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CUSTOMER EXPERIENCE CHALLENGES: BRINGING TOGETHER DIGITAL, PHYSICAL AND SOCIAL REALMS

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Structured Abstract

Purpose: This article explores innovations in customer experience at the intersection of the digital, physical, and social realms. It explicitly considers experiences involving new technology-enabled services, such as digital twins and automated social presence (i.e., virtual assistants, service robots).

Design: Future customer experiences are conceptualized within a three dimensional space −low to high, low to high physical complexity, and low to high social presence − yielding eight octants.

Findings: Our conceptual framework identifies eight "dualities", or specific challenges connected with integrating digital, physical and social realms that challenge organizations to create superior customer experiences in both business-to-business and business-to-consumer markets. The eight dualities are opposing strategic options that organizations must reconcile when co-creating customer experiences under different conditions.

Research Implications: A review of theory demonstrates that little research has been conducted at the intersection of the digital, physical and social realms. Most studies focus on one realm, with occasional reference to another. This article suggests an agenda for future research and gives examples of fruitful ways to study connections among the three realms rather than in a single realm.

Practical Implications: This paper provides guidance for managers in designing and managing customer experiences that we believe will need to be addressed by the year 2050.

Social Implications: This paper discusses important societal issues, such as individual and societal needs for privacy, security, and transparency. It sets out potential avenues for service innovation in these areas.

Originality/Value: The conceptual framework integrates knowledge about customer experiences in digital, physical, and social realms in a new way, with insights for future service research, managers, and public policy makers.

Key words: Customer experience, service design, service ecosystem, technological innovation, service innovation, value creation

Paper Type: Research Paper.

CUSTOMER EXPERIENCE CHALLENGES:

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Customers seek to engage with service brands and interact with service organizations that enable superior experiences (Lemon and Verhoef, 2016). Organizations respond to customers and shape markets by designing and delivering unique experiences that provide them with a competitive advantage and lead to favorable business outcomes (e.g., customer retention and profitability) (Bolton et al., 2014; Verhoef et al., 2009). Technological developments are changing the capabilities of service organizations and systems (Breidbach et al., 2018) and transforming the customer experience (Lemon, 2016; Van Doorn et al., 2017). In the future, a customer might simultaneously interact with a service robot, sensors built into the servicescape, a mobile application, and a human being, who might be an employee or a friend! Moreover, changes in society will accelerate developments in the digital, physical, and social realms. In 2050, people worldwide aged 65 or older will outnumber children aged five and under; they will become parents much later in life; and most people will live in a large city and not own a car (Cohen, 2014). These population trends will also change the nature of services because each customer is an active participant who co-creates value by drawing upon a unique assortment of capabilities and resources available in these realms.

These three trends −developments in the digital, physical, and social realms, changes in actors' capabilities and resources, and societal changes− will stimulate an increase in the need for customized customer experiences. Ultimately, organizations are likely to become more efficient and effective in serving customers so that consumer and societal well-being will improve. However, to truly understand and co-create value within a customer experience, firms

require a comprehensive view of the customer experience over time that integrates the digital, physical and social realms. Without this integration, organizations face many customer experience challenges in both business-to-consumer (B2C) and business-to-business (B2B) markets. Predictions abound about the death of brick and mortar stores, how customers will spend more time in virtual reality, and the ways that robots and artificial intelligence (AI) will replace service employees (Huang and Rust, 2018). For instance, robots are already showing promise in assembling IKEA furniture without human assistance (Burdick, 2018). New developments in each of these realms are already causing marketplace disruptions. For example, as we were writing this article, Amazon, Berkshire Hathaway and JP Morgan announced that they will partner to transform healthcare in the United States (USA) marketplace (Tracer and Son, 2018).

The challenges and opportunities facing service organizations are significant and substantial because *customer experiences arise at the intersection of the digital, physical, and social realms* for each customer. This paper reviews what we know, and don't yet know, about customer experience, with a focus on connections among the digital, physical, and social realms. We view the customer experience as encompassing customers' cognitive, emotional, social, sensory and value responses to the organization's offerings over time, including pre- and post-consumption (Kranzbühler et al., 2017; Lemon and Verhoef, 2016; Voorhees et al., 2017). We bring together recent research concerning value co-creation and interactive services, digital and social media (augmented and virtual reality), multi-channel marketing (e.g., store beacons), service operations (e.g., leveraging AI in business processes), and technology (e.g., the Internet of Things). In doing so, our paper addresses managerial questions such as:

- How do digital, physical and social elements interact to form the customer experience?

- How might organizations integrate digital, physical and social realms to create consistently superior customer experiences in the future?
- How do customer experiences at the intersection of digital, physical and social realms influence outcomes for individuals, service providers and society?
- What are the opportunities, challenges and emerging issues in the digital, physical and social realms for organizations managing the customer experience?

Our paper offers a conceptual framework for analyzing the formation of customer experiences that incorporates the digital, physical, and social realms and explicitly considers new technology-enabled services. Customer experiences are conceptualized within a three dimensional space − low to high *digital density*, low to high *physical complexity* and low to high *social presence* − yielding eight octants. This framework leads to a discussion of specific opportunities and challenges connected with transitioning from low to high digital density and from low to high social presence environments for both B2B and B2C services. It also reveals eight "dualities" – opposing strategic options – that organizations face in co-creating customer experiences in each of the eight octants of the framework. We review relevant conceptual work about the antecedents and consequences of customer experiences that can guide managers in designing and managing customer experiences. Moreover, we identify possible future conditions that can significantly impact customer experiences identifying heretofore unanswered questions about customer experiences at the intersection of the digital, physical, and social realms, thereby outlining a research agenda.

THE CUSTOMER EXPERIENCE

The customer experience originates from a series of interactions between a customer and a service provider (Gentile, Spiller, and Noci, 2007). Researchers agree that a customer's

perception of his/her experience is holistic in nature and involves multiple internal and subjective responses to interactions with an organization (Meyer and Schwager, 2007; Schmitt, Brakus, and Zarantonello, 2015). The customer experience can thus be conceptualized as holistic, comprised of multiple interactions across touchpoints involving the customer's cognitive, affective, emotional, social and sensory elements (Lemon and Verhoef, 2016; Verhoef et al., 2009). Voorhees et al. (2017) emphasize that the customer experience takes place throughout many interactions relevant to a core service offering, including multiple "moments of truth" that influence customer outcomes. Edvardsson, Enquist and Johnston (2010) not only highlight the importance of social interaction between customers and between customers and employees, they note the role of technology, as well as the physical elements of the servicescape.

The customer experience can also be viewed from an organizational perspective (Kranzbühler et al., 2017), where the focus is on designing and delivering an experience for the customer (Bolton, 2016). Grewal et al. (2009) argue that customer experience management is a business strategy that creates a win–win solution for the service provider and its customers. Homburg et al. (2017) further emphasize the firm-wide managerial implications of customer experience management through changes in cultural mindsets, strategic directions, and the development of firm capabilities. A firm adopting customer experience management attempts to provide the prerequisites in forms of the digital, physical and social realms that occur at different "moments of truth" in time and space (Zomerdijk and Voss, 2010).

While this prior work makes a valuable contribution to our understanding of the customer experience, in the main, it has tended to focus on one or two realms. For example, literature has focused on physical elements, such as present in a physical servicescape (e.g., Bitner, 1992; Mehrabian and Russell, 1974), or social interactions (e.g., McColl-Kennedy et al., 2017c;

Rosenbaum and Massiah, 2007; Rosenbaum et al., 2007), or digital elements (e.g., Huang and Rust, 2018; Ordenes et al., 2014; Zaki and Neely, 2018 (Forthcoming)). Our customer experience framework *integrates* these three realms - digital, physical and social - and what it may mean for managing customer experiences in the future.

Figure 1 here

Customer Experience Conceptual Framework

One way to imagine the future of service, from both a customer and organizational perspective, is to consider customer experience scenarios as depicted in Figure 1. This figure depicts the customer experience in a three-dimensional space. The dimensions are characterized by low to high digital density, low to high physical complexity and low to high social presence. This section sets the stage by characterizing each dimension and the next section expands upon this framework by providing examples and then identifying critical issues that arise in each octant of the cube. As these sections will demonstrate, the digital, physical, and social worlds will converge much sooner than we think.

Digital Realm

The Internet is a platform that supports many important marketplaces for goods and services, including information services. Hence, an organization's ability to leverage digital technologies is an increasingly important source of competitive advantage because businesses must respond to market dynamics effectively and in a timely manner (Kumar and Reinartz, 2016; Leeflang et al., 2014). Organizations are adoping innovative digital technologies, such as mobile, location-based, virtual reality, digital twins, blockchains, AI, wearable technologies, neuroscience, and business process automation, as well as machine-to-machine interactions through the Internet of Things

(IoT). Digital technologies can provide a highly personalized and immersive environment that allows for interactivity and rich information exchange between the organization and consumer (Parise, Guinan, and Kafka, 2016). Digital technologies are changing customers' expectations and behavior, how organizations and networks are organized, and the role of "humans" in the marketplace– where the lines between human and machine are becoming blurred (Lemon, 2016).

Organizations are facing a 'crisis of immediacy' as they attempt to meet customers' needs for content, expertise, and personalized solutions in real time (Parise et al., 2016). Today's digital technologies enable virtual experts, that is, agents who interact with consumers to answer questions, provide recommendations, and deliver advice in any place, time, or format (Breidbach et al., 2018). Virtual experts range from human experts connected to the consumer through video conferencing to digital agents that interact with the user through mobile apps or augmented reality technology. Business managers and researchers are rethinking theory and practice to accomodate the digital era's increasing complexity, high information availability, high reach, frequent interactions, and faster speeds of transactions (Wedel and Kannan, 2016). Given these characteristics, we view the digital realm as ranging from low to high information density.

