

Investigating Modular Reuse as an Underlying Mechanism of Conceptualization during Service Design – the Case of Key Activity Orchestration

Fabian Hunke
Karlsruhe Institute of Technology
fabian.hunke@kit.edu

Hauke Thomsen
Karlsruhe Institute of Technology
hauke.thomsen@student.kit.edu

Gerhard Satzger
Karlsruhe Institute of Technology
gerhard.satzger@kit.edu

Abstract

The ability to effectively conceptualize services plays a key role in service design. Yet, action-relevant insights for service designers on how this crucial phase of service design could be systematically pursued remain surprisingly limited.

This paper explores "modular reuse", a frequently used principle to efficiently implement and modify service processes in downstream, i.e. implementation, activities as a possible underlying mechanism to inspire and facilitate the conceptualization phase. In a Design Science Research approach, we develop and formatively evaluate three design principles, which enable the purposeful reuse of existing service elements for the conceptualization of new services.

This research contributes by 1) tapping into novel ways to improve the conceptualization phase of service design, proposing an underlying mechanism to increase its effectiveness; 2) providing initial design principles that serve as prescriptive guidelines in the creation of new methods and tools to leverage the idea of modular reuse for the conceptualization of new services.

1. Introduction

Service design has emerged as a multidisciplinary field of research that adopts a human-centered, systemic perspective on services in order to systematically address service innovation in organizations [30]. It relies on a variety of methods and tools to explore, conceptualize, and implement new services in order to bring innovative service ideas to life [46]. The conceptualization of services – essentially the description of what is to be done in the intended service offering and how this is going to be achieved – forms the backbone for decision-making in service design at all planning levels [17, 31]. Its creation and refinement thus are key activities during service design.

Surprisingly, service design literature offers little guidance on how to systematically advance the

conceptualization of services. Existing research pays close attention to human-centered, multi-actor and participatory considerations in upstream, explorative activities of the service design process, e.g., to help customers co-create their desired experiences [35] or to identify latent customer needs [32]. However, the causal relationship between the exploration of service opportunities and the conceptualization of services is still poorly understood in service design research. Thus, despite its key role, the conceptualization phase remains a bottleneck in service design requiring further research to provide service designers with appropriate knowledge and guiding mechanisms to make the conceptualization phase more effective.

Against this backdrop, we suggest that in practice new conceptual elements of services do not necessarily have to be developed from scratch but are already available to service designers in modular form – for example, from established elements of existing service concepts from past service design projects that build on similar, exploratory findings. Adapting the idea of 'architectural innovation' from innovation management theory [19], we argue that the conceptualization of services can be facilitated during service design by considering (re-)combining established conceptual elements to bring innovative service ideas to a conceptual stage. For this purpose, we investigate the mechanism of *modular reuse*, a principle that has been introduced to service design research as a means to efficiently implement and modify service processes. An approach that we believe seems particularly promising for conceptualizing digital and cybernized services, as digital technologies are closely linked to service innovation by enabling new configurations of resources and a redesign of roles in services [26, 40]. As such, this paper explores the research question:

Which design principles allow to facilitate the conceptualization phase of service design through the modular reuse of existing service elements?

For that purpose, we conduct a Design Science Research (DSR) project and report on its initial design cycle in this research. We believe this research

contributes to the ongoing discourse on the systematization of service design and its methodological underpinning [30]. We are able to provide insights into a novel way to improve the conceptualization of new services in order to support and systematize this key process of service design. We propose modular reuse as an underlying mechanism, which is demonstrated and evaluated using a prototype artifact. As our evaluation results suggest, this might provide practitioners with a practical approach to conceptualize new services during the service design process effectively.

Below, we first present the foundations of our research and review related work. This is followed by our research methodology in Sec. 3, in which we present our DSR approach, lay out our evaluation strategy and introduce the context for specific demonstration and evaluation. Next, we present our findings in the form of generic design principles, the instantiation in a prototype artifact and evaluation results. We then discuss our findings and close with a conclusion.

