Innovations

The Changing Nature of Service Design -Designing Services in the Metaverse

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Abstract

Recent research on service design has focused predominantly on ecosystem-based approaches from management and organizational viewpoints. Other popular approaches center on user experience, value creation and socioeconomic aspects. Less emphasis has been given for the needs for variation of design and delivery methodologies and processes in various types of contexts, including virtual ecosystems. Literature approaches digital ecosystems as homogeneous horizontal platforms where companies and users co-create value using defined design approaches and tools, and neglects ecosystem differences in terms of development and use domain, particularly immersion and virtualization. This paper analyzes the changes that virtual service design environments like metaverse expose to traditional service design practices. It presents a framework for service co-creation in metaverse from the perspectives of Context, Perception, Relationship, Resources and Process. The framework is validated in a real-life case study on public service design in metaverse. The paper contributes to digital service design research and makes managerial recommendations for virtual service design.

Keywords: *Digital Service Design, Design Framework, Value Creation, Metaverse*

1. Introduction

Digitization of services has been studied extensively during the past decades. The early studies, originated from marketing and management disciplines, focused on efficiency gains and structural arrangements (Solem et al. 2022). Service design related questions focused on adaptation of new organizational practices (Trischler et al. 2019) that enable innovation, reactivity to competition and relative differentiation in rapidly commoditized digitization of services (Tuunanen et al., 2023).

Later, service design originated studies emphasized the multi-disciplinary nature of digital services, and applied more human centric and participatory approaches, including economic and the socio-technical processes that accompany digitization (Lusch& Nambisan, 2015). Service design focus was on user experience, user engagement and rapid prototyping, borrowing from design thinking, open innovation and institutional logic approaches (Hormazábal et al, 2021).

The most recent digital service research approaches focus on the ecosystem nature of service systems (Alexey Sklyar, Christian Kowalkowski, Bird Tronvoll, David Sirhammar, 2019), (Vargo, S. L., Akaka, M. A., & Vaughan, C. M. (2017). The service-ecosystem view approaches digital servitization in terms of growth trajectories (Coreynen, Matthyssens, & Van Bockhaven, 20170 platforms (Cenamor, RönnbergSjödin, &Parida,

2017), exploitation of big data (Opresnik&Taisch, 2015), and supply chain interdependencies (Vendrell-Herrero, Bustinza, Parry, &Georgantzis, 2017).

These approaches echo a strong emphasis on the managerial, operational and technical processes underlying service design. Less emphasis has been devoted to new service design opportunities that advanced and immersive technologies like virtual reality, AI and metaverse enable (Yogesh 2022). These technologies enable completely new real time user engagement opportunities, a new value creation logic and opportunity for innovation that need to be considered in service design processes.

This paper explores these opportunities with focus on the key question in service dominant logic, namely value creation. Building on Vargo et al. mapping of value as phenomenological, always co-created, multidimensional and emergent (Vargo, S. L., Akaka, M. A., & Vaughan, C. M. (2017), (Ostrom et al., 2021), it explores the impacts of novel enabling technologies on service design process. Special emphasis will be given metaverse as a context for service design and provisioning.

The paper presents a framework for service design in immersive and ubiquitous technology setting. Building on (Saberian et al, 2020) mapping of digital service dimensions, it analyzes metaverse for service design from the perspectives of Context, Perception, Relationship, Resources and Process. The presented framework will be tested for early validation in a real-life case study of using metaverse for design of digital identity system for issuance and authentication of government IDs. The paper contributes to digital service design and digital ecosystem literature. The managerial contribution will lay in the planning of service design and delivery in metaverse.

The rest of the paper is organized as follows. Chapter 2 presents the emergence of conceptual research on metaverse, specifically as a context for service design, along with the proposed framework. Chapter 3 presents the methodology for the framework validation. This is followed by a description of the case study findings in Chapter 4. The paper concludes with discussion on the findings and contribution of the study.

2. Metaverse as a Service Design Environment

The metaverse is a world that transcends countries, borders, and gender. It is a hybrid multi-layered digital society that mirrors and augments the real world (Yogesh, 2021). Conceptually it has been seen as a fully immersive three-dimensional environment that is accessed through XR interfaces. It is constantly evolving by artificial intelligence collecting data on the user behaviors, and feeding it into development of the environments (McStay, 2023). The impacts of metaverse on our societies cannot be ignored, since global Metaverse economy is estimated to be worth $13 trillion by 2030 (Citibank 2020).