Physical Realm

The physical realm includes the arrangement of furnishings and equipment that influence their functionality, spatial arrangements that enhance convenience and a sense of comfort, ambient elements and cultural resources, that is, signs and symbols that invite customers to engage in the service encounter (Bitner, 1992). Cues from the physical realm directly influence how customers act and respond during service encounters (Ballantyne and Nilsson, 2017). For example, customers can use cultural resources as cues that set the rules and expectations of how to act and interact within the service environment. A sense of place can be facilitated by using cultural

artifacts, signs, and symbols to create a sense of belonging to a collective, brand community or sub-culture, enriching shared customer experiences.

Many elements of the physical realm are subtle yet pervasive in their effects on the customer experience. For example, the physical realm of a servicescape influences the nature and quality of interactions between customers and employees of the organization (Bitner, 1992), as well as customer-to-customer (C2C) interactions (Tombs and McColl-Kennedy, 2003). Successful organizations combine elements of the physical realm to offer an integrative narrative to their customers, thereby inviting customers to be immersed in their own phenomenological experience (Petermans, Janssens, and Van Cleempoel, 2013). In service and retail contexts, the physical servicescape offers customers an immersive experience that can deliver enduring emotional moments and memories (Giraldi, Mengoni, and Bevilacqua, 2016).

As organizations move to digital platforms, the constituents of the physical realm remain central to understanding the customer experience – indeed, they may act as a reference point. Ballantyne and Nilsson (2017) note that functionality, use of space, and cultural messaging remain important aspects of the online customer experience. They add that "... the technological development of the Internet and the emergence of new social media are shifting the *market place* for business further towards *virtual market space*" (p. 227), merging the physical and digital via technology. For example, retailers are already using augmented reality, such as smart mirrors for customers to try on clothes, and businesses are using virtual reality to manage workplaces. Hence, we characterize the physical environment as ranging from low to high physical complexity, where technology is an increasingly important component.

Social Realm

Interactions are at the heart of the social realm of the customer experience. Early work considered the social realm as a stage where customers and employees performed experiences (Pine and Gilmore, 1998; Solomon et al., 1985; Surprenant and Solomon, 1987). However, researchers now agree that the social realm is defined by the interactions among actors (e.g., customers, employees, partners) through different interfaces which are increasingly non-human (De Keyser et al., 2015; Lemon and Verhoef, 2016; McColl-Kennedy et al., 2015b). Organizations must take account of customers' social environments and their expectations about organization-based resources, such as settings, products, and atmospherics, in order to design service experiences for customers (Verhoef et al., 2009).

Since customers actively co-create experiences, organizations must facilitate customers' interactions with other actors. Customers can influence other customers through smartphones, social networks, and other means (McColl-Kennedy, Cheung, and Ferrier, 2015a; Tombs and McColl-Kennedy, 2013). C2C interactions, such as reviews or shared evaluations of a service, can influence customers' "approach or avoid decisions" thereby influencing organizational outcomes (e.g., customer acquisition) and customer outcomes, such as their attachment to a service place or environment (Rosenbaum and Massiah, 2011). The social realm helps customers fulfill utilitarian, social and psychological customer needs. Moreover, in a virtual context, interactive media devices connect customers both inside and outside the boundaries of the physical setting (Benoit et al., 2017; Sands, Harper, and Ferraro, 2011), giving customers a collective sense of "social presence."

A sense of social presence arises between humans, as well as between human and non-human entities such as service robots (Van Doorn et al., 2017). It can be experienced in both physical and virtual contexts – and it increasingly characterizes service and retail settings.

Research has shown that social density may affect the customer experience (Tombs and McColl-Kennedy, 2003). For example, in high social density contexts, interactions are frequent among several actors, such as in a crowded café or an active social media chat room. The effect can be negative (e.g., crowding) or positive (e.g., convivial) to the customer experience. Conversely, in low social density contexts, infrequent interactions between actors may be negative (e.g., lonely or isolating) or positive (e.g., calming or serene). For these reasons, we believe that the density of social presence can be quantified from low to high and that both traditional and technology-mediated service encounters can be characterized in this way.

CUSTOMER EXPERIENCE OPPORTUNITIES, EMERGING ISSUES AND CHALLENGES

The world is undergoing a fourth revolution – a technological revolution − that is unprecedented in its scale, speed and complexity (Department for Business Energy and Industrial Strategy, 2017). Customers can enjoy entertainment, shop, learn, socialize, and work within digital environments that also have an overarching social dimension (Ballantyne and Nilsson, 2017). Cognitive systems (artificial intelligence, or AI) will transform the way we live and work in diverse ways, ranging from the diagnosis and treatment of cancer to the security of online transactions (Wirtz et al., 2018). In the information age, people and organizations are able to make better decisions on the design and management of the customer experience (Patrício et al., 2018). For example, knowing the weather forecast, what time a train will depart or when a broadband outage might occur helps minimize friction (e.g. wasted time and effort), allows individuals and organizations to work effectively and also enhances the customer experience (National Infrastructure Commission, 2017). Since there are many possibilitites, this section focuses on exemplar future services that are likely to emerge by the year 2050 in three service

sectors: (1) asset-heavy B2B services; (2) healthcare; and (3) B2C retail and professional services. We will use each sector to provide a foundation for identifying opportunities and emerging issues. Then, we summarize some of the challenges of creating customer experiences at the intersection of the digital, physical, and social realms.

Figure 2 here

Opportunities and Emerging Issues in Asset-Heavy B2B Services: from traditional support service to digital twin service

Opportunities**.** Opportunities for using digital technologies to improve productivity and efficiency in managing demand and capacity are prevalent in many B2B service sectors. Some examples are located in the digital/physical/social space in Figure 2. This subsection focuses on opportunities for asset-heavy B2B services such as construction, defense, energy, and transport services (National Infrastructure Commission, 2017). Asset-heavy organizations design, build, and deliver an integrated offering that includes the sale or lease of (large) assets integrated with support services such as maintenance and repair. In these environments, traditional repair services have a physical servicescape, such as a workshop or depot, with a social dimension, such as a team of service experts who work with customers to produce comprehensive repair solutions that are critical to the respective customer's day-to-day site experience and productivity (Zaki and Neely, 2018 (Forthcoming)).

There are many opportunities for asset management services because asset failure significantly disrupts the economy, endangers people's health and safety, and incurs environmental consequences (National Infrastructure Commission, 2017). For this reason, organizations collect vast amounts of data from asset sensors for remote, preventive maintenance and other purposes (Zaki and Neely, 2018 (Forthcoming)). For rail services, asset failures and

related incidents costs the UK economy £1.3bn - £1.9bn a year ($1.8bn –$2.6bn), which includes fare losses, the cost of passengers' time on delayed or cancelled trains and damage to the holistic customer experience (MacDonald, 2017). Data are critical inputs to predictive or 'asset health monitoring' solutions. Proactive condition-monitoring services apply existing operational data, real-time sensor data, advanced engineering analytics and forward-looking business intelligence to produce recommendation analyses that identify potential equipment faults (Qiu et al., 2013). They have many advantages in service networks, including timely scheduling, convenient maintenance services, monitoring machine health, increased uptime and fuel efficiency and reduced operating costs (Zaki and Neely, 2018 (Forthcoming)).

Emerging Issues. In the future, monitoring technologies are likely to be digitally connected with assets to diagnose faults in the high physical and low social realm – e.g., autonomously stopping equipment in the event of a threat of a strike by employees. An especially exciting example is a "digital twin" – that is, a dynamic virtual representation of a physical object or system across its lifecycle, using real-time data to enable understanding, learning and reasoning (National Infrastructure Commission, 2017). For example, RollsRoyce has signed a memorandum of understanding with universities and other institutes with the aim of creating an open source digital platform to develop new ships. The platform will allow the creation of a digital copy of a real ship, including its systems, that synthesizes the information available about the ship. Any aspect of the digital twin ship can be explored through a digital interface, creating a virtual test bench to assess the safety and performance of a vessel and its systems, both before its construction and through its lifecycle (RollsRoyce, 2017). The United Kingdom (UK) National Infrastructure Commission (NIC) has suggested building a digital twin of the entire country which would bring together power, water, rail, communications,

meteorological, demographic, and transport data to give insights and answer questions such as: Is it possible to avoid building a new hospital carpark by managing appointment times and traffic flows? How can energy consumption be reduced by 10% per person over six months? What is the impact of closing a specific road in the event of a water leak? (National Infrastructure Commission, 2017).

Figure 3 here

Opportunities and Emerging Issues in Healthcare Services: from traditional care to digital care

Opportunities**.** Health is an important context for service researchers and practitioners (Danaher and Gallan, 2016). Traditionally, healthcare has been centered on the schedules and settings of the clinical team and infrastructure. However, experts forecast that reliance on the physical realm will diminish over the next 20 years due to changes in technologies (Topol and Hill, 2012). Today, surgeons 'virtually' assist in operations outside the confines of the hospital using network links and satellite calls and dermatologists diagnose skin cancer in remote areas of Australia using smartphones (Wolf et al., 2013). In the future, clinicians will be increasingly less reliant on patients visiting the clinic, as health services enter the digital realm. See Figure 3, which provides healthcare examples located in the digital/physical/social space.

Emerging Issues**.** Customers will increasingly shape their own experiences in digital healthcare (McColl-Kennedy et al., 2017c). Personalized, rather than population-based, solutions will be available in the treatment and management of disease. Improvements in diagnostic accuracy and sensitivity have become apparent with advances in genome pattern sequencing and prognostic decision-making (Topol and Hill, 2012). Today, the Mayo Clinic offers grants to organizations to develop technological applications that can monitor an individual's anatomical

changes to detect the onset or progression of disease symptoms (Mayo Clinic, 2018). In the future, smart devices will enable patients to quickly make decisions about their healthcare and treatment options, rather than waiting for results from laboratories or clinics. By 2050, healthcare organizations will leverage AI, 3D printing, sensory technology, real-time data processing and big data repositories to design and deliver services (Antons and Breidbach, 2018). As technologies become more sophisticated, robotic assistants will be in hospital wards, in our homes and playing a critial role in the operating suite (Lanfranco et al., 2004). Today, robots have begun to assist in the operating suite and to fulfill social roles, such as cuddly companions for the elderly, and hotel ambassadors (e.g., Softbank Robotics' robot, Pepper). In the future, they will be carers for the infirmed and assistants to medical consultants.