2. Foundations

2.1. Service Design and the pivotal role of conceptualization

Service design has become an established discipline in service research that adopts a human-centered, systemic perspective on services in order to systematically address service innovation [30]. It initially referred to a subset of the NSD process associated with descriptive activities to specify the concept, structure or infrastructure of a service [23]. More recently, it has evolved into a strategic and comprehensive innovation approach to service innovation in organizations. As such, service design is positioned as a creative, iterative and collaborative practice that ensures the co-creation of value by different actors through its human-centric and systemic perspective on service systems [30].

At the core of these activities, service design aims to explore, conceptualize and prototype new service concepts. To this end, it relies on various methods and tools, including, e.g., research techniques and visual representation methods, to improve cooperation between the different actors involved [31, 35]. Building on customers' needs, beliefs, and demands that are identified in exploratory upstream activities, the conceptualization of services – essentially describing what is to be done in the intended service offering and how this is going to be achieved – forms the backbone for decision-making in service design [17, 31]. Service concepts allow to inform internal stakeholders for buy-in decisions and to secure senior management support

while also providing a means to specify service system actors and resources to rigorously define services [46].

Despite their key role, actionable insights into how to systematically facilitate the conceptualization of services remain surprisingly limited. Either they appear overly complex or they tend to focus on a dyadic vendor-customer relationship [6, 7]. However, services are commonly described as socio-technical systems in which value is jointly co-created by several actors involved, which implies the necessity to include operant and operant resources of, e.g., customers or third parties into considerations during conceptualization activities when designing new services [12, 28, 46]. Blomkvist and Holmlid [9] discuss the possibility to use referential techniques that leverage existing service solutions, so-called exemplars, for conceptualization. They argue, that such exemplars could be considered as a means for inspiration, exploration, and analysis of design solutions in order to make the conceptualization more effective. Nevertheless, little is reported about methods or practices that would exploit the potential of exemplars. Beverungen et al. [7] conceptualize recombinant innovation in the context of service design, which aims to systematically reuse and combine existing resources within a service system that were previously unconnected in order to address service innovation. However, they focus strictly on the combination of existing elements and neglect opportunities that could radically overturn core conceptions [19]. Thus, further research is necessary to provide service designers with appropriate knowledge and guiding mechanisms to make the conceptualization phase more effective.

2.2. Service Modularity and Modular Reuse

The concept of modularization originates from systems theory and has been developed in an effort to make an object's complexity more manageable by breaking it down into its components [34]. While modularity is a well-known concept in, e.g., manufacturing or software engineering [33], the modularity of services is still an emerging field of research [15, 38]. In the context of services, the principle of modularization is seen as a means of enhancing service design practices and methods and to make service design more dynamic [12, 39]. As such, service modularization offers the opportunity for a modular design of new services, where a *reuse* of existing or established components forms a possible principle for approaching the design of new, innovative service systems [15, 38, 39].

Three key concepts emerged from the attempt to theorize the application of service modularity and modular reuse in service design [38]. Services are decomposed into independent *service modules* which

themselves contain a system of components, the smallest units a service system can be divided into [43]. By building up a “library of elementary building blocks” [2, p. 1488], parts of a service system can be easily substituted or new services designed by reusing existing service modules [4, 38]. In order to allow for seamless composition of service modules, it is essential to precisely define the interconnections and interdependencies between the modules and to specify the way they interact [8]. Tuunanen et al. [38] link these so-called interfaces with the concept of *service architecture*, which generally provides a generic integration framework to combine service modules [11]. In addition to the standardization of the interfaces, the architecture also incorporates boundary information as well as the required technical infrastructure that enables the provision of service activities [38]. Thirdly, *service experience* refers to the possibility of personalization and customization of the service to match new customer demands through modularization [38]. Tuunanen and Cassab [39] argue that modularization leads to an increased perceived utility and likelihood of trial for enhanced service offerings. Especially for complex services that require active customer participation, they found that the reuse of familiar service modules reduces users' anxieties and at the same time increases their efficiency – thus adding value to services.