In scholarly research metaverse has been approached from technical, marketing, management, and strategic approaches. This is explained by the fact that the most promising early applications are found in consumer markets in gaming, tourism and retail (Park & Kim, 2022a). In service research, it is seen as a natural extension of the platform economy (Zoltan et al., 2021). Later research has included approaches from philosophy and psychology, as well as sociology, culture and politics (Olnes et al., 2017). Institutional methods to control ‘worlds’ in metaverse don’t exist, which raises interesting questions on governance both in virtual worlds and our own (Bermejo & Hui, 2022) With this, substituting formulas from the real world would not work in metaverse.

Labeling metaverse is complicated with the fast-paced development and various levels of maturity in applications. Metaverse applications have been categorized by the complexity of interface, interaction, social

value, and level of immersion. The purpose for building the environments is the decisive factor for the design choices. This paper takes a service-oriented view on metaverse as an environment to deliver value through design of high-quality user experience and user engagement. The focus is on review of service design processes like design thinking, journey mapping, gap analysis and value mapping to understand the changes exposed by metaverse. The proposed framework focuses on the metaverse resulted changes in the design thinking areas of Context, Perception, Relationship, Resources and Process. References to innovation literature are made, since innovation is a central concept to service design (Clack and Ellison, 2019).

Context

The metaverse can be viewed as a collective virtual open space (Bermejo & Hui, 2022). We take the position that metaverse is a context where users try to complete tasks, and their experience and success is influenced by their environment, while they also influence their immediate environment with their actions. Like in the real world, context is too often taken for granted (Domanski et al., 2020). This has led to multiple studies and typologies to assess innovation and entrepreneurial ecosystems, to find out the characteristics that make environments more conducive for new innovations.

In real world digital service design is met with physical constraints in terms of capacity, interfaces, interactions, latency and cognition. The interface to a digital service is typically an application or web portal with limited options for user decisions or interaction. Interaction is organized by chatbots, FAQs or helpline with inevitable lag between enquiries and responses. The user's physical surroundings have an impact on the experience, but the service provider has no control over the fact. User support is limited and based on user inputs, which can lead to misunderstandings and errors.

In a virtual world the service provider designs and controls the use environment, which unifies the service experience and gives more control to the service provider in the design of the service experience. Users can be given a controlled set of options to customize the environments. This highlights the importance of contextual design and provides opportunities to guide user choices and provide additional services.

In terms of user engagement for service design, the user choices and interactions are recorded by AI, and constitute a rich set of data for design purposes. Users interact not only verbally by conscious responses, but all observed behavior is recorded for interpretation. This gives more colorful insights to user preferences, values and choices, and accelerates and authenticates the design process.

Perception

Currently our digital service experience is highly influenced by visual and sometimes audible perception. Metaverse adds the element of full immersion and modalities of touch and social awareness besides the sound and visual modalities. People are embodied as avatars and utilize haptic devices or interfaces for interaction. User motivation and perceived importance of the task dictate the level of immersion, the psychological sensation of being within the environment where the action takes place (Polyviou, 2022). Advanced metaverse technologies enable both verbal and non-verbal language signs and recognizes moods. The multi-sensory simulation of reality that VR can create is a powerful, scalable, and infinitely flexible.

The implications to service design are manifold. User engagement can take place early in design process with representative virtual prototypes, and channels for open and user-driven innovation are immense. Full immersion and multi-user interaction enable new models of engagement and accumulated data can be used for detection of non-verbal and indicated clues for better outcomes.

Relationship

Metaverse enables adding social elements like social identity and ties in user-to-user interaction. These relationships heighten the experience and simulate reality in service interactions. The opportunities for self-representation in chosen ways generates an arena for self-expression and experimentation of social situations. This can be especially useful for training and rehabilitation services. The relational aspect is somewhat out of control off the service providers, which is why certain rules and moderation needs to be exposed. The opportunity to deliver services for groups of individuals is also relatively new and enables new applications like work, clubs and communities that can be self-managed.

For service design, the relationship between the user and service provider can be strengthened and customized, which helps in building brand satisfaction and loyalty. The full history of interactions is stored for future use and analysis and supports modelling future use and optimization of services.

Resources

Metaverse is designed by the platform provider, who can add virtual resources into the worlds. With this metaverse is a profit generating place where physical currency is invested in virtual world, and returns are drawn back after use. This opens opportunities for design of novel business models and revenue logics. Users are encouraged to enhance their avatars with in-game purchases (Shen et al., 2021). The ownership of the assets currently follows traditional earning logic, but new peer to peer models is emerging, and change the dynamics in metaverse. In terms of ownership of virtual assets, one should act as a lawful object to make transactions in metaverse. This notion is only accepted in the USA, so overall metaverse related exchange of assets is currently done in physical world.

