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Reflection note:

From Digitalization to Cybernization

Delivering value with cybernized services

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Abstract. This reflection note, based on the lead author's keynote presentation at the Information Systems Research Seminar in Scandinavia/Scandinavian Conference on Information Systems 2019, makes an argument for the need to study the transformation from digital services to cybernized services offered by service providers to their customers. We first discuss the digitalization of services. Then, we argue that the emergence of cyber-physical systems enables a new kind of services that apply; e.g.; the internet of things, analytics of sensor-based big data, and artificial intelligence for value creation. In other words, the cybernization of services. We illustrate two particular approaches for understanding value creation for such cybernized services, specifically, value co-creation and co-destruction that are derived from the service research literature. We discuss the implications for information systems research, and argue that value co-creation and co-destruction should be studied together. Lastly, we depict the provision of healthcare services as a potential avenue for cybernization, and promote the use of the design science research for future studies.

Keywords: cybernization, cybernized services, cyber physical systems, digitalization, digital services, value co-creation, value co-destruction, design science research, interdisciplinary research.

1 Moving from digital to cybernized services

Services form a significant part of organizations' creation of value. Compared to manufactured goods, the production processes of services are distinct in terms of being intangible, experiential, and co-produced (Chandler and Lusch 2015; Ding et al. 2019; Yu and Sangiorgi 2018). That is, a service is a process-driven activity that requires various actors and systems to work conjointly to be effective and efficient in its creation, delivery, and ultimately, in its experience (Kelleher et al. 2019; Lingren et al. 2019). Traditionally, services offered by organizations were predominantly driven by human activities and elements, and are still important for basic services, such as banking, hospitality, healthcare, or education; i.e.; as service phase one. In the same vein, much of the service and value creation literature emphasized human aspects, such as interpersonal (Dagger et al. 2013), task-based (Coelho and Augusto 2010), and empathetic skills (Bove 2019), in a bid to explain the logic behind human-based service creations.

Since advanced technologies have been increasingly adopted in the last few years, the human element is gradually being complemented, or entirely replaced, by digital systems. We term this phase of service evolution *digital services*; i.e.; service phase two. To illustrate, automated kiosks, teller machines, check-in stations, appointment systems, and telecare in home care (cf. Karlsen et al. 2019) are examples of common practices. Today, however, technology is advancing rapidly, and providing new value propositions for ever-demanding consumers (e.g., fulfilling service needs in real time in the physical world). Based on these advancements, organizations are encountering a new phase of service evolution, which we term *cybernized* services; i.e.; service phase three.

Baheti and Gill (2011) defined cyber-physical systems (CPSs) as "systems, which integrate the computational and physical capabilities and expand the capabilities of physical world entities through computation, communication and control." We argue that the *cybernization* of services, which is the application of cyber-physical systems to develop, design, and provide context-aware and interactive services, is a highly important frontier for research and practice that requires new knowledge and understanding of how organizations create future value (Peters et al. 2016), and how advanced technologies can be employed to create such value. Examples of services enabled by cyber-physical systems; i.e.; *cybernized services*; are (semi)autonomous vehicles, augmented reality applications, and facial tracking systems for service authentication (Baheti and Gill 2011; Poovendran 2010).

To illustrate a commercial use case, the recently launched Amazon Go grocery store embodies the concept of a *cybernized service*. Customers in Amazon Go stores (cf. Figure 1) are tracked with sensors and video cameras. With the help of artificial intelligence (AI), the collected data is utilized to bill a customer's Amazon account for the collected