Several benefits arise from service modularization application in service design. Reducing complexity offers a considerable advantage when designing new services by reducing the service system under consideration to smaller, more manageable components [4]. In addition, it allows faster and cost-effective improvement in reusing service modules from other available services, while allowing parallel work on different aspects of module design [4, 11, 13]. Böhmann, Junginger, and Krcmar [11] also point out that it can lead to a reduction in operating costs, as economies of scale may be achieved by using modules across multiple services. Similarly, modularization enables the rapid and effective integration of service modules offered by third-party service providers and serves as a basis for outsourcing [5, 43]. Voss and Hsuan [43] further point out that a systematic decomposition

may lead to a better understanding of an organization’s current service architecture and the identification of key linkages between its modules.

From a service design perspective, the concepts of modularity and modular reuse have been primarily investigated as a means to efficiently implement and modify service processes. In this research, we want to adopt these concepts for the upstream, i.e. conceptualization, phase of service design. Building on the idea to purposefully use „exemplars” as a reference point to increase the effectiveness of the conceptualization of services ([9], cf. Sec. 2.1), we aim to investigate whether „modular reuse“ including its key constructs could serve as an underlying mechanism to systematically achieve this. In this sense, we build on previous work considering existing resources in a service system (e.g., [7]) by drawing on a repertoire of existing or already established conceptual elements that are made available for reuse from earlier conceptualization phases in order to make service conceptualization more effective during service design.

3. Methodology

3.1. Overall Research Design

The objective of this research is to explore modular reuse as an underlying mechanism for the conceptualization phase of service design. We pursue a DSR approach, which has proven to be an effective method for solving real world problems and it has been emphasized to be particularly useful in the context of service design as it promotes the development of new constructs and methods [25, 36]. Following the approach proposed by Kuechler and Vaishnavi [25], we distinguished our successive research activities between awareness of the problem, suggestion, development, evaluation, and conclusion (cf. Figure 1).

To create awareness of the problem, we initiate our DSR process by reviewing the literature at the intersection of service design and service conceptualization. We learned that actionable insights into how the conceptualization of services could be enforced during service design are still scarce, despite

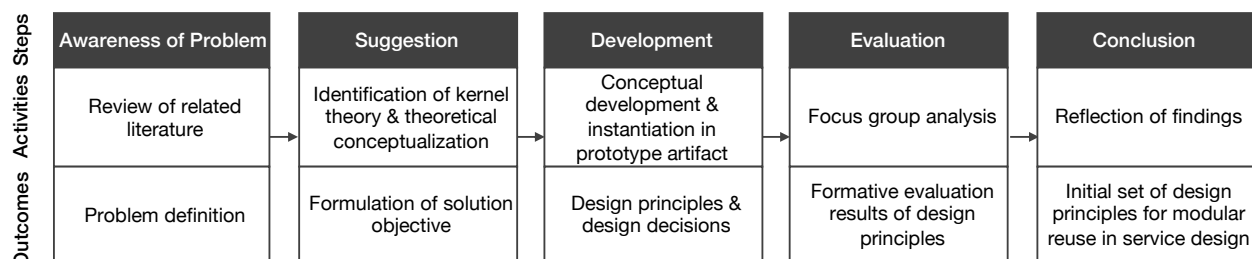


Figure 1. Overview of the DSR steps conducted in this research based on [23].

the emphasis on the importance of conceptualization for downstream activities of service design (cf. Sec. 2.1). Inspired by the concept of architectural innovation from innovation management theory [19], which emphasizes a purposeful and selective recombination of existing elements as a viable source of innovation, we identify and adapt the mechanism of modular reuse to conceptualize a solution objective. Following further reading in the field of software engineering, service process design, and service modularity as possible kernel theories (cf. Sec. 2.2), we develop design principles to provide prescriptive statements on how the mechanism of modular reuse could be created and deployed to facilitate the conceptualization of services during service design. In particular, these design principles are meant to serve as generic principles of form and function to prescriptively guide the development of new methods and tools facilitating the conceptualization phase in the future. In this sense, our understanding of design principles builds on the descriptions of Gregor et al. [18] and is closely related to "meta-design" as described by Walls et al. [44]. In order to demonstrate and subsequently evaluate the design principles, we instantiate them in a prototype artifact through design decisions. For the purpose of creating an artifact that would function in a real-world scenario, we turn to the problem of *key activity orchestration*, which is a well-known problem that frequently occurs during the conceptualization phase of service design, *to exemplify the creation of service concepts in general*. Finally, we demonstrate and evaluate the effectiveness of the artifact (i.e., its underlying design principles) in a focus group session [37].

