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Is Newer Always Better? Assessing Recombination Types of Digital Services

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Research Paper

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Abstract

Organizations rely on recombination to develop new innovative services. However, a comprehensive understanding of the influence of different recombination types on user perceptions of such services is missing. Based on theory from service science and the concept of recombinant digital innovation, we derived a TAM-based research model to study how associative and additive recombination types influence user perceptions of services and tested it in an online experiment with 362 participants. Our results show that additive recombination types are more capable of positively affecting perceived novelty, perceived value, and adoption intention than associative types, which is dependent on the respective setting of the service. We contribute to research by shedding light on the influence of different recombination types on user perceptions of services and the need for operand-specific digital innovation in service systems. Practitioners can use our findings to improve the configuration of service systems.

Keywords: Service Systems, Recombinant Innovation, Digital Services, Digital Technologies.

1 Introduction

The influence of the digitalization disrupts diverse industries in nearly all their facets (Nambisan et al., 2017). Triggered by the diffusion of new digital technologies such as mobile devices and ubiquitous high-speed internet access, consumers adapt their preferences and usage patterns with unprecedented velocity (Wirtz et al., 2013). Consequently, pre-digital organizations that aim to fathom the opportunities of the online world and organizations that already rely on online businesses have to constantly provide digital services within their service systems to answer these changing customer demands (Beverungen et al., 2019a). This can be achieved by developing innovative digital service solutions that generate new value propositions in an unstable competitive environment (Beverungen et al., 2018).

One approach for developing such services is based on the emergence of novel digital technologies, which push the development process for innovative solutions (Lusch and Nambisan, 2015; Wiesböck and Hess, 2020). However, organizations are confronted with high initial costs and extensive risks linked to implementing completely new technologies into their service systems (Li and Peters, 2019). These conditions often hinder organizations from expanding their offered services and, therefore, decrease their competitive strength. However, despite these impairments, many companies are still able to create novel and innovative service solutions, which can be achieved by reutilizing diverse resources such as knowledge, organizational entities, tangible components, and digital components (Hund, 2020; Hund et al., 2021). For example, Amazon reutilizes contents such as news programs, music, and audiobooks by offering them via their own voice assistant service on the Amazon Echo device (Henfridsson et al., 2018). In the context of the digitalization and its corresponding emergence of online services, the recombination of digital technologies is set into focus in this study as a form of reutilizing established resources in service systems (Maglio et al., 2009; Spohrer et al., 2007). This approach can be described

as a specific form of recombinant innovation. Based on Schumpeter (1934), recombination means that novel innovations result from novel combinations of established elements rather than the novelty of the elements themselves. Although this approach is already applied in diverse industries, the particularities of recombining digital technologies are often unclear. Consequently, companies often rely on the reutilization of established digital technologies by exploring user reactions to different types of recombinations in the form of uncoordinated trial-and-error procedures (Lundberg et al., 2020). Such an unfocused approach impedes organizations from realizing the advantages of different types of recombinant innovation (e.g., cost- and risk-reduction), which hinders the development of services that address new customer demands. Therefore, insights into how users perceive different types of recombinations would be promising to structure the configuration of digital service systems.

While recombination is undoubtedly not a new concept in research, its interplay with digital technologies and service engineering has attracted interest in recent IS literature (e.g., Beverungen et al., 2018; Hund, 2020; Nambisan, 2020). First theoretical remarks in this field introduce a set of concepts and frameworks that help to define digital technologies as the resource for innovative service solutions (Fleming, 2001; Gadrey et al., 1995; Gallouj and Weinstein, 1997). Insights in this field primarily focus either on the exploration of organizational conditions for the recombination of digital technologies (e.g., Hron et al., 2021; Lundberg et al., 2020; Øvrelid and Kempton, 2019) or on recombination as a process of value co-creation applied by users (e.g., Ebner et al., 2019; Hund et al., 2021). However, research is missing that describes how users perceive different recombination types. Such insights would help organizations decide on recombination types that enable a goal-oriented development of promising novel and innovative services. Hence, our study investigates how different recombination types of digital services influence user perceptions. Such insights would allow organizations to efficiently utilize the different types of recombinant digital innovation (Beverungen et al., 2019a; Dreyer et al., 2019; Knop et al., 2017). Hence, we propose the following research question:

RQ: *How do recombination types influence user perceptions of recombined digital service solutions?*

To answer this research question, we conducted an online experiment with 362 subjects situated in the context of digital media services. Within this experiment, participants were opposed to a recombined digital service solution in the form of a video streaming service solution. We manipulated this service to examine how recombination types affect the participants' perception of the respective content. First, we found that perceived novelty is a central variable for assessing user perceptions of different recombination types, which can be utilized to enhance perceived value as well as adoption intention of a recombined digital service solution. Second, our results indicate that additive recombination types are capable of eliciting higher levels of perceived novelty, perceived value, and adoption intention, which is, however, dependent on the presented content. Therefore, our study makes a significant twofold contribution to research: On the one hand, we emphasize the importance of the relationship of the subjective novelty of recombined innovative service solutions and their utility. The higher the perceived novelty of recombination types is, the more positive the service solution will be evaluated by users. On the other hand, we shed light on the general influence of recombination types on user perceptions, which is, however, dependent on the specific context. Consequently, our findings hold important implications for the employment of recombinant digital innovation through aligning it to user perceptions and thereby enabling companies to develop services that focus on serving mutable customer demands efficiently.