Figure 4 here

Opportunities and Emerging Issues in B2C Retail and Professional Services: from traditional service to digital service

Opportunities**.** Digital technologies are already prevalent in B2C industries, including retail, automotive, consumer goods, logistics, media and professional services (World Economic Forum, 2017). Retailing is especially rife with digital service innovations with concommitant organizational changes. In the past, in-store and online retailing were characterized by high physical complexity and high social presence. At present, both are shifting from low to high digital density realms (Ballantyne and Nilsson, 2017). Figure 4 depicts some examples in the digital/physical/social spaces. Consumers, attracted by the convenience of easy digital access to user reviews, comparison pricing, and endless aisles, have come to rely on online and mobile shopping.

Traditional retailers are bringing digital channels into stores and online retailers are opening brick-and-mortar shops in high-profile locations, seeking to create experiences that cannot be delivered through a device. Both traditional and online retailers are working toward the same goal: a highly personalized, consistent, and integrated shopping experience across all points of contact between retailers and customers. The integration of digital technologies with physical (store) environments will enhance the customer experience and improve employee performance. For example, AmazonGo is a new kind of bricks-and-mortar store with high digital density, so that no physical checkout is required. Amazon is also experimenting with computer vision, sensor fusion, and deep learning through a seamless phone application which may radically change the customer experience (Amazon, 2018).

Emerging Issues**.** The World Economic Forum predicts a dramatic shift from traditional services to digital services (World Economic Forum, 2017). In the USA, professional services are estimated to be the second-largest employment sector (after healthcare). In the UK, they account for 15% of its gross domestic product (GDP) and employ 14% of its workforce. Employment in professional services is expected to grow to approximately 21 million jobs by 2024 (U.S. Bureau of Labor Statistics, 2015). One reason for this growth is that online platforms offer a convenient alternative to the traditional physical marketplace for healthcare and professional services. Due to the dramatic shift from traditional services to digital services, employees and customers will participate in the co-creation of services within a high digital density environment. In Figure 4, this change implies moving from the high physical complexity, high social presence and low digital density octant to the low physical, high social presence and high digital density octant.

Increasingly, many customers are expecting 24/7 access to professional services. For example, Upwork is a platform connecting 5 million client businesses with more than 12 million freelancers (Upwork, 2017). In the legal profession, virtual courtrooms are replacing the need for physical ones, as lawyers, witnesses and judges can now hold hearings via video link (Susskind and Susskind, 2015). We speculate that the next transition will be to the low physical, low social presence and high digital density octant. For example, the law firm of Baker and Hostetler recently developed an AI lawyer ('Ross') to handle its bankruptcy practice and replaced 50 human lawyers. Ross can read, understand, analyze language and generate responses backed up with legal references. It also monitors current litigation to notify colleagues about recent court decisions (Addady, 2016).

Challenges of Navigating the Path to High Digital Density Environments

Business managers and researchers anticipate that a major benefit of AI and "big data" will be service innovations that create new value propositions (Hartmann et al., 2016; Huang and Rust, 2018; Mayer-Schönberger and Cukier, 2013). In addition, people, organizations, and society will benefit from the move to high density digital environments through increased convenience, universal access to information to inform decisions, and new solutions. However, people and organizations must *shape* the role that technology plays in the design and delivery of the customer experience. Interconnections between devices and platforms have the potential to create complex service systems that -- if they fail – could have far-reaching consequences that could be very destructive. For example, Tay, the rogue chatbot that Microsoft developed, was a female chatbot with its own Twitter account. It is a machine learning project, designed for human engagement that communicates with 18-to 24-year-olds, learn from them, and get smarter with time. Within 24 hours from its launch, Tay tweeted about smoking drugs, and claiming that

"Hitler was right …" and "feminists should … burn in hell." Microsoft shut the service the next day (Regelado, 2016).

Organizations cannot access the information they need to co-create services with customers because multiple technical solutions exist that are designed to be optimal for well-defined local problems – but these solutions are often disconnected and (consequently) sub-optimal from a system or network standpoint. Although hardware, software, platform and networking standards have been established across organizations, each organization and its customers typically use their own tools and data standards. Consequently, data architecture is fragmented and there is no integrated enterprise information platform within an organization – let alone across organizations. This misalignment creates challenges because it is unclear which technologies are needed and how they should be implemented and integrated into the existing information and communication technology (ICT) infrastructure in organizations. Moreover, organizations' utilization of analytical methods is currently limited, ranging from descriptive analytics (e.g., dashboards) applied to high volume, high velocity data to diagnostic, predictive, and prescriptive analytics (e.g., cognitive systems and optimization models) which require more costly, complex methods and typically more structured data (Wedel and Kannan, 2016).

Challenges of Navigating the Path to High Social Presence

Organizations have experience with the migration to high social presence environments that involve humans, usually when digital density is low. Research has shown that the use of technology by employees can improve their performance under some conditions (Ahearne et al., 2008), thereby improving the customer experience. However, digital technology can augment or eliminate the human element, *thereby changing the roles of customers and employees*. Larivière et al. (2017) argue that employees and customers are taking on new roles as enablers, innovators,

coordinators and differentiators ─ rather than traditional deliverers of the core service. For example, smart technology has begun to expand frontline service interactions in both B2B and B2C contexts and to deepen customer-organization relationships (Marinova et al., 2016).

In addition, very little is known about automated social presence −such as robots, avatars, augmented and virtual reality− as opposed to humans. Already, people are encountering automated social presence when they are served by a robot in a restaurant or hospital, consult intelligent virtual assistants, interact with others in simulated or virtual environments, receive medical care through telepresence and so forth (Plambeck, 2018; Walsh, 2018). Indeed, many people access technology through a virtual assistant, such as Siri and Alexa, which exhibit a personality and encourage anthropomorphism. Thus, social presence can now occur digitally, rather than due to the physical presence of a human actor, so that high social presence can be achieved through automation (Van Doorn et al., 2017). Researchers have become especially interested in the "uncanny valley," a term that denotes the uncomfortable sensation associated with a mismatch between an individual's expectations and a robot's behavior (Mori, MacDorman, and Kageki, 2012).

Table 1 here

NEW APPROACHES TO RECONCILING CUSTOMER EXPERIENCE DUALITIES

Until this point, we have identified opportunities and challenges for enhancing the customer experience in the future and considered ways that organizations and customers might make the most of them. In this section, we discuss how the intersection of digital, physical and social realms poses systematic challenges for organizations, customers, and society. We focus on tensions that, unless addressed, may inhibit the conditions necessary for value co-creation

between actors in a network. We term these tensions "dualities," defined as the opposition or contrast between concepts or strategies.

We organize our discussion by considering the circumstances in each of the eight octants because they represent different conditions that beget different dualities. These are described in Table 1 (which maps our three-dimensional octants into two-dimensional space.) Some dualities may apply in more than one condition. We do not aim to unambiguously classify dualities, but rather to elucidate how they arise from service design and delivery opportunities, challenges and trade-offs. In addition, we provide examples and offer guidance on ways to resolve these dualities through innovations in the design and management of customer experiences for probable future conditions.

Base of the Pyramid or Scarcity in Digital, Physical and Social Realms

The low digital/physical/social octant represents a condition of scarcity in which resource constraints (or uneven distribution of resources) hinder value co-creation in many forms (Gebauer and Reynoso, 2013; London, Anupindi, and Sheth, 2010). There are vast numbers of people who live every day with scarce resources, sometimes referred to as Base of the Pyramid (BoP). In addition, during natural disasters, individuals may find themselves temporarily without access to many resources (Cheung, McColl-Kennedy, and Coote 2017). We believe that the scarcity duality arises from fundamentally different perspectives on value held by different actors in a service ecosystem. For example, for-profit business objectives (and sometimes nonprofit objectives) may not match the goals of individuals in markets with scarce or unevenly distributed resources due to cultural/political issues related to power structures (Arora and Romijn, 2011).

New Approaches. One approach to these challenges is to acquire a partner or engage in a network alliance, thereby tapping into knowledge resources and capabilities related to the local

market (Rivera-Santos and Rufín, 2010). An example of a successful alliance that co-creates value with customers who face scarce resources in many countries is the United Nations-led initiative to eradicate malaria by 2040 (UN News, 2015). Another approach to successfully operating in markets with scarce resources entails the development novel business models, especially with respect to pricing. For example, organizations may enable customers to share a service and its costs, design smaller packages or bundles, create pre-paid service plans, or develop micro-finance or loan programs (Anderson and Markides, 2007). Last, actors in markets with scarce resources may turn to the moral economy to co-create value with the limited resources available (Cheung, McColl-Kennedy, and Coote, 2017).

Bundling Services: High Digital Density, Low Physical/Social Resources

High digital density realms are capable of supporting favorable emotional, social, and sensory responses. Thus, gamification – that is, adding game-like elements to a task to encourage customer participation ─ can be an especially attractive strategy for organizations in B2C markets. Research has shown that gamification can lead to customer learning, engagement, and improved customer experiences (Harwood and Garry, 2015; Landers, 2014). Games are also effective in employee training, team-building and management. However, this strategy is only effective when the goals of the organization and its customers are aligned. Games have rules and structure, whereas play often does not, so organizational and customer goals may conflict (Hofaker et al., 2016; Walz and Deterding, 2014). This conflict may cause customers to refuse to participate in games, thereby defeating the purpose of the gamification.