In the following, we give a brief description of our application domain for the development and evaluation of our artifact, i.e., key activity orchestration, and a more detailed description of our evaluation strategy.

3.2. Context for Artifact Development and Evaluation: Key Activity Orchestration

Service systems are commonly defined as networks composed of individuals, technology, and organizations, in which services are based on the entities' interaction to co-create value [28]. While this basic abstraction has been widely accepted as the key to modern, service-dominant economies [30], it offers little guidance to organizations to actually conceptualize new services. As the digital transformation continues, new ways of capturing and transmitting large amounts of data are being established and advances in information systems technology provide the means to analyze them [20]. Service systems are thus evolving into digital and cybernized environments providing the

potential to create new service offerings [21, 40]. This liquefaction of data throughout the service system is accompanied by a steadily increasing access to analytical capabilities [22, 27].

As service-relevant data is often distributed across the service system's entities, this poses new challenges for service design. Customers may use tracking functions to generate data on their own mobile devices, which can provide a valuable basis for fitness applications. Business partners may provide important data sources, such as machine data that they operate in the field. Similarly, analytical capabilities and skills are typically spread across different organizational units of the service system that specialized in the development and configuration of analytical models [22]. As a consequence, the proper orchestration of service-relevant activities – from data collection to execution based on analytical results – has become an inherent challenge when conceptualizing new, technology-based services during service design.

We define a distinct and restrictive study context that allows an initial investigation of modular reuse as the underlying mechanism for the conceptualization phase in service design. To this end, we utilize the orchestration of key activities within a service network between individuals, technologies and organizations as an important (sub-)task in the conceptualization of new, technology-based services *to exemplify their overall service concept creation*. The reuse of proven, individual service elements – e.g., the application of established analysis methods provided by business partners or the use of previously exploited data sources in the service network – as a means to uniquely configure service systems for value co-creation seems to be suitable and a promising application domain for investigating the mechanism of modular reuse in service design [12]. Thus, we decide to draw on the context of key activity orchestration to demonstrate and evaluate our generic design principles.

3.3 Evaluation strategy

To develop an evaluation strategy for our DSR project, we consult the "framework for evaluation in design science (FEDS)" [41], which provides guidance for the design of evaluation episodes. Our overall evaluation attempt is guided by the intention "to rigorously establish that the utility/benefit [of modular reuse for conceptualization of services] will continue in real situations" [41, p. 82]; therefore, following the authors' recommendation, we apply their "human risk & effectiveness strategy" and start with a rather artificial and formative evaluation early in the project, to quickly shift to naturalistic settings in summative evaluations in

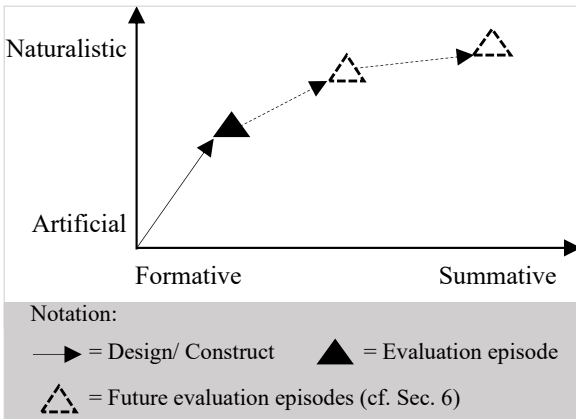


Figure 2. Evaluation strategy adapted from [41].

possible subsequent design cycles. Figure 2 summarizes our overall evaluation strategy according to [41].

Against this backdrop, we conduct an exploratory focus group workshop to evaluate our design principles in a first evaluation episode [37]. We recruit the workshop participants in their capacity as graduate students of the successfully completed specialization "Service Design Thinking" within their master's program. Within this unique teaching program [45], the participants form a service design team together with students of the same program from international partner universities. Each team receives an individual, real-world challenge from a corporate sponsor and develops a real solution over a period of 10 months using the principles of service design. We consider these students to be particularly experienced in service design, as they not only have theoretical knowledge of service design, but have also gained intensive practical service design experience including its routine practices over a considerable period of time. Therefore, we regard them as suitable participants for our first (rather artificial) evaluation episode.