2 Conceptual and Theoretical Foundations

2.1 Recombinant digital innovation in service systems

Due to digitalization's ubiquitous technological advancements, services are constantly changing and becoming more complex as more entities and technologies are involved in their provision (Spohrer et al., 2007). Service system theory serves as a fundamental abstraction to reduce this complexity and describe how configurations of various resources form systems that help to create value. Within a service system, an operant resource can perform actions on operand resources, making them valuable. For example, the informational value of daily news (i.e., operand resource) can only be utilized by making

these news usable through a medium such as a news show (i.e., operant resource) that transmits the information. Against this background, the operand resource is a static resource, which is only usable and, therefore, capable of generating value through actions applied by the operant resource (Spohrer and Kwan, 2009). These actions are referred to as the actual service and are also enabled by configurations of resources within the respective service system (Maglio et al., 2009). Concerning online services, this means that a digital service solution can be described as an operant resource that consists of a combination of distinct digital technologies that are modular and interconnected (Wiesböck and Hess, 2020; Yoo et al., 2012). Hence, all digital technologies already used within established service solutions of a specific organization can be combined with each other to form new services. At this point, the concept of recombinant innovation helps to understand how this reutilization of established digital technologies results in the development of innovative digital service solutions. The underlying concept is rooted in the theory of recombination, which postulates that "to produce means to combine materials and forces within our reach […]. To produce other things […] means to combine these materials and forces differently" (Schumpeter, 1934, p. 65). As a prevailing concept in information system literature, the term recombinant innovation mainly describes the generation of digital solutions by reconfiguring digital resources already used within existing solutions (Hund, 2020). Consequently, it can be deduced that recombinant digital innovation focuses on the connections between digital technologies rather than the individual technologies. Their novelty relies more on *how* than *which* resources are being combined (Nambisan, 2020). In essence, recombinant digital innovation's specific characteristic is that it aims to set up new relationships between technologies already used in established configurations to form new recombined configurations (Fleming, 2001). This implies that the components of a recombined digital solution can be part of multiple solutions simultaneously (Gadrey et al., 1995).

Henfridsson et al. (2018, p. 89) describe recombinant digital innovation as the "idea that novel products and services derive from the carrying out of new combinations of components […]". This process theoretically follows three predefined types of recombination mechanisms, which can be adopted from service engineering (Beverungen et al., 2018). First, dissociation mechanisms aim at splitting up the components of a set solution to use them individually and apart from each other. Second, association mechanisms seek to set up new connections between components of already established solutions. Third, addition mechanisms comprise the supplementation of an established solution with a new component, which ultimately leads to the generation of a new recombined solution. Although these three recombination types are theoretically applicable in the general context of service systems, it must be noted that – especially in the context of digital innovation – dissociation mechanisms target the decomposition of services into their spare parts. Suppose this decomposition is applied to the granularity of single digital technologies. In that case, these technologies are isolated and not connected to essential technical infrastructures such as a device to use the service. Therefore, dependent on the respective definition on the granularity of digital technologies, some single digital technologies are not completely capable of forming a holistic service solution on their own (Henfridsson et al., 2018; Yoo et al., 2012). For example, a single network technology such as the internet cannot form a usable digital service solution without digital devices and interfaces that enable its access. Consequently, the dissociation mechanism is factored out as it outcomes are only partly viable in the context of this study. Therefore, we focus on associative and additive recombination types, as they aim to generate holistic, innovative recombined digital service solutions. Against this background, the associative recombination type (ASO) connects distinct technologies from multiple established solutions by setting up new ties between them. Thereby, a new solution is created, whose innovativeness results from the novelty of the new connections between its components. Following Fleming (2001), this means that any resources can be connected with each other, leading to a seemingly endless spectrum of options for recombination. Consequently, in the context of recombining digital technologies as a key resource for innovative digital service solutions, this means that through association, such technologies can be put into contexts for which they were not originally intended (Toivonen and Tuominen, 2009). In return, the additive recombination type (ADD) aims at supplementing an established solution with a new digital technology, which was not originally implemented by the organization that applies this recombination mechanism. Thereby, a new solution is generated, the innovativeness of which results from the novelty of the new

connections of its components as well as the new technology itself. In contrast to the association mechanism, it is important that addition mechanisms focus on the development and implementation of new modules instead of solely recombining existing modules (Beverungen et al., 2018).

To clarify these mechanisms, we introduce an example for association and addition for a B2C and B2B business perspective: In a B2C context, service innovation through associative recombination would occur if a broadcaster recombines its contents – which are originally only sent via its linear program service – with the infrastructure of its online news website. The broadcaster thereby creates a new recombined digital service solution in the form of a video-on-demand service by associating components of the linear program service and its online news website by setting up new ties between the architectures of their established digital infrastructures. If this broadcaster would then also implement a 360-degree presentation mode that they did not utilize so far, a new 360-degree streaming service is created through an addition mechanism. In a B2B context, an association would occur if a cloud service provider recombines software modules that store data with modules that help to analyze data. Thereby, a joint associated cloud-based big data service solution is created. If the provider then also implements a visualization software that was not used before, a new additive digital service solution is created, consisting of a cloud-based big data visualization service solution. Based on these four examples, it becomes clear that the mere type of recombination used by organizations is irrelevant from the users' perspective. Accordingly, it is all the more critical that organizations are aware of different types of recombination mechanisms and how their outcomes are perceived by users, which is central to our study.

We summarized our theoretical foundations for this relationship of digital innovation in the context of service systems in Figure 1: A service system consists of operant and operand resources. In the context of this study, which is set at the intersection of digital innovation and service system theory, the operant resource is a configuration of a set of digital technologies. These can already be established within other solutions of a service system and are capable of being reutilized through two different types of recombinant digital innovation, namely association and addition. While the association type only relies on the reconfiguration of digital technologies already established within the service system, the addition type focuses on reconfiguring these established digital technologies with individual new digital technologies. Through these two types of recombination, new recombined digital service solutions are generated, which can serve as new operant resources. These new operant resources are applied to make a service system's operand resource usable and therefore generate value.