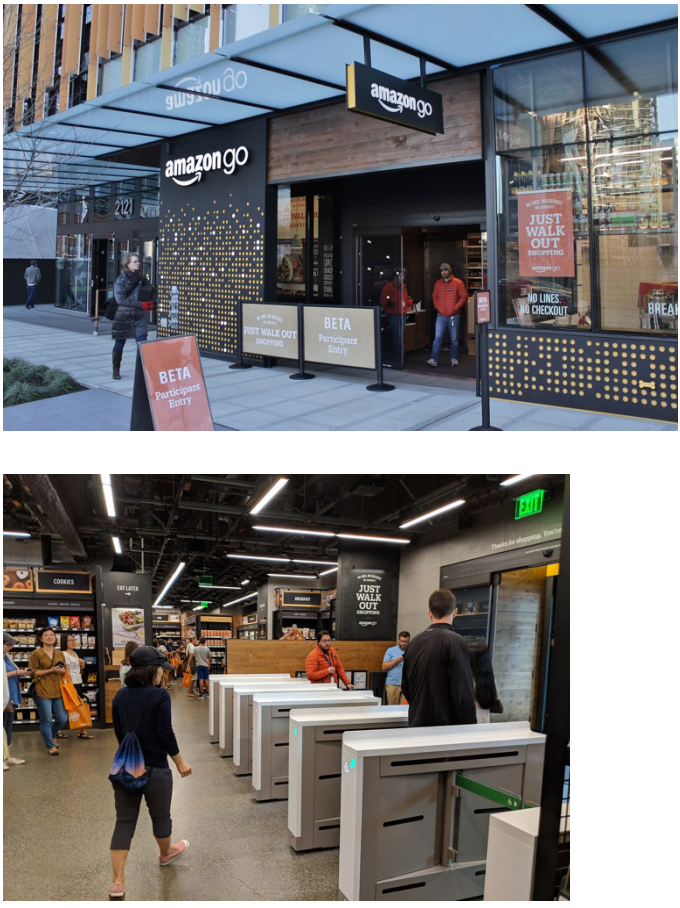

Figure 1. Amazon Go Store by Bruce Englehardt (top) and Sikander Iqbal (bottom), licensed under the Creative Commons Attribution-Share Alike 4.0 International license. https://en.wikipedia.org/wiki/Amazon_Go

items as the customer leaves the store, illustrating AI's seamless integration into organizational work routines and processes (Zijm and Klumpp 2017). In general, AI uses machine learning capabilities and natural language processing abilities to learn and implement computational intelligence that resembles human problem-solving abilities (Chen et al. 2012). Consequently, we contend that the increasing prevalence of AI in combination of a cyber-physical system heralds undeniably an era of *cybernized services* that are distinct from 1) human- and 2) digital-based services.

2 Problem of value creation for cybernized services: A service research perspective

What we currently lack is a way to study and conceptualize service experiences from the cybernized service user's viewpoint. The traditional service research literature offers some solutions to this problem. Namely, the concept of value co-creation that is one of the fundamental principles of the modern approach to understanding service experiences according to service-dominant logic (Vargo and Lusch 2004). Value co-creation occurs when there is an interaction between service provider and service user. This process connects the service experience of the consumer and the intangibility of services; that is, the service happens at a certain time, in a designated place, and cannot be stored *in situ* (see; e.g.; Grönroos and Voima 2003). More specifically, Tuunanen et al. (2010) argued that value co-creation for users is an interplay of system value propositions and customer value drivers. These are summarized in Figure 2.

A service system, such as the Amazon Go Store, provides users with valuable experiences that directly instigate users' goals, and thus, drive customer behavior. Tuunanen et al. (2010) claimed that users can potentially have an identity (see; e.g.; Creed et al. 2002) attached to digital artifacts they use. Lamb and Kling (2003) further argued that actors use artifacts to form and construct identities for themselves, and that the use of such systems is a social act. Finally, Tuunanen et al. (2010) emphasized the importance of the context of system use (see; e.g.; Orlikowski et al. 1995) for value co-creation.

Tuunanen et al. (2010) also suggested that there are three key value drivers for users. First, Tuunanen et al. (2010) referred to the 'service process experience,'; i.e.; how users experience the service *in situ*. Holbrook et al. (1984) proposed the notion of 'playful consumption,' in which play becomes an integral part of the service experience. For