4. Results

4.1. Design Principles for Designing Modular Reusability during Conceptualization

Based on the initial design cycle outlined in Sec. 3, we identified three design principles to contribute to design knowledge for establishing modular reuse as an underlying mechanism for the conceptualization phase of service design. In this section, we provide a more detailed description of the design principles and the theoretical conceptualization on which they are based.

A modular perspective on services

Blomkvist and Holmlid [9] discuss the benefits of using reference techniques during the conceptualization phase of service design. Exemplars, e.g. experiences of previously designed services, could serve to inspire and facilitate the conceptualization process of new services by contributing to the understanding of design options.

In practice, service design is highly multidisciplinary, and service design teams usually consist of heterogeneous experts from different disciplines [24]. Therefore, as a basis for a purposeful application of exemplars during conceptualization, a consistent and abstract perspective on services and their components can eliminate conceptual ambiguities between team members and reduce misunderstandings. Furthermore, the use of a standardized format would help to create a common understanding among the participants [16]. A generic representation of the service by breaking it down into its components enables designers to identify service modules, i.e. exemplars that could be referenced, more effectively. This leads to our first design principle:

DPI: Principle of service decomposition

Provide a generic, modular perspective on services that allows service designers to decompose a service into its components.

(Re-)connecting the dots for conceptualization

Suppose services are decomposed into a number of independent components, they are linked together in often complex relationships. Service designers need to be equipped with effective means to understand the underlying modular structure of the service to achieve a purposeful composition of modules. Related application areas such as business modelling have recently seen a rapid increase in methodological tools such as, e.g., the business model canvas. Avdiji et al. [3] argue that the success of these tools is largely due to their ability to outline the underlying problem by using an ontology to abstractly represent the context in order to eliminate conceptual ambiguities and reduce complexity. Similarly, Vink et al. [42] stress that framing, i.e. creating a point of view from which, for example, a service can be perceived, is a crucial activity of service design in the conceptualization of services. To enable a modular reuse of service elements during conceptualization, it is thus essential to draw on a generic modular structure that reveals the service architecture and thus formalizes the interdependencies, i.e. the boundaries and connections between modules. Thus, a formalized representation guiding the (re-)combination of service components seems appropriate [10]. Accordingly, the second design principle becomes:

DP2: Principle of concept visualization

Provide a generic architecture of services to allow service designers to combine individual modules into a holistic representation.

Managing service modules for a reuse

In order to be able to use reference techniques in service design, a repertoire of existing exemplars is required [9]. Similarly, the basic idea of modularization is to use an existing library of modules for the design of new solutions [2]. Thus, to make this concept usable for service design and its conceptualization phase, a repository is required. This repository needs to be easily accessible in the service design process and it needs to be possible to store developed modules in it. This idea forms our third design principle:

DP3: Principle of module management

Provide a module repository to provide service designers with previously developed service elements and to enable a guided reuse of service modules during service design.

4.2. Prototype Instantiation

In order to instantiate the proposed design principles, we refer to the context of key activity orchestration, a problem that often occurs in the phase of conceptualization (cf. Sec. 3.2) and make distinct design decisions (DDs) to create a prototype artifact. An overview of our DDs and the respective design principles (DPs) they address is presented in Table 1. The prototype artifact is illustrated in Figure 3.

Based on previous work on the orchestration of key activities during service design, we use the Key Activity

Canvas, a canvas-based tool for service design, as the basis for our prototype artifact. In essence, the tool horizontally provides conceptual meta-activity phases that need to be represented in each service. Vertically, the tool subdivides each activity phase into a customer, company, and partner perspective. A set of key activities are identified and orchestrated by, first, collecting for each activity phase whether and in what form these three entities can contribute to the fulfilment of the activity using post-its. This collection allows the exploration of alternative activity configurations within each phase in a second step. Further information on the Key Activity Canvas and its development can be found in [22].