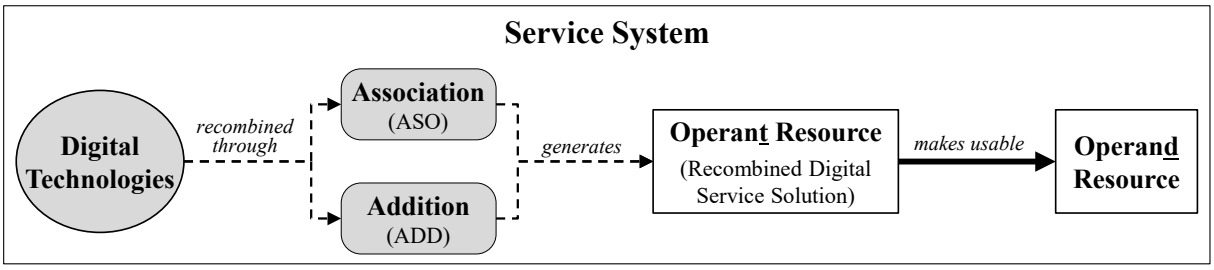

Figure 1. Recombinant digital innovation in service systems through association and addition.

2.2 TAM in the context of recombinant digital innovation

To describe how users perceive the two recombination types and thereupon deviate insights on and recommendations for the application of recombinant digital innovation in organizations, a model is necessary that encompasses the individual perceptions experienced when using an associative or additive digital service solution. These perceptions can be described with the help of an individual's views and attitudes towards a recombined solution. Therefore, we introduce the general properties of the technology acceptance model (TAM) extended by constructs of the value-based adoption model (VAM) to meet the context of using a recombined digital service solution in an individual setting. Models that study the influence of diverse factors on the adoption of technological solutions have a long tradition in IS research (Venkatesh et al., 2003). Most of them are related to the basic principles of TAM by Davis (1989), which postulates that all external influences on the user's attitude towards using a

specific technological solution are mediated by cognitive assessments. However, due to the user-specific context of our study, a service must be assessed from a cognitive and affective perspective (Kim et al., 2007). Hence, the cognitive perceptions measured in TAM must be supplemented with affective perceptions to describe how the influence of an external variable on the attitude towards it is mediated. In the context of recombination types of digital service solutions, this attitude can be expressed as an overall assessment of the utility of the service, which can be described as the value a user perceives by consuming a service solution. Following Zeithaml (1988), perceived value can be implemented to assess what a user receives and gives when using a solution. Consequently, a user's attitude towards a service solution can be introduced as the value that is provided through using it, which is a trade-off between its benefits and sacrifices. As this perceived value influences the behavioral intention to use the solution, it serves to evaluate if users perceive the outcomes of associative and additive recombination differently.

Throughout IS theory, the object of investigation (i.e., external variable) was implemented in diverse forms, such as objective perceptions of proficiency in teaching (Kimmerl, 2020), prior experience with IS (Wang et al., 2008), or design parameters of service channels (Hoehle et al., 2012). By comparing these examples, it becomes apparent that the selected external variable is directly related to the context being researched. Consequently, as this study aims to describe the influence of recombined digital solutions on users' adoption intentions, it needs to describe how the perception of such a solution can be predicted. As outlined before, the outcomes of recombinations differ regarding their degree of novelty (Schumpeter, 1934). This novelty can be assessed as either objective reality or subjective perception. Objective novelty is determined by the inherent characteristics of an innovative solution compared to existing alternatives. The more of its characteristics are still commonly unknown, the higher is the objective novelty of that innovation. Subjective novelty describes how novel a solution is perceived by a user compared to his individual experiences. The more a used solution provides unknown features to this specific user, the more novel this solution is perceived (Wells et al., 2010). Against this background, a subjective assessment of novelty is reasonable to measure how the two recombination types are perceived by users, as higher degrees of novelty influence the perceived value of a service solution. To explain this relationship between subjective novelty and the perception of associative and additive recombination types, we draw on arousal theory: It states that users constantly seek to reach an optimal state of arousal (OSA), which is located on a continuum ranging from extreme drowsiness to extreme wakefulness (Berlyne, 1960). For example, if an individual is in a very languid arousal state, it seeks a stimulus (e.g., using a service) that helps to reach the OSA. The influence of novelty differs based on an individual's prior experiences. Thus, the perceived novelty of an individual can be approached as an affective belief. It can be described as "the degree to which a user perceives an innovation to be a new and exciting alternative" (Wells et al., 2010, p. 818) to an existing one. Considering these theoretical remarks, it can be followed that user perceptions of the two different recombination types can be assessed by measuring how much subjective novelty users attribute to a recombined digital service solution. In the light of arousal theory, this novelty helps describe the user's attitude towards the service solution, which is mediated by the benefits and sacrifices an individual experiences through the usage of the service. Consequently, our general research model proposes that organizations should focus on applying the type of recombination mechanism that's outcome lead to higher levels of perceived value, which is influenced by the perceived novelty a solution is capable of reaching. This theoretical relationship serves as a basis for our research model, which will be derived in the following section.

3 Hypothesis Development

To answer how the two different recombination types influence user perceptions and their evaluation of a recombined digital service solution, we analyze the influence of the outcomes of an associative and additive recombination on the central independent and dependent variables in our model. As outlined before, the arousal theory describes the relationship between the subjective novelty of a service solution and its perception. The more novel a stimulus is perceived, the easier it is to reach the optimal state, as novel stimuli generate higher levels of arousal (Scitovsky, 1976). Thus, it can be implied that the more novel a recombined digital service solution is, the greater the influence of the stimulus on an individual's perception of that solution will be. Therefore, we implement *perceived novelty* as our model's central

dependent external variable. Moreover, to evaluate whether users prefer one of the two recombination types, we adopt *adoption intention* from TAM as our central dependent variable. This allows measuring which outcome of the two recombination mechanisms users prefer and therefore should be focused on by organizations. The completed research model is illustrated in Figure 2.