Hence, a duality can arise in balancing a participant's goals (i.e., entertainment) with organizational goals, such as customer learning or buying (Harwood and Garry, 2015). The underlying reason for this duality is that gamification implicitly requires the creation of

"optimal" bundles of features (i.e., learning components, entertainment components) that are valuable to both parties. This same dilemma – optimal service bundling – also occurs in high digital density B2B markets in a very different form. B2B customers may be faced with a multitude of bundles that encompass an overwhelming number of options and combinations, so that a non-expert encounters a "paradox of choice" -- whereby a customer feels better during the bundle creation process but (objectively) ends up worse off (Reutskaja and Hogarth, 2009). In both of these situations, complex bundling increases the challenges of co-creation – that is, creating value for both parties while successfully monetizing the service.

New Approaches. Organizations must know (or learn) the customer's preferences to determine the appropriate mix and sequences of entertainment and content (i.e., the bundle) that will be most effective in creating value (Landers, 2014). Since organizations and their customers are likely to value bundles (and the underlying components) differently, organizations must also adopt a relational approach to mitigate conflicts that influence value co-creation (Tuli, Kohli, and Bharadwaj, 2007). In sum, organizations operating in both B2B and B2C markets characterized by a high digital density environment must intensively develop resources and capabilities for leveraging descriptive and diagnostic analytics of customer data to co-create service bundles and pricing options that are valuable to both parties.

Autonomy versus Interdependence in High Social, Low Digital/Physical Environments

High social presence creates a shared experience, which requires high levels of trust to accomplish integration of social resources (Hennig-Thurau, Gwinner, and Gremler, 2002). When physical and digital resources are limited, organizations are constrained in their capabilities to use traditional methods of creating trust and integrating social resources. For example, many of today's business models rely on digital platforms to build trust and integrate social resources

(e.g., Airbnb), and such platforms are absent in this octant. Hence, a duality may emerge between autonomy (which frequently implies competition) versus interdependence (which can be more cooperative). Instances of both competition and cooperation can be observed in markets, as social actors work independently or collectively to meet their needs (Cheung and McColl-Kennedy, 2015).

New Approaches. Organizations must find social mechanisms for aligning organizational, customer, and employee goals. Often, this requires a significant culture change within organizations, necessitating an alignment of all departments, including those that are internal-facing, on quality as defined by the customer (Olian and Rynes, 1991). In addition, relational forms of coordination are expected to be most useful under high levels of task interdependence, uncertainty, and time constraints. Although recent contingency theories emphasize the importance of shared knowledge or shared understandings, the theory of relational coordination argues that shared knowledge is a necessary but not sufficient condition. If effective coordination is to occur, participants must also be connected by "relationships of shared goals and mutual respect" (Gittell, 2006, p. 75).

Regulatory Challenges in High Social/Digital Environments

In this octant, digital density and social presence are high but physical complexity is relatively low. New business models are already emerging to fit these conditions. For example, both Airbnb and Uber bring together (human) service providers and consumers via an electronic platform. A duality emerges regarding the source of regulation: is it imposed by one of the actors in the ecosystem (such as the government), or by the community? As we have seen from the history of both Airbnb and Uber (Bowcott, 2017), the most likely answer is that different actors or groups may regulate different aspects of the customer experience. As we write, the US

Congress is holding hearings about whether and how to regulate Facebook (Kang and Roose, 2018).

New Approaches. Governance by the community requires C2C communication and often uses a digital platform for information sharing and a mechanism for risk-sharing (Capaldo, 2014). To encourage information sharing, organizations must develop a reputation for making and keeping brand promises. New communication models ─which combine "bottom up" and "top down" communications─ can be helpful in this respect (Batra and Keller, 2016; Lamberton and Stephen, 2016). In addition, to manage customer experiences in high social/digital spaces, organizations will need to utilize descriptive and diagnostic analytics to facilitate co-creation activities (Wedel and Kannan, 2016). In this way, organizations operating in this octant can facilitate the flow of information, the integrity of evaluations, and the ability of customers to co-design their experiences (Bolton, 2011).

Transparency versus Privacy in Complex Physical, Low Social/Digital Environments

In this octant, interactions between organizations and customers take place in a physically complex space where other actors and sources of information are low (low social presence and low digital density). For example, the healthcare industry is currently transitioning from a fragmented low digital density environment to an integrated high digital density environment. Patients share personal health information with medical providers, and sharing occurs (locally) within the healthcare network. Hence, patients struggle to maintain their privacy and obtain transparency from their healthcare providers (Berry and Bendapudi, 2007). In this octant, trust between the service provider and customer is essential because both actors are identifiable. Consequently, there is some loss of privacy and (at the same time) a need for transparency from the partner. These two needs are in opposition, creating a duality that can impede the

development of the customer-firm relationship. Moreover, there are a host of unresolved issues associated with data base management, data sharing and privacy, and these issues can arise even when digital density is relatively low.

New Approaches. To address this duality, information sharing and appropriate attitudes toward risk must emerge. Personal sharing of data and organizational data collection are both likely to be necessary. Ideally, organizations should store activity information and personal identifiable information in separate ways that cannot be misused. Organizational transparency concerning data management practices are necessary because customers' perceived control over the provider's handling of personal data can offset their perceptions of vulnerability (Martin, Borah, and Palmatier, 2017, p. 36). Often, governments have intervened to ensure organizational transparency and appropriate security concerning the handling of medical records (Gostin et al., 1996). We may see similar interventions occur in other industry sectors where people share sensitive information, such as in banking and finance, accounting, and law.

Standardization versus Flexibility in Environments High in Physical/Digital Resources

In this octant, the environment is both physically complex and digitally dense, so that customization may be necessary for organizations and customers to co-create superior experiences. Customization typically depends on the willingness of customers (people or businesses) to share their information with service providers. However, customers' concerns about data privacy and security may inhibit them from engaging with service systems. Martin et al. (2017) found that when organizations are transparent in their data management practices and offer customers some level of control over their individual data, they can diminish the negative effects of customer data vulnerability. Since social presence is low in this octant, trust-building is likely to require digital technologies that ensure data privacy and security. Thus, when customer

experiences occur in a state of high physical complexity and high digital density yet low social presence, a duality arises from trade-offs between standardization versus flexibility of services and offerings (Bowen, Siehl, and Schneider, 1989).

New Approaches. The trade-off between standardization and customization arises because data sharing depends on customer perceptions of control and risk (Ding and Keh, 2016). Today, regulations and best practices for data privacy and security are evolving very rapidly, as well as users' expectations about how their data is collected, stored, used, protected, and deleted. Cyber threats, viral infections and security breaches can have a major negative effect on the customer experience, eroding trust in organizations and potentially disrupting customers' relationships with brands. According to analysts, only about 50% of the information in the digital universe that should be protected actually is protected (Gantz and Reinsel, 2012). From an organizational perspective, customer knowledge and organizational learning is required (Kumar and Reinartz, 2016). From a customer perspective, decision support systems (Bharati and Chaudhury, 2004) and high coping abilities are required (Gabbott, Tsarenko, and Mok, 2011). For these reasons, much more work is needed on how trade-offs between customization and standardization depend on the resources and capabilities of the organization and its customers.

Avoidance versus Attraction in Environments High in Physical/Social Resources

In this octant, the environment is rich in physical and social resources but not in (digital) information. Examples include hair and beauty salon services, traditional nursing, and repair services. Customer experiences in this condition may produce tensions between customer avoidance and attraction (Bendapudi and Berry, 1997; Grégoire, Tripp, and Legoux, 2009). This duality may be particularly true in branded customer experiences, where employee-brand congruency and employee authenticity play a significant role in attracting customers (Sirianni et

al., 2013). For example, Starbucks has leveraged its employees to create branded customer experiences that are effective in attracting and retaining customers (Gallo, 2017).

New Approaches. Researchers are beginning to investigate how employee-brand congruency ("fit") and employee authenticity influence the customer experience. Researchers have suggested that employee emotional competence, employee-customer rapport and matching employee-customer empathy influence the customer experience and business outcomes (Delcourt et al., 2013; Gremler and Gwinner, 2000; Wieseke, Geigenmüller, and Kraus, 2012). However, there are many unanswered questions: When and how do customers wish to engage with service offerings in situations where other customers (or other people/employees) are involved (Libai et al., 2010)? To what extent do customers require feedback and perceived control to participate in a successful service experience (Guo et al., 2016)? Recently, Singh et al. (2017) have emphasized that organization-customer interactions are embedded in rich contexts and thus increasingly diverse, so that deepening customer engagement and creating consistently excellent service encounters across multiple touchpoints is necessary for the co-creation of value. They have called for research to investigate the opportunities and challenges of effectively managing organizational frontlines and outlined a forward-looking research agenda.

Capabilities versus Resources: Leveraging High Physical, Social and Digital Resources

This octant is rich in resources, with high physical complexity, high digital density and high social presence. For this reason, actors in the service ecosystem must have the capabilities to manage these resources to co-create value (Frow, McColl-Kennedy, and Payne, 2016). A duality is likely to emerge over how the service creation and delivery process is managed, which leads to the question: Is individual optimization necessary to co-create a superior customer experience?

What can organizations offer, and what do customers prefer and when? What role does each actor in the service network play?