User engagement for the design of virtual and interfacing devices can be taken in real use context. Users have an immersive experience of the use of the assets and can give feedback through multiple channels. User experience today is limited to the physical artefacts, and development of this service component will enhance experience significantly.

Process

A typical way to present user engagement process in service design is through visual maps like a journey map. User engagement begins during service exploration phase, which in metaverse environment is typically prior to entering metaverse. Thus also these physical, ancillary interactions leading to metaverse interaction needs to be professionally designed. The aspect of raising awareness and managing expectations is crucial with new audiences. The experience should be a seamless continuation of the experience in a virtual world for consistency.

In service design the end-to-end experience can be modeled virtually. The early encounters though an app or a website can be tested virtually and designed to carry the aspect of captivity. The typical process of lab testing prior to real life testing can be combined and thus reduce testing cost and time significantly. Dissemination of knowledge is synchronous, and the amount of data collected can be modeled in real time.

The most significant change to the design process is the role and power of the user. Reflecting service ecosystem literature, also the dynamics among the parties and platform provider change. The calls for more self-organizing and bottom-up governance models where the power and influence need to be reconfigured

Service

Sarker has addressed the questions of user assessment of services in metaverse in areas of focused attention, perceived usability, novelty, aesthetics, felt involvement, user-content and user-user interactivity (Sarker et al., 2019). In metaverse these aspects are easily measured through time spent on tasks, number

and immersion of interactions, return to worlds and user volunteered inputs. The beforementioned aspect of value remains the key design criteria and dictates the other elements of design. Opportunities for value creation are extended, and the measurement between delivered, intended and perceived value is measurable.

In design of services, the hierarchy of the design is flattened. Unnecessary data and noise can easily be filtered and focus on value adding elements. Opportunities to engage niche providers for extended experiences is simplified, and qualitative data can be used seamlessly with quantitative data. The dynamics of the service experience are changes since users are not bound to cultural or customary habits. Metaverse creates its own culture and interactions that can or would not follow those of our society today.

The following table summarizes the changes to the design process.

Table 1 Service Design Framework

Service Element	**Traditional Design**	**Metaverse Design**	**Design Change**
Context	Interfaced through apps or portals No control over use context	Immersive presence in metaverse Provider designs use context	Focus on contextual experience design Consistent service experience
Perception	Visual and audible interaction Identified through digital ID	Perceived through avatars Identified as a chosen form of self	Early involvement in design process Rich data collection
Relationship	Two-way relationship Pre-defined alternatives	Multi-way relationship Jointly constructed	Add the dimension of shared service to design
Resources	Physical resources Currency exchanged	Virtual assets and tokens Virtual exchange	Niche providers Changing nature of currency
Process	Stage gate models Data exploitation challenges	Data driven steering Real time adjustments	Speed and cost of process reduced Use of data
Service	Created in interaction Situational aspects dominant	User defined interactions Textual exchange	AI based learning and prediction of actions

3. Methodology

The enquiry started with an extensive review of current publications on metaverse in google scholar. The papers were filtered by the year of publication, starting from 2021, which marked a huge leap in the publications on metaverse. Also, the later publications were considered more relevant due to the fast

evolution of the concept in the recent years. The over 160 papers that were discovered, were further filtered with key word user engagement, in order to focus on service related aspects in metaverse.

The selected 68 papers review revealed huge interest in user related aspects of immersion, security and privacy, and increasingly on the adverse impacts of metaverse. The review revealed the evident gap in service design focused papers. The other related stream of literature considered metaverse conceptually as an extension of platform economy. In this instance the authors looked back to their extensive past research on platform economy in 2022 (Jeffery, 2022), and build the framework on service design elements based on past literature on service design on digital platforms.

The presented service dimensions were reflected on the metaverse literature findings on the design changes prominent in metaverse and validated in a case study on metaverse based service design in the selected case study. The value of the validation was to ensure that the framework dimensions were relevant and extensive enough to support identification of process changes in current service design methodologies.

The authors selected case study methodology (Yin, 2014) for the validation of the framework due to the paper's applied approach and qualitative nature. The authors worked in the case project as researchers and the findings are based on participatory observations. The project took place in 2022-2023 as a part of a smart city digital transformation project in the Middle East. The project was lead by the digital development agency of Dubai, which is responsible for the implementation of local research and innovation strategy in the nation.

The case study featured a development of a smart government system for establishing citizen digital identity. The digital identity can be used to access several government e-services and replace the need for in-person interactions in issuance of government identity cards. The ultimate objective is to have a fully paperless government, where all government services ranging from healthcare and traffic to housing and taxes can be accessed in a same secure platform. This blockchain based platform is secure and cost efficient, and offers better user experience.