As described before, the *subjective novelty* of innovative solutions can stem from two sources: On the one hand, a solution will be more novel if its involved components are combined in novel ways (Schumpeter, 1934). The more novel connections between the digital technologies of a recombined service solution exist, the more this solution will be perceived as novel (Henfridsson et al., 2018). On the other hand, a solution will be more novel if its components themselves are novel (Fleming, 2001; Wiesböck and Hess, 2020). This means that the more novel the technologies within a digital solution are perceived, the higher the total *perceived novelty* of this solution would be. Associative recombined solutions are generated through recombining components of established solutions. Consequently, its source of novelty is only based on the novelty of new ties. Therefore, the more a solution consists of novel unprecedented connections between its components, the higher its *perceived novelty* will be. In contrast, additive recombined solutions are generated by supplementing an established solution with a new component. Thus, its source of novelty is based on the novelty of new ties to the added technology and the novelty of the new technology itself. This means that additions are capable of providing more options to generate novelty compared to associations. Therefore, we argue that ceteris paribus, the *perceived novelty* of an additive recombined digital service solution will be higher than for association. Consequently, an associative digital service solution extended with a new digital technology generates an additive digital service solution that leads to higher *perceived novelty*. Hence, we hypothesize:

H1*: Additive digital service solutions positively influence perceived novelty.*

Based on the arousal theory, it can be implied that the higher the *perceived novelty* of a recombined digital service solution is, the easier it will be for an individual to reach the optimal arousal state when using this service (Scitovsky, 1976; Wells et al., 2010). Accordingly, the easier it is for an individual to reach the OSA, the higher the subjective value that is attributed to this service. In return, the higher the attributed value is, the more likely an individual intends to adopt a solution (Davis, 1989). Consequently, if an additive digital service solution is more capable of reaching the OSA than an associative digital service solution, its *adoption intention* will be higher. Hence, we hypothesize:

H2*: Additive digital service solutions positively influence adoption intention.*

As outlined before, the *perceived novelty* of a recombined digital service solution serves as the central predictor for the perception of a service in our model, mediated by the benefits and sacrifices this service solution entails. While the perceived *usefulness* from TAM can be classified as a cognitive benefit (Davis, 1989), we introduce *enjoyment* in our model to account for affective benefit in an individual's estimation of the total benefits that a recombined digital service solution can offer (Kim et al., 2007). *Enjoyment* can be defined as "the extent to which the activity of using [an innovative solution] is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated" (Davis et al., 1992, p. 1113). Analogously, the sacrifices also consist of a cognitive and an affective component. The cognitive component is adopted from TAM and adjusted to the context of service solutions: *Perceived ease of use* describes an individual's belief that the usage of a solution would be less effortful (Davis, 1989). To fit in the logic of a sacrifice, we reverse this construct and establish it as *technicality*. This cognitive component of sacrifices can be determined by characteristics such as complexity in use and system reliability (Kim et al., 2007). Additionally, we implement the affective component of sacrifices as a perceived *change of habits*. In the context of IS, a habit can be defined as "the extent to which using a particular IS has become automatic in response to certain situations" (Limayenm et al., 2003, p. 2). Consequently, it can be implied that when the consumption of a service solution becomes a habit, its usage becomes familiar and therefore requires less mental affective effort. Hence, a change in these habits caused by adopting a new digital solution would lead to less familiarity and, in return, more mental effort (Gefen, 2000; Lin et al., 2012). Thus, novelty serves as a variable to express users' beliefs towards a service solution and guide cognitive and affective assessments of this service (Wells et al., 2010). Accordingly, a user will compare the recombined digital

service solution to experiences that lead to comparable affective beliefs. Therefore, if novelty is perceived as a feeling of excitement, users will develop a positive mood when using a novel recombined solution. This approach to novelty implies that when a user has a positive affective belief towards the stimulus (i.e., the recombined digital service solution), benefits will be overrated, while sacrifices will be underrated (Alhakami and Slovic, 1994). Against this background, we expect that if a recombined digital solution is perceived as being more novel than the alternatives the user experienced before, this will positively influence the perceived benefits. Thus, *perceived novelty* will positively influence *usefulness* and *enjoyment*. Hence, we hypothesize:

***H3a**: Perceived novelty positively influences usefulness.*

***H3b**: Perceived novelty positively influences enjoyment.*

Regarding sacrifices, if an individual uses a recombined digital service solution, the same effect occurs vice versa. Suppose the user perceives a recombined solution to be more novel, the positive affective belief biases the perception of sacrifices to be less impactful. Consequently, *perceived novelty* will negatively influence the sacrifices *technicality* and *change of habits*. Hence, we hypothesize:

***H4a**: Perceived novelty negatively influences technicality.*

***H4b**: Perceived novelty negatively influences change of habits.*

Perceived value is a utility construct that resembles the result of the trade-off between benefits and sacrifices the usage of a recombined digital service solution offers to the user. In our model, benefits are composed of *usefulness* and *enjoyment*. *Usefulness* resembles the concept of product quality, which refers to a customer's perception of superiority of the provided functions (Zeithaml, 1988). This superiority leads to a relative increase in utility for the user, leading to more *perceived value*. Therefore, the higher the *usefulness* of a recombined digital service solution, the higher the perceived value. In addition to this, the increase in value through *enjoyment* can be traced back to an increase in emotional value (Sweeney and Soutar, 2001). If the consumption of a recombined digital service solution is more enjoyable for the user, the assigned emotional value is also higher. Therefore, the positive influence of *enjoyment* can be defined as "the utility derived from feelings or affective states that a product generates" (Kim et al., 2007, p. 116). This means that the more a recombined digital service solution is enjoyable, the higher its *perceived value*. Hence, we hypothesize:

