the proposed reuse of service concept elements for modular service design. In terms of our final design solution incorporating all the design principles, the senior project manager remarked retrospectively: "I believe that you can add real value [by reusing the service concept elements] versus an empty Business Model Canvas [the tool often used by service designers]. That was my first gut feeling right away, and it was confirmed that way [through the workshop]" (Interviewee 1). During a typical workshop using a Business Model Canvas, starting with a potential service they had distilled in their exploration phase, the service design team used it to elaborate and refine one concrete service concept element during a typically structured workshop session. In contrast, the team deepened their divergent thinking activities using our solution and the embedded modular service design approach. It arrived at more nuanced service concept elements during convergent thinking activities, thus enhancing the service designers' ability to create or choose the elements more effectively. Purposefully reflecting on service concept elements from established use cases increased the ability to think divergently and created different approaches to solutions. The archetypal references provided by our solution helped to develop the ideas further. The suggestions assisted in detailing specific service concept elements and fostered convergent thinking.

General discussion and implications for service design research and practice

Previous researchers have argued that service innovations are often architectural. Consequently, new service concepts can result from reusing individual service elements, for example, by combining operant resources such as knowledge or technology in a different way or by aligning them better, without the service elements themselves necessarily providing innovations (Henderson and Clark, 1990; van Riel *et al.*, 2013; Barrett *et al.*, 2015). However, the processes and models guiding service design tend to be oversimplified and require more detailed guidelines for practical application (Chai *et al.*, 2005; Patrício *et al.*, 2018; Gustafsson *et al.*, 2020). Teixeira *et al.* (2019) argued that design knowledge, in the form of design principles, offers a robust base for service design methods and models. Following this guidance, we examined how reusing service concept elements can support modular service design. In response, this work makes several novel contributions to service design research as well as practice that we elaborate next.

Implications for service design research

First, we introduced *reusing service concept elements* to facilitate modular service design. While the existing literature pays considerable attention to the early explorative activities of the service design process, the methodological underpinning for conceptualizing and systematically modularizing services remains limited (Ostrom *et al.*, 2015). Previous research by Tuunanen *et al.* (2023) discussed the benefits of using design principles to formalize modular service design and suggested a new method to derive them based on interviews. In our study, we pick up on their thoughts by concretizing and evaluating general design principles for the purposeful and targeted reuse of service concept elements for modular service design. By formalizing and demonstrating how to purposefully reuse service concept elements, we make an initial yet actionable contribution to closing this gap in the literature. The findings are also generalizable beyond the developed analytics-based digital service and should be applicable to any services, but particularly to technology-mediated and digital services.

Second, we enable *modularization at the service attribute (*i.e. *element) combination level* to resolve the complex problem of operationalizing service modularization in service (Tuunanen and Cassab, 2011; Bask *et al.*, 2010a). Our study develops concrete design principles for such modularization and operationalizes and evaluates them in a real-world setting. Service designers can use our study's findings to define service concepts gradually and then identify promising concept configurations more effectively—complementing aspects such as intuition and experiences. This approach also allows parallel work on different aspects of module design (Baldwin and Clark, 2000; Böhmann *et al.*, 2003), but also codesigning services. Trischler *et al.* (2018, p. 75) reported that "codesign teams generate concepts that score significantly higher in user benefit and novelty but lower in feasibility". Our modularization approach can contribute to solving this problem as it focuses on the efficacy of modular service design. Furthermore, using codesign to develop service attributes potentially would improve the efficacy further by bringing the collaborative style of working into the service design work.

Third, previous service design service research often does not follow an *explicit process for developing theory-based solutions*. For example, Teixeira *et al.* (2017) offer limited justification for the design choices of their Management and INteraction Design for Service (MINDS) service design method. Intensifying efforts in this regard and developing theoretically grounded design principles to support the development of future solutions or methods will bring more robust results and offer generalizable design knowledge that can make a novel contribution to the service research literature. Our study applies design principles to develop generalizable knowledge. We identified problems related to service concepts; then, we used this knowledge to iteratively develop design principles, which we applied in a specific research context to develop an analytics-based digital service (the "Design Board"), and evaluated the design principles empirically. Consequently, our study contributes to the literature by building on a robust DSR approach to developing design principles for modular service design research.

Lastly, our study offers valuable *implications for service design research* in general. Designing service design methods, models, or tools for creating new services represents an important stream of service design research—and ought to benefit from a systematized approach such as DSR for their development (Ostrom *et al.*, 2015). However, service design research still lacks empirical experience in step-by-step guidance for applying DSR and insights into robustly evaluating the efficacy of the research outputs remain limited (Patrício *et al.*, 2018). This work provides further guidance for researchers to reinforce the foundations of DSR in service design research (Teixeira *et al.*, 2017, 2019).