In an effort to build a state-of-the-art system from the start, and to enable easy access even for disadvantaged and marginal groups, the service delivery was planned for a metaverse environment. This also supports the national knowledge economy agenda of full digitalization, user participation and inclusion, which was highlighted by nominating year 2023 as the year of metaverse in the UAE. Since this is a massive undertaking, the case study focuses on the user facing part of the project, namely the design of the user interface and avatars.

The objective of the project was to design an arena where users interact with virtual agents for handling government services. The project involved the design options for users to develop their avatars, design of the visual 3D customer service agents for realistic service interaction, and the visual environment where the interactions take place. The project engaged relevant government representatives, software design companies and test users for early input and feedback. All user facing interactions took place in metaverse environments in order to simulate the real service environment.

In addition to the design of the service, also the service design process was mapped and analyzed for learning purposes. This was done through user observations, system collected data and interviews. 30 interviews were conducted with the users, who volunteered local university students. User engagement took place in September-December 2022 in a controlled environment in the development laboratory, using virtual reality headsets and handheld controllers provided by the service provider. The data was collected in a

Suffescom platform and analyzed with word recognition analysis with selected key words. Collected data was categorized for further analysis using key words 'Useful', 'Usable', 'Findable', 'Credible', 'Desirable, 'Accessible' and 'Valuable'. The terminology and preferred use was explained to user prior to the experience.

In the next stage, the accumulated data was compared and complemented with the interview data for further verification of findings. Interviews took place during and after the immersive experience. Each interview took 20 minutes, and addressed question on the users' experience in using the service interms of ease of use, credibility of 3D agents, , improvement to comparable online portal services, preferences for access and design elements, as well as any possible negative aspects. Findings were reported primarily for the software development purposes, but also used for recording the learnings for the process design purposes. The findings are listed to on the before mentioned framework categories in the following chapter.

4. Case study Findings

The user responses were compared to the authors' proposition on the service elements of use context, perception, relationship, resources, process and service. Furthermore, the data collection process and quality of data were reflected to a typical design thinking based user engagement process.

Table 2 Key Results

Service Element	User Feedback	Design Change
Context	Simulation of in-person exchange is preferred to online textual service 3D service environment is exciting and curiously explored Visual elements and audio increase ease of access, intuitive browsing and experience	Focus on contextual experience design Broader design options, need for multi-layered technology tools
Perception	Avatar supported immersion and focus on situation Movement and facial features added to the experience Support was considered easier to receive than in text based services	Increased importance od user role in service Increased focus on avatar design as a leading source of experience Additional service dimensions though audio, gestures and moods design
Relationship	Voice interaction preferred to chatbots Visual outlook for the service personnel a part of the experience Personable feel and options to voice various concerns	Relational aspect for follow up and future expectation of service Increased focus on visual design and customization

Resources	Interface was seamless to use Voice and facial recognition used instead of ID number or QR codes	Collaborative design with multiple providers Need for trust, shared development tools and transparency
Process	Real time feedback and combination of textual, audible and observed data Low threshold access and training needs Reduced time and need of testing personnel	Speed and cost of process reduced Use of data efficient and optimized
Service	Simulation of physical experience Options to augmented services Learning and modeling future behavior	Augmentation of services though technology Modeling user behavior and behavioral change

5. Discussion

The paper is making a first attempt to conceptualize the differences between the digital service design and delivery in real world and virtual world environments. The differences are highlighted in a satisfactory manner, but the imposed changes are manifold and depend on the use domain and maturity of the metaverse application. In order to reach more profound contribution, the authors will next focus on selected parts of the service process.

The proposed literature-based categorization focuses on the key aspects of service design and anticipated context independent design process changes. The key changes can be summarized as the control over context, data accumulation, deeper user needs discovery, user-to-user relationships and faster time to market.

The experience is individually perceived, but metaverse establishes a more controlled environment where the experience can be modelled and anticipated. This enhances service quality, consistency and conformity. Other key benefits include multi-channel data collection and machine learning for predictability and enhancement of user behavior. This again offers more customized experience modeled to users' preferences. Relationship building and user defined identity further improve service satisfaction. Metaverse further reduces design time and adaptability.

The authors see immense potential in exploring metaverse opportunities as a three-dimensional platform or an arena for shared experience design. Future research avenues include service structuring and collaborative models, which is a less studied area in business-to-business context. Also, the aspects of broader human and societal impacts of virtual world experiences need further study and experimentation.

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