Using the Key Activity Canvas comes with two advantages. First, the tool was developed to provide a visual representation of the key activities of a service. It thus allows us to fulfil design principle 2 by providing a generic architecture. Secondly, the tool is based on an abstraction of the required activities of a service by structuring the conceptual key activities of digital services from data generation to the application of the analytically derived results. This subdivision is used in our prototype to generally decompose a service (i.e. its comprehensive set of activities) into individual service modules (i.e. individual activities) in order to fulfil design principle 1.

To realize a prototypical module management (design principle 3), i.e. to make individual key activities within a comprehensive set of activities available for a reuse as a component in new services, we use post-its in conjunction with a tangible module repository. Following the successful application of the Key Activity Canvas in a service design project, individual activities can now be transferred as modules to the module repository. In this way, they are stored for

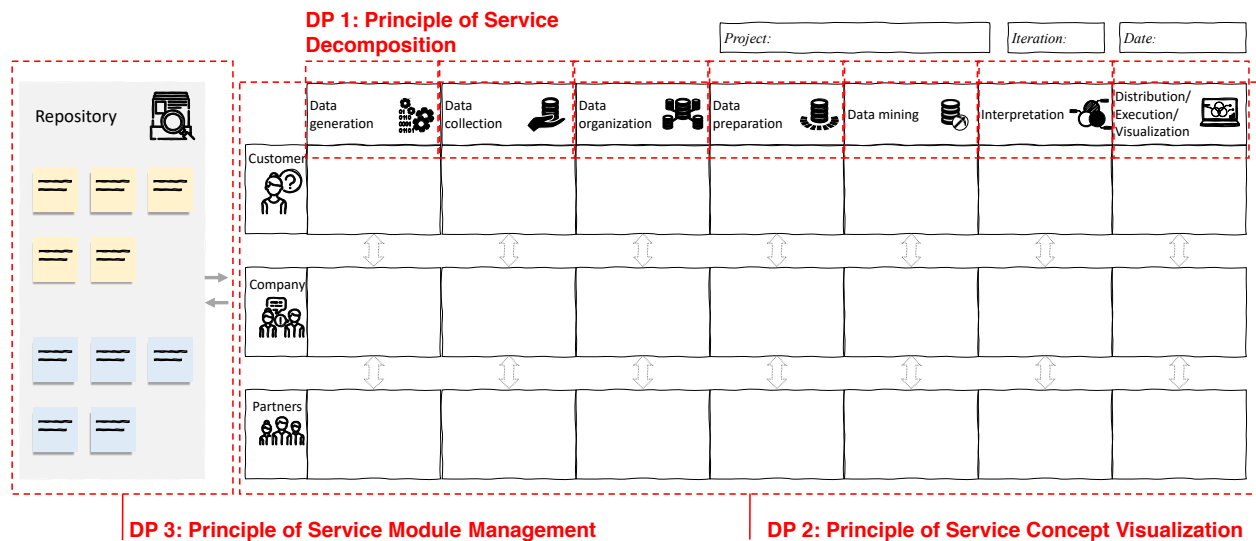


Figure 3. Exemplary instantiation of the proposed design principles in a prototype artifact.

modular reuse and can be consulted when the tool is used again.

Table 1. Summary of our design decisions.

DDs	Description	Addressed DPs
1	Decompose key activities into meta-activities	DP1
2	Provide an overall architecture in a pre-defined template	DP2
3	Use post-its to resemble service modules	DP3
4	Provide a module repository board to access and store existing modules	DP3
5	Consider using post-its from the module repository board when conceptualizing key activities	DP1, DP2, DP3