***H5a**: Usefulness positively influences perceived value.*

***H5b**: Enjoyment positively influences perceived value.*

The sacrifices a user experiences by consuming a recombined digital service solution have a negative impact on *perceived value*. While *usefulness* increases the cognitive component of *perceived value*, *technicality* resembles its counterpart. Technical complexity and inconvenience generate additional effort, which can be seen as a cognitive expenditure the user has to make (Davis, 1989). The more complex it is to use a new digital solution, the higher the negative effects on a utilitarian value will be (Rogers, 1995). Consequently, the higher the *technicality* of a recombined digital service solution, the lower the *perceived value* will be. Similarly, a change of habit resembles the same relationship from an affective perspective. The more the usage of a digital solution becomes a habit, the less effortful its usage will be due to an increased level of familiarity (Limayenm et al., 2003). This means that a *change of habits* indicated by adopting a recombined digital service solution would lead to higher relative efforts. From an affective perspective, the new recombined solution would be recognized as unfamiliar. This unfamiliarity negatively influences the emotional value attributed to the solution (McAllister, 1995). Therefore, the higher the *change of habits* would be when a recombined digital service solution is adopted, the lower its *perceived value*. Hence, we hypothesize:

***H6a**: Technicality negatively influences perceived value.*

***H6b**: Change of habits negatively influences perceived value.*

In our model, we propose that *perceived value* predicts *adoption intention*, which originates from the economic theory of utility, which states that individuals maximize their value based on given resource limitations (Kahneman and Tversky, 2013). The variable *perceived value* addresses this theory by comparing benefits with sacrifices (Kim et al., 2007). Hence, if the benefits outweigh the sacrifices of

recombined digital service solutions, this leads to higher *perceived value*. Besides, users evaluate their option of adopting a new solution compared to a reference point (Thaler, 1985). If the *perceived value* of using the new solution exceeds the *perceived value* of a familiar alternative, it is more likely to be adopted. Consequently, the higher the *perceived value* of a recombined digital service solution, the higher its *adoption intention* will be. Hence, we hypothesize:

***H7**: Perceived value positively influences adoption intention.*

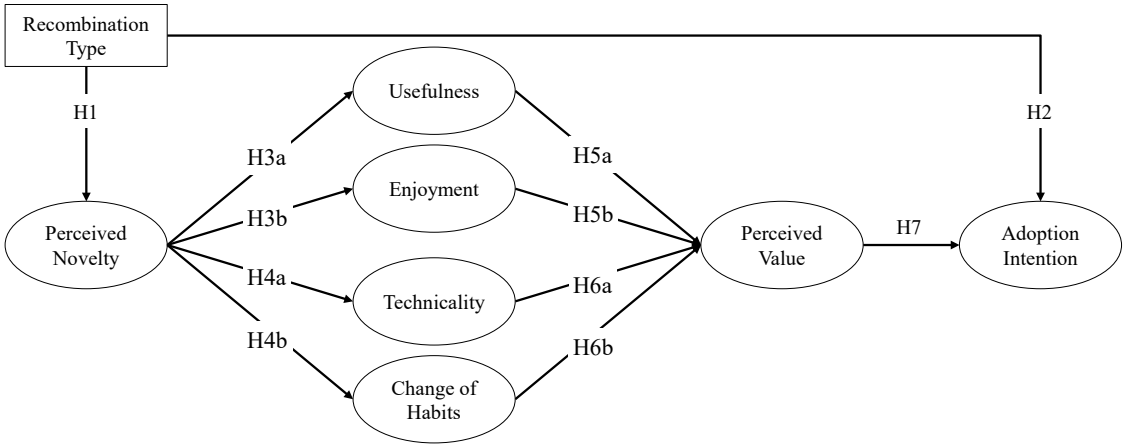

Figure 2. Research model.

4 Method

4.1 Experimental Design

To test our research model, we conducted an online experiment that tested associative and additive digital service solutions. Therefore, we applied the context of a digital streaming service solution. This approach is viable for our study as it allows measuring the actual perceptions of recombined service solutions of a reasonably diverse sample, which soundly suits the overall context of online services. The increasing availability of high-speed data networks and the extensive diffusion of mobile devices led to new customer demands for higher temporal and local flexibility while consuming media contents (Wirtz et al., 2013). This required developing innovative online content services such as streaming services which are often based on already established digital technologies (Alt and Militzer-Horstmann, 2017; Shivendu and Zhang, 2019). Consequently, this setting was suitable since the media industry depends on the efficient development of new digital service solutions in particular (Hess and Constantiou, 2018). The operand resource in such a service system was incorporated by the content that is being consumed. In contrast, the operant resource was the actual service solution used to consume the content. Thus, we implemented the two recombination types of digital service solutions as stimuli in the experiment: One group watched the content in form of a video-streaming service without other technical functionalities, which can be referred to as the associative digital service solution. The other group watched the same video except that they were given the possibility to change the perspective in 360-degree as additional functionality. This stimulus can be referred to as the additive digital service solution. Thereby, it was possible to ascribe potential differences in user perceptions regarding the two recombination types to the addition of the 360-degree technology as all other conditions were equal. Admittedly, it is arguable that different presented contents (i.e., operand resources) could lead to different results regarding the perception of the recombination types. Hence, we implemented two content settings to control this effect: While one group watched a video of a virtual painting passage (i.e., ART), the other group watched a rollercoaster ride (i.e., ROL). This allowed covering a considerable range of personal interests within the group of participants. Consequently, our experiment had a 2x2 between-subject design with manipulations of the recombination type (ASO vs. ADD) and the presented content (ART vs. ROL). Thus, our study consisted of four groups: ASO-ART (group 1), ADD-ART (group 2), ASO-ROL (group 3), and ADD-ROL (group 4). We adapted the original videos for our experiment to resemble the

described recombination types. Therefore, we disabled all additional functionalities for groups 1 and 3 and implemented the functionality of changing the perspective in 360 degrees for groups 2 and 4. The lengths of both videos were roughly two minutes and sounds were disabled to avoid additional biases.

Figure 3. Experimental procedure.