New Approaches. Organizational learning is required to properly design and deliver exceptional customer experiences (Payne, Storbacka, and Frow, 2008; Slater and Narver, 2000). Hence, organizations will require superior data and business analytics (Barton and Court, 2012). One option is that the organization develops distinct service modules that the customer can assemble to co-design the experiences that he/she prefers, thereby co-designing locally-optimal solutions. Other organizations have outsourced certain functions (e.g., field services) when they can be managed independently from the rest of the service system. For example, many organizations use automated social presence (e.g., chatbots) to solve simple service requests from customers and route complex service requests to highly trained service representatives who can use more powerful tools to collaborate with customers. A further dilemma emerges about whether services can (and should) be co-created dynamically, in real-time, or asynchronously - ahead of time (Bolton, 2018 (Forthcoming)). For example, Amazon has filed a patent for a method and system for anticipatory package shipping – whereby it leverages predictive analytics to ship packages to a nearby logistics hub before the customer has requested it (Kopalle, 2014).

Figure 5 and Table 2 here

THE SERVICE ECOSYSTEM: INTEGRATING THE DIGITAL, PHYSICAL AND SOCIAL REALMS

Organizations and customers face many trade-offs in co-creating a superior customer experience and dualities will inevitably arise. A key issue is how to design and manage customer experiences so that there is a congruency within and across the three realms. By congruency, we refer to the fit between the organization's capabilities and resources and the customer's

capabilities and resources. Congruency requires (1) connectivity among the realms, (2) consistency among the elements in the different realms, and (3) thematic cohesion – taken together, superior service design. This framework is depicted in Figure 5. It highlights the need for an integrated theoretical perspective on how value co-creation takes place within and across the digital, physical and social realms. This section discusses how mid-range theory has evolved in the services literature to capture this increasingly complex service ecosystem. See Table 2.

Theories Originating from Research on the Physical Realm

Traditional theories about the customer experience began in the physical realm (e.g., Bitner, 1992). Table 2 shows that these theories emphasize people's cognitive, emotional and sensory responses to stimuli. Subsequently, service researchers recognized the importance of the social servicescape (e.g., Tombs and McColl-Kennedy, 2003). It emphasized social and socially symbolic stimuli that may enhance or constrain people's actions, thereby influencing the customer experience. Emergent theory has begun to consider the customer journey over time, as well as bringing together the digital, physical and social realms. In this way, it recognizes that customer experiences are path dependent and co-created in a "blended servicescape." Since organizations, such as American Express, are already experimenting with augmented and virtual reality, business practice is over-taking business theory at this point in time.

Theories Originating from Research on the Digital Realm

A parallel stream of research has focused (solely) on the customer experience in the digital realm (Table 2). It has been dominated by several powerful theories, such as the technology acceptance model (TAM) (Davis, Bagozzi, and Warshaw, 1989). They have provided a deeper understanding of the customer experience by identifying many concepts that are important in the digital realm, such as ease of use and self-efficacy. However, this stream of research has

emphasized technology acceptance and adoption (Venkatesh, Thong, and Xu, 2012), rather than technology usage. By focusing on the adoption decision, research recognized an implicit comparison standard, namely the physical realm (i.e., without technology). However, emergent theory has begun to consider technology usage as a collective (social) phenomenon through networks rather than as an individual phenomenon (Kozinets, Patterson, and Ashman, 2016).

Theories Originating from Research on the Social Realm

Theoretical work has consistently recognized the social realm, beginning with conceptualizations of customer and employee roles within a service encounter (Surprenant and Solomon, 1987). However, as technology has come to mediate and augment encounters between organizations and customers, theoretical work increasingly emphasized how organizations and customers actively collaborate and coordinate their activities to create superior customer experiences (Bowen, 2016); Larivière et al. 2017). Technology may induce new employee and customer roles in the service encounter. In addition, the boundaries between customer and employee roles becomes less clear because technological mediation abolishes the need for the co-location of customer and providers (Schumann, Wünderlich, and Wangenheim, 2012). Moreover, as the nature of customer participation changes, role clarity and successful role performance are necessary to co-create high quality service, favorable customer experiences and successful organizational outcomes (Bolton and Saxena-Iyer, 2009).

CONNECTING AND INTEGRATING THE THREE REALMS

This section assesses the current status of service research and practice in integrating the digital, physical and social realms of the customer experience. We review where we are now, where we are going, and suggest a way forward. Our agenda for future research is summarized in Table 3.

Where Are We Now?

Theoretical and empirical research on the holistic customer experience typically focuses on either the digital or social realm and uses the physical realm as a reference condition. This tendency is evident from the second and third rows of Table 2 which describe theoretical work in the digital and social realms. Service researchers have made substantial progress in understanding the customer experience in three octants: (1) high physical complexity, low digital/social environments, (2) low physical complexity, low social presence and high digital density environments, and (3) low physical complexity, low digital density and high social presence environments. In these three octants, the physical, digital and social realms are primarily investigated in isolation from the other realms.

In the (primarily) high physical complexity environment, research on the customer experience now emphasizes a broader and deeper array of physical elements than in the past. For example, retailing studies have focused on sensory elements, contextual factors and touchpoint characteristics (Verhoef et al., 2009). In the low physical/digital, high social environment, service researchers are studying interactions between customers and frontline service employees that incorporate some use of digital technology, such as tablets or kiosks. For example, when an employee attempts to establish rapport with the customer, technology can forestall a customer's response to the employee's rapport building – thereby decreasing the customer's holistic evaluation of the service encounter (Giebelhausen et al., 2014). In contrast, when an employee does not attempt to establish rapport, technology can serve as an alternative way for a customer to navigate the service encounter – thereby increasing the customer's holistic evaluation of the service encounter. In low physical complexity, low digital density and high social presence environments, research is deepening our understanding of how customers' evaluate experiences in which they actively engage, participate or co-produce (Bendapudi and Leone, 2003).

These three octants provide a solid foundation for service research and practice as it confronts the dualities that arise under more complex conditions. For example, Marinova et al. (2016) recently proposed a conceptual framework in which smart technologies can substitute for or complement frontline employees' efforts to deliver customized service because they can facilitate learning that connects customer-employee connections. As high digital density becomes ubiquitous in many marketplaces, researchers in these three octants will have more opportunities to deepen and test their theories from these two octants – thereby moving to adjacent octants.

Where Are We Going?

Our earlier discussion on navigating the path to high digital density described how service researchers have made progress in understanding environments characterized by high physical complexity, low social presence and high digital density. For example, AliBaba offers a computational system called Apsara to provide intelligent vehicle detection services. The 'ET City Brain for Hangzhou' helps police to respond to traffic collisions much faster: three minutes compared to 15 minutes (Goldman Sachs Equity Research, 2017). The 'ET Environment Brain' can intelligently monitor pollution of water, air and soil in Jiangsu province; it is expected to be helpful in disaster forecasting, extreme weather warning and environmental protection (Goldman Sachs Equity Research, 2017). Transport for London has demonstrated that using and sharing data with the public can save people time and money, roughly £15m and £58m per year respectively (BEIS, 2013). The release of open data by TfL has supported the growth of London's technology economy to the value of £14m pa in GVA and over 700 jobs and has led to a £20m increase in bus usage. Open travel data facilitate travel apps, real-time alerts (that save time, reduce uncertainty and lower information costs), growth in the economy, and increased use

of public transport (Deloitte, 2017). These are very recent developments in a few "smart cities." Rigorous research in this octant is only beginning. Ng and Wakenshaw (2017) argue that shifting boundaries due to information flows are likely to transform markets and exchanges, and propose a research agenda for this area.

Our earlier discussion on navigating the path to high social presence described how service researchers have made progress in understanding environments characterized by high physical complexity, low digital density and high social presence. In this octant, social presence implies a human or a robot (both of which have physical presence), but not an avatar or digital personal assistant (which requires high digital density). Naturally, there has been much more progress in understanding human social presence as opposed to robots. However, researchers are attempting to create robots capable of exhibiting natural-appearing social qualities – a field called "socially intelligent robotics."

In this interdisciplinary research stream, there has been a focus on developing socially assistive robots that help human users through social rather than physical interaction (Feil-Seifer and Matari, 2005). Recall that empathy is an important dimension in customer experience. For example, empathy can improve patient satisfaction and motive them to recover and enhance experience to therapy programs (e.g., Rogers, 1975). Machines cannot demonstrate empathy, but it is possible to create robots that display signs of empathy, such as recognizing the user's emotional state, communicating with people, displaying emotion, and conveying the ability of taking the customer's perspective. From this perspective, a healthcare robot should *appear as if* it understands others' emotions, mimics those emotions, and behaves as though others' emotions affect it (Tapus, Mataric, and Scassellati, 2007). Service research has only just begun to tackle issues in this octant. Notably, Van Doorn et al. (2017) have provided a conceptual framework for

studying the relationship between automated social presence and customer outcomes. They argue that social cognition and psychological ownership mediate this relationship and that a customer's relationship orientation, tendency to anthropomorphize, and technology readiness are likely moderators.

A Way Forward

As Figure 1 illustrates, there are three octants in which there is little or no service research: high physical/digital/social, low physical complexity, high digital/social and low physical/digital/social environments. Interconnections among the digital, physical and social realms have the potential to create complex service systems that benefit consumers, organizations and society. Despite research in each of the octants, it is evident that there is little theoretical and empirical work that explicitly connects the digital, physical and social realms. However, service researchers and practitioners have begun to recognize that our failure to understand the connections among the three realms has potentially serious consequences (Lemon and Verhoef, 2016).

We must begin by recognizing that the three realms are already connected, and these connections will only increase between the present and the year 2050. What is needed is a better understanding of how the three realms should be connected and integrated to co-create superior customer experiences. This need is evident from numerous press reports of failures in complex service systems – with far-reaching and destructive consequences. Recent examples are easily called to mind. In December 2017, Atlanta's airport was halted due to the ripple effects of a small electrical fire (physical) that shut down its back up power system (digital) and prevented emergency teams (social) from responding to it. Over the past decade, trading on stock exchanges (physical and social) has been suspended for a variety of reasons, exacerbated by the

high speed, automated nature of digital transactions. In the USA, critics complain that the complexity of healthcare systems is leading to out-of-control costs and poor outcomes. In all these examples, the resultant customer experience has been exceptionally poor. However, they highlight the potential for research that better connects and integrates the three realms to co-create excellent customer experiences.