5. Demonstration and Evaluation

In order to evaluate our prototype artifact respectively its underlying design principles, we conducted an explorative focus group interview [37]. The focus group consisted of a four-member service design team, which had reached the end of a service design process to design new digital services in the insurance sector. We started with a brief introduction of the Key Activity Canvas, as not all members of the focus group were familiar with this service design tool. However, we avoided explaining the intended reuse of service modules when using the tool, as we did not want to influence any of the participants, which could have led to a fixedness on this feature. The team then filled out the plotted Key Activity Canvas for three different services they had previously designed in the service

design project using post-its, and then “saved” them on a module repository board. For each service, we used a different set of colored post-its so that we could later track whether post-its (i.e. service modules) were reused to design new services. Finally, we used a service idea (i.e. a possible value proposition) that the team had developed during their project without further conceptualizing it and applied the Key Activity Canvas again. This time we placed the board with the collected post-its next to the tool to make previously established service modules available for possible reuse in the conceptualization of the new service. We responded to the participants when questions regarding the applicability of the Key Activity Canvas arose (e.g., terminology issues). Yet, we did not participate in the conceptualization activities, nor did we participate in identifying possible service modules from the module repository board. Instead, we observed the team and took memos on the team’s behavior and the dynamic created by the modular reuse in the conceptualization activities. We then conducted a semi-structured interview with the group, asking them about the strengths and weaknesses of the approach in order to trigger a discussion among the participants. Both the memos and the group interview were analyzed inductively, focusing on whether the design principles would contribute to a successful conceptualization of a new service. A summary is presented in Table 2.

Overall, the evaluation suggests the efficacy of modular reuse as an underlying mechanism in the context of service design’s conceptualization phase, i.e. it seems to support and improve the results of the outcomes of the service design team’s activities [14]. Regarding **design principle 1**, a service decomposition, we received positive feedback. The participants described that the complexity of a service could

Table 2. Summary of aggregated feedback from the focus group interview.

	Strength	Weakness
DP1	<ul style="list-style-type: none"> Allows a more detailed view on specific aspects of a holistic service Leads to a (perceived) reduction of complexity Enables a more structured conceptualization approach 	<ul style="list-style-type: none"> Modular perspective might require background knowledge on services’ single components and their respective role
DP2	<ul style="list-style-type: none"> It became very clear which stakeholder takes over which tasks Well-structured overview helped to focus on task Basis for discussion in the team and possible ‘checkpoint’ Helped to quickly adapt the modular reuse mechanism for conceptualization purposes 	<ul style="list-style-type: none"> It did not seem always clear how the interplay of modules should work
DP3	<ul style="list-style-type: none"> Repository allows easy exchange of modules It was possible to put together a new service concept very quickly It is important to be able to detach from the repository to develop new ideas. 	<ul style="list-style-type: none"> The post-it in the repository must clearly define what exactly the module does (and who can use it for what) A sorting in the module repository is missing Over time, it can be forgotten that there is already a module for a certain task in the repository

effectively be reduced by a modular decomposition. This would allow a much more structured approach for the conceptualization, as it would allow to focus on single aspects and suppress the big picture temporarily.

The participants also acknowledged the value of **design principle 2**. A generic service architecture that serves as a “blueprint” to better understand the interaction of individual service components was perceived as useful. One participant also pointed out that such a concept of visualization can also serve as a basis for deeper discussions in order to integrate further elements and design more complex services.

Design principle 3 was also deemed useful, although the participants had concrete comments for possible further developments. To begin with, we observed a support of the conceptualization activities through the availability of existing service modules. The participants felt that a new service could be designed faster with this input – aptly commented by a team member with “*ah, right, we had something like this before*”. In addition, the team noted that by using existing service modules, the mostly implicit expert knowledge from single team members that went into the previous creation of the service module could be reused, even if these experts could not be present.

However, our first evaluation episode also unveiled weaknesses requiring further attention in subsequent design cycles. First, the participants noted that the key to reusing service modules lies in the consistent and precise description of the service modules. Notes on post-its during our workshop could not always ensure this. Second, the team also agreed that it is necessary to structure the module repository, as more and more modules are being filed over time. Here, they saw the risk that individual modules would simply “*fall into oblivion*”. Third, the team also noted that strictly focusing on the aspect of modular reuse should be avoided. While the supportive character of the mechanism was confirmed, it should still be possible to think outside the box in order to develop something entirely new.