We conducted our experiment with the help of the online survey platform Qualtrics. We implemented the four different treatments by embedding Youtube video player applications that showed the respective contents and prohibited any other controls that could have led to potential abstractions. The study commenced with an introduction, data protection information, and notes about the expected duration (see Figure 3). We implemented an automatic device restriction, which prohibited participation with mobile devices and tablets to preclude a bias because of small screen sizes. After asking for control variables, the participants were randomly assigned to one of the four groups and introduced to the specific scenario. For groups 2 and 4, this introduction contained a brief instruction on how to adjust the perspective in the 360-degree video. To assure that the participants conceived how to use their service solution, we asked two comprehension questions before advancing to the actual treatment. Thereupon, the participants were forwarded to the video service, which started automatically and had to be consumed for at least 110 seconds before advancing. As indicated in Figure 3, the participants were presented with the video of their treatment adjusted to their respective screen sizes. During the treatment, participants of groups 1 and 3 watched the content without being able to use any additional functionalities. In contrast, groups 2 and 4 were able to change the perspective in 360 degrees via dragging the cursor accordingly. Afterward, all participants answered the same post-task questionnaire containing the measured constructs and demographic questions.

4.2 Measures and data collection

For our analyses, we applied established scales and adapted them to our research context, if necessary. All of the following constructs were reflective measurements and evaluated with the help of 7-point Likert scales. We adopted items for *perceived novelty* from Wells et al. (2010), for *usefulness* and *adoption intention* by Davis (1989), for *technicality* by Davis (1989) and Kim et al. (2007), for *enjoyment* by Agarwal and Karahanna (2000) and Kim et al. (2007), for *change of habits* by Limayenm et al. (2003) and Lin et al. (2012), and for *perceived value* by Sirdeshmukh et al. (2002). We also measured several control variables, such as the participants' habits regarding the content settings (i.e., art and rollercoasters) and personal innovativeness based on Agarwal and Prasad (1998), to avoid biases regarding personal interests and rejections. Our demographic control variables included gender, age, education, and occupation. We pretested the experiment first with eleven experienced researchers and thereupon online with more than 100 participants, which allowed us to identify flaws within the experimental setting. The data collection took place in March 2021. The invitation to the study was distributed via a mailing list composed of students and alumni from one of the biggest universities in Europe (5,677 subscribers) and via professional networks to avoid biases because of an exclusively student-based sample. In total, 362 participants finished the experiment with sufficient responses to the

comprehension checks. The gender ratio was 59.6% female, 39.4% male, and 0.3% non-binary. The average age was 31.23 years ($SD = 13.23$), ranging from 18 to 80. 60.77% of the respondents were students. 92.82% of the respondents had a high school diploma and 61.60% had at least one university degree. Based on the results of chi-square tests, no significant differences between the four treatment groups occurred regarding gender, education, or occupation (all $p > 0.05$). Moreover, one-way ANOVAs revealed no significant differences between the treatment groups regarding the age of the participants ($F = 0.70$, $p > 0.05$), personal interest in art ($F = 2.53$, $p > 0.05$), personal interest in rollercoasters ($F = 0.90$, $p > 0.05$), and personal interest in IT ($F = 1.61$, $p > 0.05$). Hence, we concluded that the participants were balanced across the four treatment groups. Furthermore, we controlled for influences of the personal interest constructs on our dependent variable, which were all insignificant ($p > 0.05$). After the treatment, the participants were asked two questions to check whether they carefully watched the content and if the manipulation of the addition worked. Dependent on the respective setting, these questions asked if a manipulation-specific element occurred in the video, which was answered correctly by 94.5%. The second question asked if the participants could change the perspective in the video (i.e., wrong for groups 1 and 3, true for groups 2 and 4), which was answered correctly by 91.9%. The remaining 8.1% were kept in the sample to account for a natural distribution of general technical competences of the participants. Hence, we the manipulation worked sufficiently.

5 Analysis

5.1 Test of the analysis of variance

We estimated whether significant differences between the groups occurred regarding the measured constructs to test our first two hypotheses. We used IBM SPSS Statistics 25 to assess the differences between associative and additive digital service solutions. We conducted a MANOVA to test the effect of the recombination type on *perceived novelty* and *adoption intention*, which included Pillari's trace, Wilks' lambda, Hotelling's trace, and Roy's largest root test statistics. All p-values were significant ($p < 0.05$). Hence, ANOVAs were conducted separately for the two dependent variables. Moreover, to control for influences of the settings, we also conducted post-hoc analyses regarding interaction effects.

A two-way ANOVA on *perceived novelty* indicated that the recombination type significantly affected *perceived novelty* ($F = 9.98, p < 0.05$) while the interaction effect between the recombination type and the content setting (recombination type*content setting) was insignificant ($F = 0.13$, $p > 0.05$). Moreover, the mean value of *perceived novelty* was 4.37 for the groups that tested the associative solution and 4.85 for the groups that tested the additive solution. Considering these results, it can be followed that the participants that tested an additive digital service solution significantly perceived higher levels of novelty than the participants that tested an associative solution. Thus, H1 was supported.

We conducted the same analysis for *adoption intention*. The results indicated that the recombination type significantly affected *adoption intention* ($F = 4.95$, $p < 0.05$). However, in this case, the interaction effect between the recombination type and the content setting (recombination type*content setting) was significant ($F = 4.68$, $p < 0.05$). Therefore, we compared the mean values of *adoption intention* for the two content settings individually and tested if they were significantly different. For the art setting, the recombination type significantly affected *adoption intention* ($F = 10.77$, $p < 0.05$). In this setting, the mean value of *adoption intention* was 3.85 for the group that tested the associative solution and 4.60 for the group that tested the additive solution. Considering these results, it can be followed that in the art setting, the participants that tested an additive solution significantly had higher levels of *adoption intention* than the participants that tested an associative solution. Consequently, H2 was supported for the art setting. In contrast, for the rollercoaster setting, the effect of the recombination type on *adoption intention* is insignificant ($F = 0.00$, $p > 0.05$) with means of 3.55 for the group that tested the associative solution and 3.56 for the group that tested the additive solution. Considering these results, it can be followed that the participants of the rollercoaster setting that tested an additive solution had no significantly higher levels of *adoption intention* than the participants that tested an associative solution. Consequently, H2 was rejected for the rollercoaster setting.