Interconnections among the digital, physical and social realms also have the potential to create highly favorable or unfavorable experiences for customers interacting with specific organizations. For example, a major hospital recently updated its information technology system, in which all patient information is stored in the cloud. The system went down and consequently all physicians and caregivers lost access to patient information. They resorted to pen and paper (last used 15 years ago) to document patient information, resulting in cancelled surgeries, fewer scheduled appointments and possible mistreatment of patients. This incident illustrates how connections among the three realms are already improving the customer experience. Yet we notice the benefits only when they are absent! The next section identifies some fruitful areas for future research. Table 3 enumerates specific research questions for each topic area.

Table 3 here

Connectivity Across the Three Realms**.** Organizations must develop appropriate capabilities and resources, such as technical infrastructure and data sources, to support service innovation and achieve favorable outcomes for individuals, organizations and society, more broadly. One essential capability is ensuring that relevant data are accessible to appropriate entities within the service system. At present, data-collection in many service sectors is either invasive and/or unstructured – and it is seldom well-managed and shareable among service network partners. Seamless integration of systems and devices into user activities requires a

commitment to superior data management (in the digital realm) that connects to actors (in the social realm). Today's organizations struggle to understand where their data resides, the identity of the organizational units and functions that participate in or support data-collection processes, who accesses data, how and for what purposes, and how these processes unfold over time.

Legitimate Access to Sensitive or Personal Identifiable Information. Cultural challenges limit the effectiveness of digital services within and across organizations, such as a lack of best practices, policies that prohibit data sharing, and questions relating to intellectual property. For example, as we write this article, there are calls to protect consumers' privacy by passing legislation to govern Internet companies such as Facebook and Google. In B2C contexts, a customer's perception of the legitimacy of an organization's access/use of his/her information is likely to depend on his/her perception of the organization's reputation, trust in the organization, perceived control over how his/her information is used, and perception of the risk of information mis-use and harm.

In B2B contexts, many of the sensors and devices that make up the industrial IoT are being implemented without strict data encryption and security protocols. It is important that these devices collect and store activity information and personal identifiable information (PII) in separate ways that cannot be misused. Blockchain technology promises to address this issue. However, organizations sometimes blur the lines between PII and non-PII. Thus, as digital services become increasingly reliant on intelligent, interconnected devices, organizations seek ways to protect their services from intrusions and interference that could compromise personal privacy or threaten customer safety. Data security requires more than keeping hackers outside your system; it also means backing up data, protecting data from corruption and managing to whom data are distributed.

Substitution of Digital and Social Resources for Physical Resources. It may seem surprising that we have included the low physical/digital/social octant, characterized by scarcity of all resources, as an area where more research is needed. However, we believe that there are opportunities to substitute digital and social resources for physical resources. For example, telepresence has been helpful in co-creating medical services with rural patients. We can imagine that robots and virtual assistants can enhance their work. Future work on transformative service research topics, which investigate how service contributes to well-being, might explore these conditions (Anderson and Ostrom, 2015).

Service systems are grounded in relationships among customers, suppliers, employees and other human or non-human actors in the service ecosystem (Black and Gallan, 2015). Technology acceptance may be hindered by customers (and other actors) who are disconnected, frustrated, alienated or isolated rather than immersed in a positive customer experience. When interactions and relationships between organizations and their customers are central to the value proposition, organizations will face difficult trade-offs between the efficiency and effectiveness of digital technologies. How should these trade-offs be resolved?

Blurring of Participant Roles. The distinction between provider and customer roles can become blurred at the intersection of the high digital, physical and social realms. Networked market platforms (such as AirBnB, Uber or Vandebron) are comparable to "switch role markets" (Aspers, 2009), to indicate that actors can switch back and forth between enacting the role of the customer or service provider(s). Service researchers have also tackled novel forms of collaborative consumption that arise from environments that are rich in digital, physical and social resources (Benoit et al., 2017). Thus, emergent theories recognize that customers and

providers using such services may have multiple identities and roles and act as facilitators, users, and providers simultaneously – which transforms the nature of the customer experience.

Looking to the future, thought leaders have argued that automated social presence challenges our current conceptualization of the customer experience. Indeed, Hoffman and Novak (2018) argue that the traditional human-centric conceptualization of the customer experience must be re-thought. Drawing on assemblage theory, they identify four consumer experience "assemblages": two enabling experiences (individual self-extension and communal self-expansion), and two constraining experiences (individual self-restriction and communal self-reduction). However, their conceptual work is very recent and it will take considerable work by many researchers to address the issues that they raise.

Congruency across Realms. A third issue for future research is to understand how elements from the digital, social and physical realms can better fit together to enhance the customer experience. (See Figure 5.) From the customer perspective, the customer experience is formed by choosing elements from each realm. The consumer (not the service provider) chooses what store to go to, what digital platform to use and what friends, if any, to bring. These elements can be congruent, such as when a digital platform supports social interactions with friends, or it can be incongruent, such as when the digital platform doesn't support social interactions because friends might suggest a competing product. From the firm perspective, this means that some of the elements of the digital, social and physical realms are under control, whereas other elements are outside the control of the firm. A better understanding of congruities and control from the customer and firm perspectives is important for co-creating superior customer experiences. Prior research has tended to emphasize consistency of service elements (aesthetics, atmospherics, service design). We believe future research should focus on ways to improve connectivity and

integration across realms – so that organizations can flexibly respond to customers as they actively participate to achieve their goals.

Dynamic Capabilities and Resources. Organizations must develop new resources and capabilities so that they are able to interact with customers according to their needs, capabilities and resources. In high digital/social environments, dynamic processes that co-create service in real time will be necessary for the organizations actions to be contextually relevant. Bolton ((2018 (Forthcoming)) has argued that firms must develop: (1) services that can be triggered by contextual cues, rather than focusing on (static) customer characteristics, (2) service modules so that service sequences can be customized to match customer goals, (3) services designed to support customers' multiple social identities, and (4) services that collaborate with customers during design as well as execution. Naturally, customers will vary regarding their preferences for participation and co-creation (Gallan et al., 2013). Hence, service firms must be prepared to work with customers' diverse goals, resources and capabilities.

Conclusions

Service research and practice is entering an exciting era in which the digital, physical and social realms will become intertwined and blend into a holistic customer experience. In an era where AI, robots and digital twins are a natural part of the service experience, the customer experience will undoubtedly change −for better or worse− depending on the goals and preferences of the individual customer. Researchers and managers can play an important role in improving customer experiences, organizational outcomes and societal well-being by increasing our knowledge and capabilities for co-creating service within and across the digital, physical and social realms.

The opportunities and challenges of designing and executing customized service experiences in the future may seem overwhelming due to the need for connectivity and congruence among the digital, physical, and social realms for each individual customer. The present research has developed a conceptual framework for analyzing customer experiences at the intersection of the digital, physical and social realms. In this way, it offers a way forward that explicitly considers how technology-enabled services will change the formation of customer experiences, as well as providing managerial insights. We have provided a research agenda (in Table 3 and Figure 5) to encourage future research about customer experiences at the intersection of the digital, physical and social realms.

Figure 1

Depiction of the Customer Experience in Digital, Physical and Social Realms with Eight Octants