6. Discussion

6.1. Towards a more profound methodological underpinning of the conceptualization phase

Despite the key role ascribed to the conceptualization phase in service design, it requires a deeper methodological underpinning to shape related activities, guide service designers, and improve service design outcomes. This research investigates modular reuse as a possible underlying mechanism to address this problem. The approach seems to be particularly promising for the design of technology-based services,

e.g. digital or cybernized services, as technology is closely linked to service innovation by enabling new configurations of resources and a redesign of roles in services. Modular reuse has been investigated primarily as a means for efficient implementation and modification of service processes; e.g., for mass-customization of IT-related services by configuring (seemingly) individualized value propositions composed of predefined modules [15]. We complement this literature stream by investigating modular reuse as a means to stimulate rather creative activities during the conceptualization phase of service design. We argue that the opportunity to incorporate established conceptual elements for systematic reuse facilitates service designers to increase their creative outcomes and, thus, to improve their effectiveness during the conceptualization phase of such services in general.

We propose three design principles that enable to achieve modular reuse during conceptualization activities – 1) a modular perspective, which allows to decompose services into modules, 2) a concept visualization, which serves as an underlying service architecture to (re-)connect service modules purposefully, 3) a module repository, which allows to file service modules for a reuse in new services. We believe, these design principles enrich existing efforts to formalize service design activities (e.g., [7]) and might serve as prescriptive guidelines in the sense of higher-order principles. Service design relies on methods and tools to enforce and facilitate its foundational premises in practice. Thus, our design principles might contribute to the development of new constructs and methods instantiating the mechanism of modular reuse in the future.

Furthermore, the application of modular reuse as an underlying mechanism could also serve as a means to transform implicit into explicit knowledge for service design teams making expert knowledge sustainably available. As our evaluation suggests, existing service modules, which may have been preceded by input from individual experts, can be used in the design of new services even if these experts are not available or not part of the actual service design team. Thus, the successful conceptualization of a service can be decoupled from individual experts through modular reuse and leads to service design teams jointly exploring and testing new solutions. Nonaka and Krogh [29] describe this process as knowledge transformation from implicit to explicit knowledge in organizations – an effect, that seems promising for the design of digital and cybernized services, which often build on specific data sources or analytical applications [21, 40].

In sum, this research taps into a novel way to improve the conceptualization phase of service design by proposing modular reuse as a possible underlying

mechanism to increase its effectiveness. The three design principles identified in this research could provide a starting point to further explore modular reuse for the conceptualization phase of service design, both methodologically and conceptually.

6.2. Limitations and Future Research

Our research certainly comes with some limitations. Firstly, the results presented in this paper are only formatively evaluated. Although we believe that our focus group possesses profound service design know-how, the setting of the evaluation remains rather artificial. Typical hurdles of service design in practice, such as time or cost pressure, were neglected. In addition, we decided to work closely with a service design team and have in-depth discussions instead of consulting a wider range of respondents. This certainly influences our perception of how the Service Design Team operates. Secondly, we use a specific application context for our demonstration and evaluation activities. While the adequacy of this application context has been substantiated by literature, this limits the generalizability of the results presented here to the service design discipline in general.

In turn, these limitations also offer opportunities for future research activities. Firstly, our evaluation revealed fruitful insights on how design principle 3 could be elaborated, which we aim to explore in a subsequent design cycle of our DSR project. In particular, we aim to incorporate research on functional fixedness theory, e.g. [1], as an additional kernel theory to ensure that modular reuse is not perceived as a mandatory activity during the conceptualization phase. Secondly, we plan to shift our evaluation setting towards a more naturalistic setting. For that purpose, we aim to conduct a field study with a service design team in an organization to further evaluate how modular reuse could purposefully be included in service design activities in practice.

7. Conclusion

Service design increasingly attracts the attention of organizations as a systematic approach to service innovation. Nevertheless, the conceptualization of services – the core activity of service design – remains surprisingly under-researched, and conceptual foundations guiding the required activities methodologically are still rare. In order to tackle this deficit, the present research examines modular reuse as a fundamental mechanism for the conceptualization phase of service design. We propose three initial design principles, 1) the principle of service decomposition, 2) the principle of concept visualization, and 3) the

principle of module management, that are intended to serve as prescriptive guidelines enabling service design researchers to develop a new class of methodological tools that support conceptualization activities during service design.

8. References

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