5.2 Test of the partial least squares structural equation model

Before estimating the PLS model, we conducted a factor analysis in SmartPLS based on the suggested thresholds by Hair et al. (2011). We calculated Cronbach's Alpha (CA) and composite reliability (CR) to assure internal consistency. As displayed in Table 1, all constructs exceeded the suggested thresholds of 0.7 for factor loadings, CA, and CR except *change of habits* which admittedly slightly deviates with tolerable discrepancy (Matsunaga, 2010). Convergent validity is given as all average variances extracted (AVEs) exceed the suggested threshold of 0.5. We established discriminant validity by assessing cross-loadings, the heterotrait-monotrait ratios (HTMT), and the Fornell-Larcker criterion. All factor loadings exceeded their cross-loadings. Moreover, all HTMT ratios were below the conservative threshold of 0.85, as suggested by (Henseler et al., 2015). The Fornell-Larcker criterion was met, as square roots of the AVEs exceeded the inter-construct correlations.

Construct	Loadings	CA	CR	AVE	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) *Perceived Novelty*	.905-.921	.897	.900	.829	.910						
(2) *Usefulness*	.743-.897	.926	.926	.731	.620	.855					
(3) *Enjoyment*	.944-.960	.975	.975	.910	.798	.599	.954				
(4) *Technicality*	.729-.895	.874	.894	.629	-.198	-.194	-.192	.793			
(5) *Change of Habits*	.635-.821	.631	.801	.576	-.526	-.576	-.545	.222	.759		
(6) *Perceived Value*	.891-.939	.940	.957	.848	.727	.585	.779	-.303	-.542	.921	
(7) *Adoption Intention*	.922-.970	.973	.979	.903	.551	.530	.649	-.113	-.516	.704	.950
Note: Elements in grey boxes represent the square root of AVE for the corresponding construct.											

Table 1. Factor loadings, consistency and validity criteria, and correlation matrix.

We estimated our research model using partial least squares structural equation modeling (PLS-SEM). Based on (Hair et al., 2011), we conducted a bootstrapping procedure with 5,000 subsamples to test the significance of the path coefficients in the structural equation model. We displayed the results in figure 4. Based on our estimations, the hypothesized positive effects of *perceived novelty* on *usefulness* ($.620$, $p < 0.001$) and *enjoyment* ($.798$, $p < 0.001$) as well as the negative effects of *perceived novelty* on *technicality* ($-.198$, $p < 0.001$) and *change of habits* ($-.526$, $p < 0.001$) proved to be significant. Analogously, the positive effects of *usefulness* ($.129$, $p < 0.01$) and *enjoyment* ($.632$, $p < 0.001$) on *perceived value*, as well as negative effects of *technicality* ($-.136$, $p < 0.001$) and *change of habits* ($-.098$, $p < 0.05$) on *perceived value* also proved to be significant. Lastly, we hypothesized that *perceived value* positively influences *adoption intention,* which was proven, too ($.705$, $p < 0.001$). Therefore, the hypotheses of the PLS model can be supported. We also tested for differences of the proposed model between the experimental settings by conducting multigroup-analyses (MGA), which yielded no significant differences between the manipulations of the recombination type.

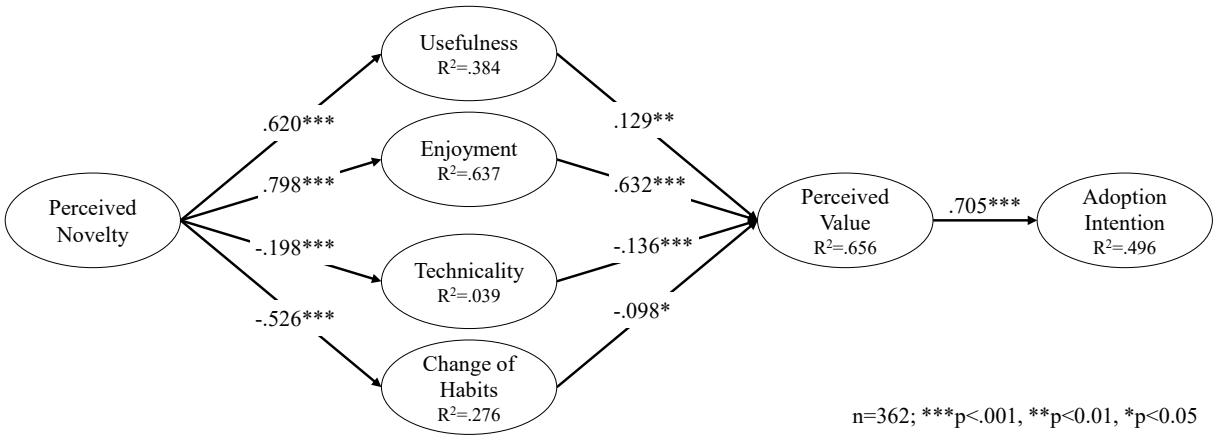

Figure 4. Results of PLS estimations.

6 Discussion

First, our findings suggest that the recombination type affects user perception of recombined digital service solutions. Additive recombinations are capable of positively influencing the perceived novelty and adoption intention of a service solution as supported by the art setting. However, this positive influence was confirmed in both settings for perceived novelty, but only in the art setting for adoption intention. Therefore, it can be implied that the addition of a digital technology to a recombined digital service solution generally leads to higher levels of perceived novelty. Consequently, it can be confirmed that additive recombined digital solutions not only incorporate novelty generated through new ties between their technologies but also through the integration of a new technology itself. Moreover, it must also be implied that the recombination type can influence the adoption intention of a service solution. Nevertheless, this influence can be offset by the content transmitted via the service solution. Hence, additive recombinations can only develop service solutions with perceived value and adoption intention if they are adjusted to the transmitted content. Thus, it can be followed that the applied recombination type must be matched with the operand resource that is being transformed into actual value.