Implications for service design practice

This study introduces how to reuse service concept elements to support modular service design. We develop and apply the four design principles to design an analytics-based digital service: the Design Board. The solution can aid service designers by supporting the reuse of service concept elements during service design projects. Based on our findings, the decision support offered by the Design Board provides service designers with actionable input to make more informed service design decisions. Thus, our solution allows service designers to leverage the power of analytics while also using their intuition, empathy, and creativity. Furthermore, effectively elaborating new service concepts that bring innovative ideas to life is crucial to their success. Evidence from this study suggests that our solution will support modular service design to this end. In addition, we see the possibility of integrating the solution with established methods such as MINDS (Teixeira *et al.*, 2017), which range from designing service concepts to service systems and service encounters, and, thus, would provide complementary tools for downstream activities.

Our findings show that service designers can benefit from integrating analytics into prevailing modular service design toolsets. By using analytics in solving repetitive tasks involving processing large amounts of data or recognizing complex patterns, we can overcome some of the challenges related to inexperienced service designers. In our analytics-based digital service "Design Board", we build on this precept by incorporating a recommendation algorithm that analytically processes the data provided by service designers on their intended service concept. It also reviews any relevant connections to previous outcomes (in our case, previously developed service concept elements) virtually within an instant.

Consequently, since technology evolution will increasingly complicate the service designs, we argue that service designers can benefit from integrating analytics into service design toolsets built according to the developed design principles (like the "Design Board" described above). We also see that it will be increasingly more difficult to recognize what combination of service concept elements will be more successful than others. Understanding these successful design patterns will likely require either more experienced and technologically-savvy service designers or toolsets like the Design Board that can offer different analytical tools to support the less experienced or technologically-savvy service designers.

Limitations and future research

While the design knowledge regarding the reuse of service concept elements formalized in this study provides researchers with a promising theoretical underpinning to further advance modular service design, it is not free of limitations. A first limitation concerns our consideration of the underlying theory. We drew on theoretical foundations from the literature to formulate our design knowledge and, more specifically, the developed design principles. Although our findings show that these design principles are highly valuable for the intended use, we recognize that these theoretical premises constitute only one possible way to address our objective. We also base our three-step evaluation on qualitative data to determine our design principles' applicability, usefulness, and effectiveness. From this perspective, we see that the proposed modular service design approach should be further improved, for example, by specifying testable propositions or metrics that allow complementation with quantitative data (Gregor and Jones, 2007) or combining it with codesign approaches elements (Trischler *et al.*, 2018). In addition, while we have carefully attempted to develop design principles for formalizing service concept reuse in a general sense, we have evaluated them in a context of analytics-based digital services. Future studies should also evaluate the design principles for other types of services to strengthen their generalizability.

Also conducting a longitudinal study that examines the impact of applying our modular service design approach would be interesting. On the one hand, we noted a tendency toward an unreflective selection of service concept elements by less experienced service designers. On the other hand, more experienced service designers appreciated the ability to draw on external stimuli when needed. Future researchers could investigate which way of working prevails over the course of several projects and as service designers become more experienced with the approach in general.

Furthermore, researchers should focus on elevating contributions to the conceptual stage, articulating how these elements help advance this phase of service design. Future studies could, for instance, investigate how reusing service concept elements affects the development of concepts by service designers, both novices and experienced professionals, from the ideation stage (e.g. refining co-designed solutions, etc.). This could provide deeper insights into the processes and benefits of modular service design in the early stages of service concept development.

Conclusion

This paper proposes reusing service concept elements to facilitate modular service design. To this end, we highlight the key challenges that service designers experience when using service concepts in their projects. Aiming to address these issues and to pave the way for more effective service design, we draw on the literature to define design principles that describe the necessary solution components for reusing service concept elements for modular service design: (1) a *representation of service concept elements* to visually frame and define abstract ideas in multidisciplinary service design teams, (2) dedicated *management of service concept elements* that enables potential reuse of previously developed service concepts in the future, (3) *informative guidance* to stimulate the generation of new service concept elements, and (4) *guidance to support the design and refinement* of new service concept elements. We have detailed how these design principles are implemented in an analytics-based digital service: the Design Board. Thus, we contribute to the literature by developing a way to reuse service concepts for modular service design. Our empirical evidence indicates that reusing service concept elements enhances working sessions for conceptualization and, thus, effectively impacts outcomes in modular service design.

Notes

1. Several detailed process models for service design have been introduced over time (Brown, 2008; Stickdorn and Schneider, 2012). However, despite differences in wording or separation into activities, they share the same mindset and make use of these abstract stages at some point (Stickdorn *et al.*, 2018).
2. See Online Appendix 1 for the sample interview protocol.

3. See Online Appendix 2 for the detailed DSR evaluation procedure.
4. See more, from IDEO's design kit: http://www.designkit.org/methods/brainstorm-rules.html
5. We exemplify the application of our solution using the real-world use case of "Cochlear". More details on this example can be found in Hunke and Kiefer (2020).

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Supplementary material

The supplementary material for this article can be found online.

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