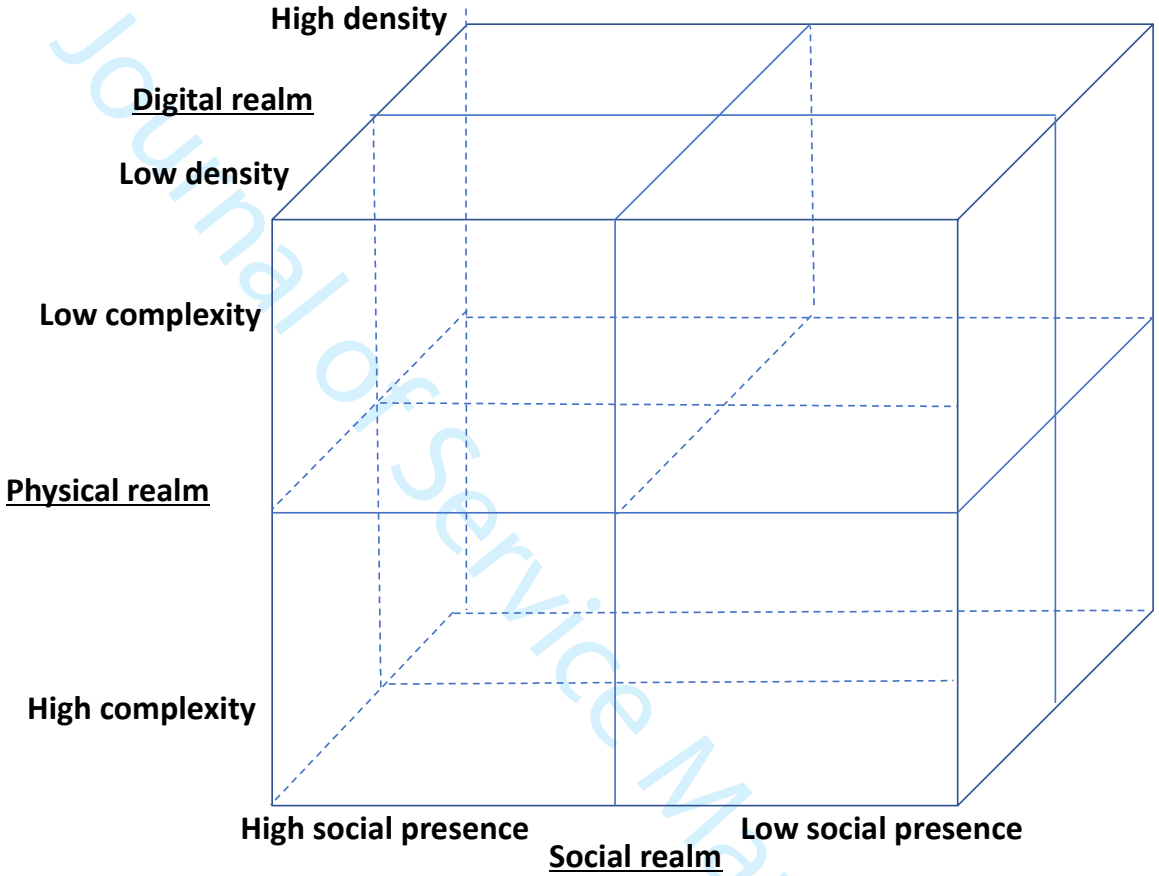

Figure 2

Future Asset-Heavy B2B Services in the Digital/Physical/Social Realms

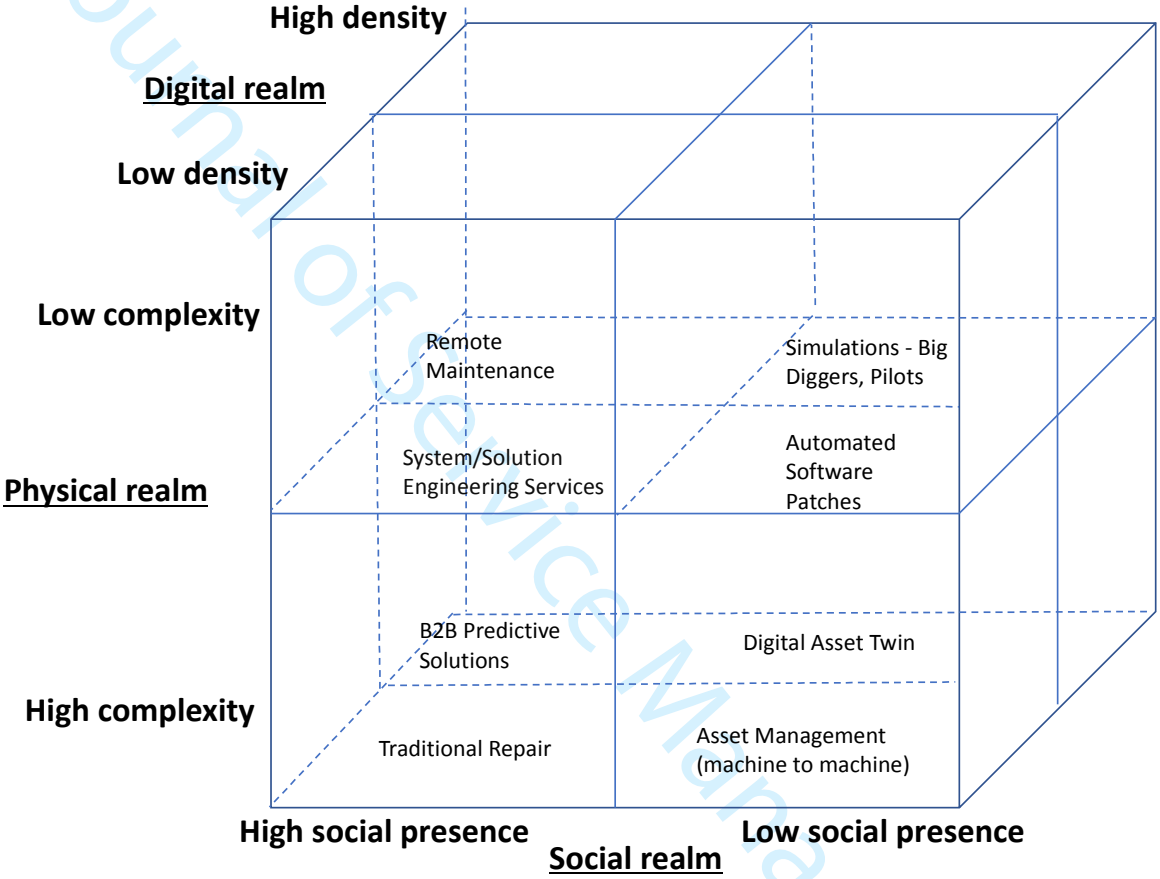

Figure 3

Future Healthcare Services in the Digital/Physical/Social Realms

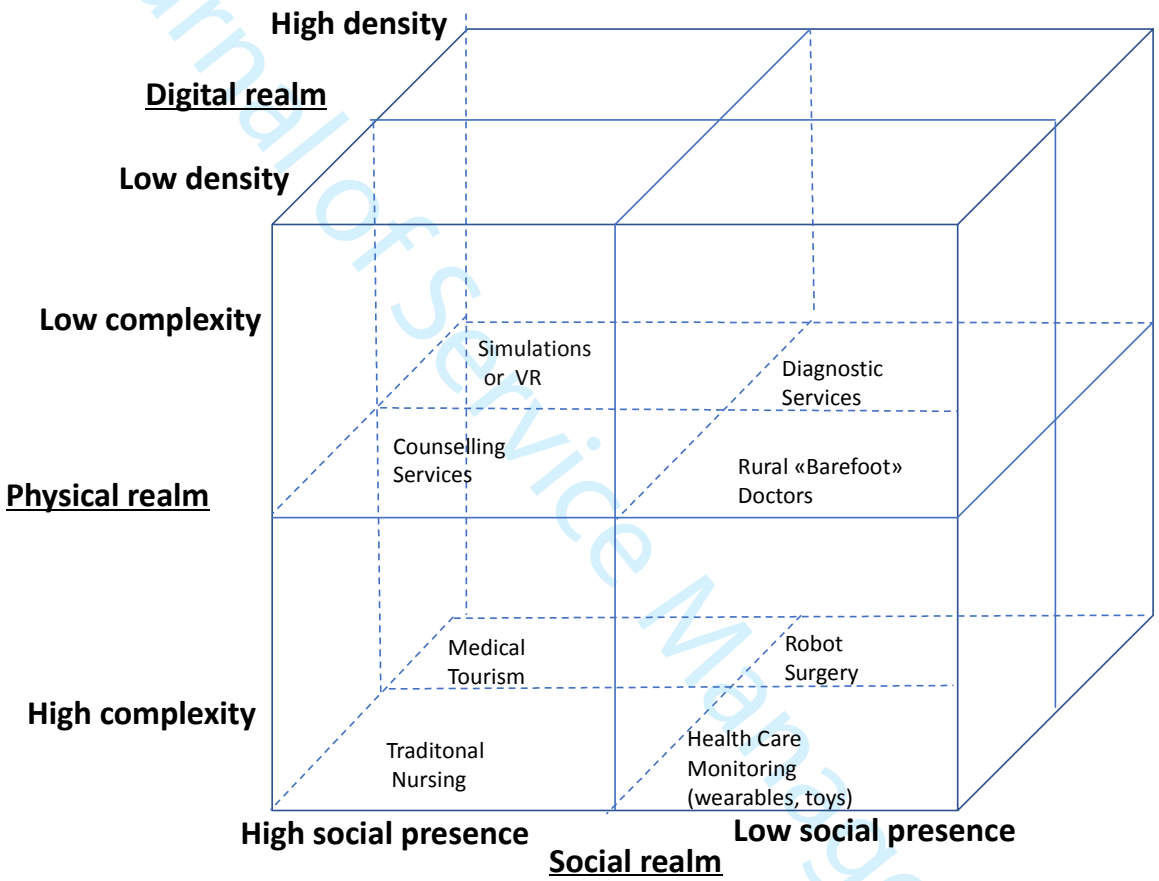

Figure 4

Future B2C Retail and Professional Services in the Digital/Physical/Social Realms