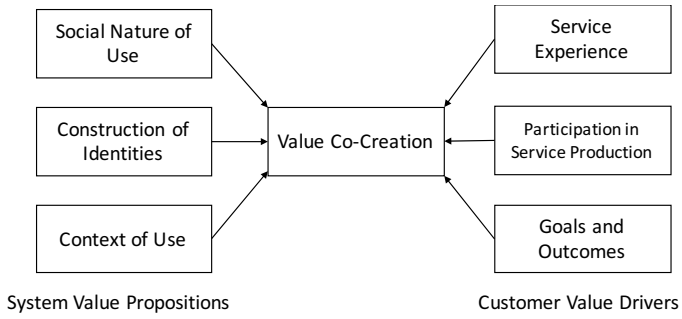

Figure 2. Value co-creation for services. Adapted from Tuunanen et al. (2010)

instance, Holbrook et al. (1984) observed how emotions, performance, and personality impact value creation in games. Second, according to service dominant logic, value is co-created, and thus, the total value of the offering is then largely determined by users while the service is in use (Prahalad and Ramaswamy 2004; Vargo and Lusch 2004). IS researchers, especially in Scandinavia, are strong advocates of user participation in systems development (Davis 1982; Bjerknes 1992). Third, in IS research, there has been a tradition of using the perceived benefits of IS as a metric that indicates success (Venkatesh et al. 2003), and more recently, the hedonic side of value has been explored as well (Valkonen et al. 2015; Van der Heijden 2004; Venkatesh et al. 2012). Kahneman et al. (2003) also suggested that users derive not only utility from consumption but also hedonic benefits and goals.

However, while extant literature often refers to value co-creation in an intrinsically positive manner, and engagement in interactive value creation processes has also mainly been explained in an unproblematic way (Prahalad and Ramaswamy 2004; Vargo and Lusch 2004), users' service encounters do not always have positive outcomes (Lintula et al. 2017; Vartiainen and Tuunanen 2016). This duality of value creation and destruction has also been recognized in the literature, which states that in interactive value creation, value destruction exists as an opposing phenomenon to value co-creation (Echeverri and Skålén 2011; Plé and Chumpitaz 2009). Plé and Chumpitaz (2009) defined value co-destruction as "an interactional process between service systems that results in a decline in the well-being of at least one of the service systems, which, given the nature of a service system, can be individual or organizational." According to Plé and Chumpitaz (2009), such co-destruction of value behavior can be intentional or unintentional, depending on the motivations and actions of the service systems; i.e.; the humans and/or the systems.

Lintula et al. (2018) studied value co-destruction in Pokémon GO game play. Pokémon GO incorporates geographic space data into a augmented reality (AR) environment complemented by social playing (Clark and Clark 2016; Tateno et al. 2016) where the players try to catch AR characters (Pokémons) that appear in their physical surroundings (Lintula et al. 2018). After interviewing Pokémon GO players in Finland, the authors found seven different key reasons value co-destruction appears with Pokémon GO game play: value contradiction, 2) unmet expectations, 3) technical challenges, 4) personal/social norm conflicts, 5) effect of constant mobile use, 6) absence or loss of resources, and 7) insufficient perceived value in use. Although some of the reasons are directly linked to Pokémon GO game play (such as the effect of constant mobile use), most are likely generalizable to other digital and cyberized service use, such

as contradictions in value (Vartiainen and Tuunanen 2016), absence or loss of resources (Lintula et al. 2017), insufficient perceived value in use, or unmet expectations.

3 Implications for IS research

We see that the implications of cybernization and the transition from digital services to cybernized services are multifold and offer a wide array of new research opportunities for IS scholars. First, we argue that there is a need to understand users and their value creation process with cybernized services to better inform service providers about the complexities of value co-creation and co-destruction *in situ*. Consequently, we posit that the context of cybernized services appears to reflect an expansion of social interaction opportunities for service users and providers; e.g.; in terms of interaction points and formats, fast-paced monitoring and reaction to the services in real time and construction of identities based on virtual and physical elements. Thus, users of cybernized services can become even more active co-creators and co-destroyers of value versus users of other kinds of services, digital and non-digital. For this reason, we should study what actions are needed in service design or provision to enable co-creation of value, but also to mitigate the pitfalls of co-destruction of value. Accordingly, we should further study users' co-destructive behavior and service process elements or components that influence the perceived drawbacks of value co-destruction with cybernized service users.

We foresee that this research will lead to further theorizing about the value creation process of cybernized service users and most importantly, looking at value co-creation

Figure 3. The complementary, interconnected, interdependent yin and yang nature of value co-creation and co-destruction of cybernized service use (https://en.wikipedia.org/wiki/Yin_and_yang)

and co-destruction as a dynamic and interactive behavior by service users and the service (provider). The analog that we have often used is the one of yin and yang (Figure 3)—how seemingly opposite or contrary forces may actually be complementary, interconnected, and interdependent, and how they may give rise to each other as they interrelate to one another. Accordingly, we argue that these two concepts (value co-creation and value co-destruction) should be studied together to understand the value creation process for any service (Li and Tuunanen 2020), but especially for cybernized services where the technological complexity of the offered services combined with reduced human involvement from the provider side, may cause increased opportunities for value co-destruction but also value co-creation.