Second, our findings suggest that perceived novelty positively influences benefits and negatively influences sacrifices a user perceives when using a recombined digital service solution. Moreover, the benefits positively influence the perceived value, while the sacrifices reduce it. Accordingly, the higher the perceived value of a recombined service solution is, the more likely it is that users intend to adopt this service. This finding is rooted in the arousal theory, which suggested that higher perceived novelty will also lead to higher levels of perceived value and adoption intention because it enhances reaching an optimal state of arousal with the help of the service. Consequently, our results confirm that in the context of recombined digital service solutions, novelty successfully forms a bias towards the positive characteristics associated with a service. Therefore, it can be implied that the more novel a recombined digital service solution is perceived, the more likely its adoption will be. As a result, the novelty of recombined digital solutions plays a central role in users' adoption considerations of new services.

Considering both these findings, it can be followed that the recombination type certainly influences user perceptions of recombined digital service solutions. This perception is largely based on the novelty a recombination is capable to provide. Moreover, additive digital service solutions are perceived as more novel by users than associative solutions. This higher novelty can lead to a higher adoption intention, which depends on the actual information transmitted via the service. Thus, additive recombination is only superior to associative recombination if the added technology supports the transmission of the selected information instead of distracting from it. Considering the question posed in the title of this study, it can be followed that newer can indeed be better from a user's perspective. The adoption intention of a service solution that is generated through addition can be higher if the recombination type is adjusted to the operand resource that is intended to be transformed into value (e.g. content or information being shown). Nevertheless, it must be mentioned that these findings are dependent on the respective setting of the service system to a certain degree. The complexity of the tested recombined service solution was relatively low compared to other settings that incorporate more complex relations between a higher number of involved entities and resources. For example, a platform-based service system that focuses the contribution of service modules from external providers would naturally lead to more potential options for application areas of recombination mechanisms, as these would lead to the recombination of complete service modules instead of single digital technologies. Against this background, it would be arguable that then dissociation mechanisms would play a higher role as their outcomes (i.e. service modules instead of digital technologies) would be capable of generating value on their own. However, we argue that the central finding of this paper (i.e., the dependency of the recombination of services on their context and content) is even more critical for such scenarios as the integration of a higher number of resources leads to more possible ways to co-create value.

7 Theoretical Contribution and Practical Implications

From a theoretical perspective, we contribute to research by explaining how digital technologies become "an active agent in service ecosystems" (Knop et al., 2017, p. 16) and how they can trigger service

innovation as its central component. Furthermore, we explained the relationship between the perceived novelty of innovative digital solutions and their adoption intention. This approach adds to IS literature by shedding light on the convergence between organizational perspectives on the generation of innovations and the customer perspective on using and adopting these innovations (Nambisan, 2020; Vial, 2019). From a service-science-specific perspective, we contribute by instantiating the importance of an alignment between operant and operand resources in the form of a content-dependency, which is a central determinant for applying recombinant innovation in smart services systems. Thereby, by utilizing the recombination of digital technologies as central components of digital services solutions, we also give first empirical quantitative insights that address issues regarding the actual configuration of resources in service systems (Wessel et al., 2019). Following Yoo et al. (2010), components in a modular architecture may be product-/service-specific. From a theoretical IS perspective, this means that the recombination of digital technologies not only depends on the involved components themselves but also on the context in which they are applied. Thus, we add to theory by giving empirical evidence for the necessity to consider recombination rather as a context-specific than a context-independent innovation process (Beverungen et al., 2018; Dreyer et al., 2019). Admittedly, this context-dependency is especially important in the observed setting of digital media services. However, we argue that every type of digital service transmits contents in various forms (e.g., videos, texts, skills) as the operand resource. Moreover, we give first empirical quantitative evidence for the influence of recombination types on user perceptions and thereby describe how organizational service systems can be decomposed and recomposed (Maglio et al., 2009). This contribution helps to define how smart service systems can be enhanced based on the recombination of digital technologies (Beverungen et al., 2018; Beverungen et al., 2019b; Lusch and Nambisan, 2015).

From a practical perspective, our results provide implications in a twofold manner. First, our results imply that organizations should utilize additive recombination to generate service solutions that provide more value to the user, as they are perceived as being more novel. Therefore, organizations should focus their activities on the recombination of new technologies with established service solutions (Henfridsson et al., 2018). Second, our study shows that organizations should avoid additive recombination with a content-agnostic approach. As outlined before, the positive effects of the perceived novelty of recombined service solutions on adoption intention can be annihilated if these are not aligned with the operand resource on which they are applied. Thus, it is recommendable to assess the respective context before deciding on a recombination type. Suppose the addition of a digital technology to an established service is capable of distracting from using the content. In that case, organizations should rely on associative recombination to omit evitable costs and risks implied by implementing new technologies.

8 Conclusion and Limitations

Overall, our study is an initial step towards a better understanding of how users perceive different recombination types of service solutions and how their perception is dependent on the properties of the operand resource on which they are applied. We shed light on how perceived novelty works as a central predictor for the adoption intention of recombined digital service solutions by using the case of streaming services. We highlighted that recombination in service systems needs to be conducted with a technology- and content-specific focus. We hope this study gives an impetus for future research about recombinant digital innovation in service systems.

Like any research, our study has a few limitations. First, the experiment was conducted online. Although we purposefully applied various quality criteria to our study and implied several attention checks, this condition still leaves space for uncontrollable influences and deviations, such as connectivity issues, which could bias the content presentation. Moreover, the art video was an artificial simulation of the painting, while the rollercoaster video displayed a sequence recorded from reality. Even though the user moved in both content settings on a linear track, the velocity of the point of view in the art setting was slower than in the rollercoaster setting. In line with research about the importance of immersion in the context of media consumption (e.g., Mütterlein, 2018), both factors could have reduced the users' possibility to immerse into the rollercoaster content and, therefore, could have affected user perceptions.

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