We encourage researchers to focus on exploring how value co-creation and co-destruction differ between traditional, digitalized and cybernized services. As cybernized services often relate to a mixture of the so-called virtual and physical, researchers could focus on understanding how the specific characteristics of this mixture (e.g., virtual and physical elements) influence the service processes from the users' point of view, the providers' point of view, and the combination of these points of view. For instance, users of cybernized services can potentially employ new ways to interact with the service provider, which can ultimately shape the outcome of the service process. As a related example, contemporary technologies can offer several opportunities for providers to engage in service recovery in real time, when technologies are able to monitor service use accurately and intervene immediately when problems emerge.

As an example of cybernized services, the provision of healthcare services is a promising area of research. Cybernized health services can enable healthcare professionals to provide services to patients without them being physically present, involving patient care interactions that are geographically disparate and enabled by telecommunications, information technology, and sensor technology. Remote consultation, monitoring, education, triage, therapeutics, and AI-based diagnostics are all features of such health services. Remote monitoring has applications in health and wellness monitoring, especially of home rehabilitation, patients with long-term conditions, safety monitoring of elderly people or workers in hazardous environments, assessment of treatment efficacy, and early detection of disorders; see, for example, Cancela et al. (2014). Technological advances, such as internet of things devices, have also made remote monitoring simple, more reliable, and cheap enough to implement on a large scale. Sensors have also become small enough and low enough in energy consumption to be worn for long periods of time. Fourth-generation mobile networks, cloud computing, and smart phones are spreading, enabling the logging and transmission of data, as well as some on-site processing without investment in new hardware. Data-processing techniques

based on artificial intelligence, such as pattern recognition and data mining, have developed enabling new applications (Patel et al. 2012). Furthermore, today's technology is not limited to measurement of physical movement but includes emotional well-being (Whitson 2013).

The value of such cybernized health services, and more importantly, the improvement in one's health, can be assessed clinically (such as laboratory measures, X-ray images, and other examinations) and subjectively by the patient herself through perceived physical, mental, and social well-being. It is known that these two assessments can be contradictory; see; e.g.; Ahlmén et al. (2005) and Chassany et al. (2006). Therefore, it is not enough to measure one or the other. For example, after hip replacement surgery, an X-ray image is not sufficient to determine the success of the operation. Furthermore, there needs to be more research into the clinical relevance of sensor data, especially in contexts other than direct vital measurements, such as laboratory measures. For instance, there is no framework for choosing sensors and translating sensor data into clinically relevant information in the case of rehabilitation and physical activity.

As such, cybernized health services present a golden opportunity for conducting design science research (DSR; Hevner et al. 2004; Kuechler and Vaishnavi 2008; March and Smith 1995; Walls et al. 1992; Winter 2008). In this regard, we have a number of well-applied DSR methods, like design science research methodology (Peffers et al. 2007) and action design research (Sein et al. 2011), which IS scholars can use for their work. Similarly, we have made great strides in developing rigorous, but also practical ways of evaluating DSR outputs (Peffers et al. 2012; Venable et al. 2012, 2016) and . In addition, we have started to recognize that DSR consists of different subgenres for applying the methods, but also for theorizing the results (Peffers et al. 2018). As such, the aforementioned DSR developments provide theoretical foundations and tool sets for designing cybernized services, while expanding our understanding of how value is dynamically co-created. This work may inspire scholars to develop design principles for cybernized service that may be further generalized to mid-level design theories and beyond (Gregor and Hevner 2013). However, we also see a need for interdisciplinary approaches to DSR to involve other research communities, such as engineering, computer, and social science, to study cybernization and cybernized services. This may open up possibilities to work with scholars who design software and hardware for physical spaces, but also understanding service from an experiential viewpoint. The possibilities are nearly endless.

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Notes

1. http://inforte.jyu.fi

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