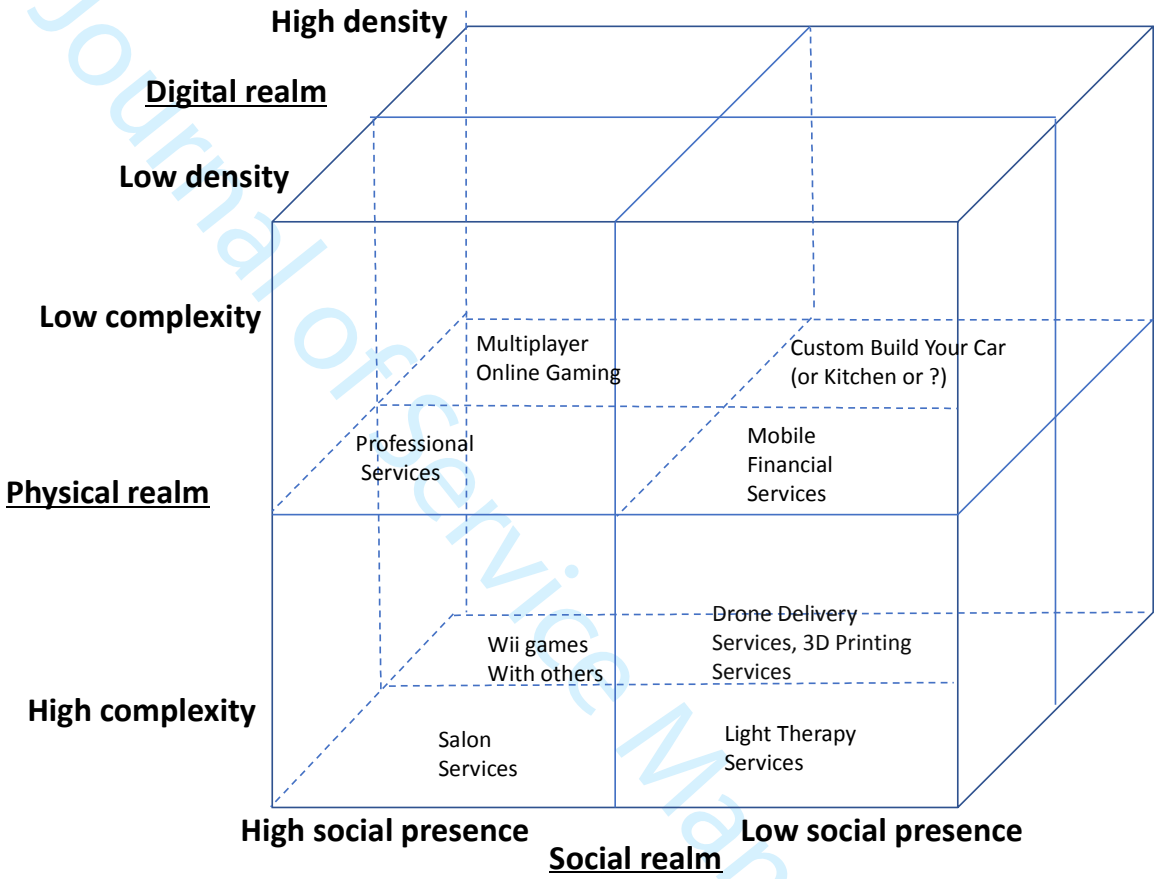

Figure 5

An Integrative Perspective on the Digital, Physical and Social Realms

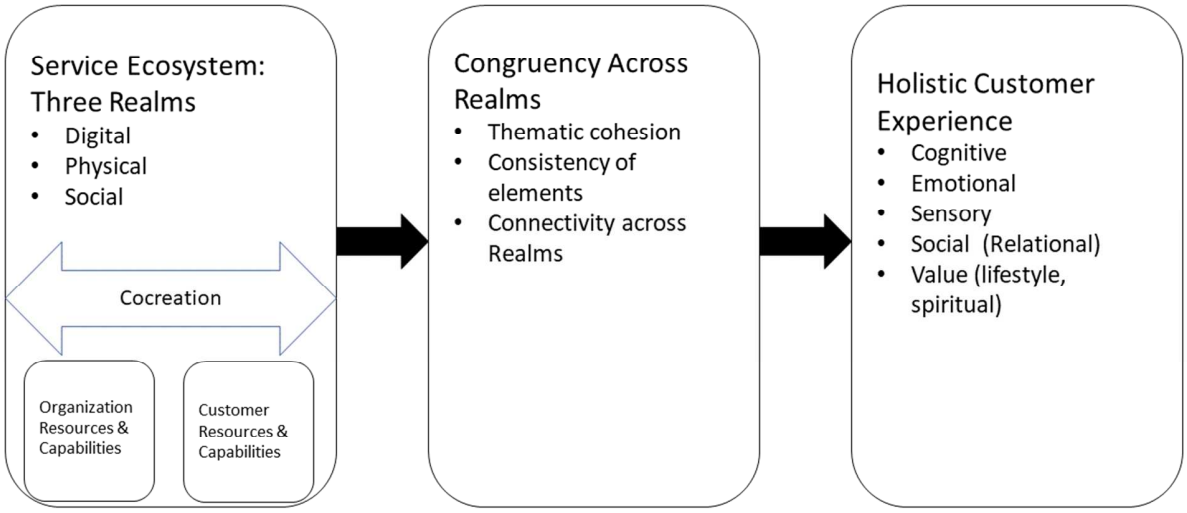

Table 1

Dualities in Each of the Eight Octants

	Low Social Presence		High Social Presence	
	Low Digital Density	**High Digital Density**	**Low Digital Density**	**High Digital Density**
Low Physical Complexity	**Base of the Pyramid Challenges** Customer perspective: scarcity of resources, values incompatability. Organizational perspective: fee versus free, potential solutions might include partner or network alliances.	**Organization Bundles vs. Customer Bundles** Customer perspective: perceived control can create paradox of choice, customer ends up worse off. Organizational perspective: requires descriptive and diagnostic use of customer data.	**Autonomy (Competitive) vs. Interdependence (Cooperation)** Customer perspective: highly social experience that requires high trust to integrate social resources. Organizational pespective: limited or no digital and physical touchpoints to create trust and align customer/organization goals.	**Regulation by Actors vs. Regulation by Community** Requires a digital platform for infomation sharing, a mechanism for risk sharing. Social presence could be delivered digitally. Requires descriptive and diagnostic capabilities but no predictive analytics.
High Physical Complexity	**Privacy vs. Transparency** Organizational and customer perspective: requires information sharing and low perceived risk. Trust between service providers and customers is critical.	**Standardization vs. Flexibility** Customer perspective: high coping abilities required. The organization's decision support systems must be excellent to provide value in real time. Organizational perspective: customer knowledged and organizational learning is required.	**Avoidance vs. Attraction** Customer perspective: feedback and perceived control needed. Organizational perspective: how to create branded customer experiences that fit with customer needs in the presence of other customers.	**Capabilities vs. Resources** Customer perspective: customer innovation and creativity through participation. Local solutions may be possible if services can be modularized. Organizational perspective: co-creation requires organizational learning and effective business analytics.

Table 2
Traditional, Extended and Emergent Theories in the Physical, Digital and Social Realms

Traditional theories/frameworks	Extended theory	Emergent theory
Physical Realm		
The term **servicescape** is introduced and defined as the manmade, physical surroundings) in which the service takes place (Bitner, 1992). This view is consistent with environmental psychology theories that argue that environmental stimuli are linked to behavioral responses through the primary emotional responses of arousal, pleasure, and dominance (Mehrabian and Russell, 1974). The servicescape has been shown to produce cognitive, emotional, and sensory responses in both customers and employees.	The term **social servicescape** is introduced and defined as including human elements in the service environment, as well as the physical (Tombs and McColl-Kennedy (2003). They emphasize how occasion (e.g., business or pleasure) and social density (number of people present) influence customers' cognitive, affective and conative responses. This view draws upon social facilitation theory and affective events theory to integrate previous theories. Rosenbaum and Massiah (2011) recognize that the servicescape stimuli has both manifest (e.g. manufactured) and abstract (e.g. subjective) meanings that may enhance or constrain employees' and customers' approach/avoidance and social interaction behaviors.	The term **blended servicescape** explicitly integrates the physical, social and virtual environment. The time-logic of exchange becomes open ended, from pre-sale service to post-sale service and beyond, and social and economic episodes become blurred (Ballantyne and Nilsson, 2017). Embedded and emerging complementarities and interdependencies between digital and non-digital emerge. Theories of cognition, such as conceptual integration, inform how customers "blend" elements and relations from diverse scenarios (Fauconnier and Turner, 1998). In the blended servicescape, customers experience a sense of presence and may act directly on the environment and make changes to it, such as augmented reality
Digital Realm		
The technology acceptance model (TAM; Davis, Bagozzi, and Warshaw, 1989), **the unified theory of acceptance and use of technology** (UTAUT; Venkatesh, Thong, and Xu, 2012), and **innovation diffusion theory** (IDS; Rogers, 1995) provide a conceptual foundation for the adoption of technology in services and in self-service technologies. These theories identify determinants to the adoption of technology (Blut et al,, 2016), including: Ease of use, Usefulness, Subjective norm, External control, Enjoyment, Image, Result demonstrability, Self-efficacy, Anxiety, Computer playfulness, Habit, Experience, Compatibility, Trialability, Risk, Technology readiness, and Need for interaction. These determinants have been found to influence directly and indirectly attitude towards usage and usage behavior.	The TAM and UTAUT models focus on how users come to accept and use a technology, including benefits to the individual. In an **extended TAM UTAUT framework**, technology *and* the way technology shapes the relationships with the physical and social dimensions are modeled as determinants of acceptance. For example, new antecedent might include the reliability of the performance of the service employee and of the other customers using the technology, or the feeling of being responsible for one's and others' usage of the service (Hazée et al, 2017)	"**Networks of desire** are complex, open systems of technologies, consumers, energized passion, virtual objects and physical objects interacting as an interconnected desiring-machine that produces consumption interest within the wider social system and among the interconnected actors, (Kozinets et al, 2016, p. 667). Desire links individuals to the social realm, to its institutions and technology into a network. Thus, desire is experienced at both an individual and a collective level. Technology channels a desire into a consumption interest (e.g. posting pictures on Facebook) that might connect (i.e. through acceptance) and disconnect (i.e. through repression) the members of the network. Technology connects consumers and shapes their private, public and professional practices (Hoffman and Novak 2017); it changes the way consumers express and repress their consumption interests.
Social Realm		
Traditional conceptualizations of the service encounter, i.e. the dyadic interaction between a customer and a service provider rely on **role theory** to describe the pattern of social interaction between a customer and a service provider (Surprenant and Solomon, 1987). Social	In **extensions of role theory**, technology may induce new employee and customer roles in the service encounter. The boundaries between customer and employee roles becomes less clear because technological mediation abolishes the need for the co-location of	Today**,** fragmentation of roles leads to **new questions**. How to these networked platforms set the rules of conduct of consumers that become producers and vice-versa? How do customer manage multiple roles and identities, and how do customers prepare, encounter, and adjust role

interaction between two people in an exchange is determined by the role each person adopts (Goffman, 1967), where a role is behaviorally based. A role is linked to tasks and functions, and it is influenced by the values, norms, and beliefs shared by people of a particular status (Moeller et al, 2013). In a service encounter, customer and employees evaluate their behavior according to whether it accords with traditional role expectations. The higher the degree of congruence between the role and actual behavior of customer and employee, the higher the likelihood to attain satisfaction.	customer and providers (Schumann et al, 2011). Technological mediation puts the emphasis on three dimensions of role theory. First, roles that were traditionally enacted by the providers are more and more enacted by customers through increased co-production and co-creation of the service encounter (Payne, Storbacka, and Frow, 2008; McColl-Kennedy et al. 2017a). Second, role clarity and role ability become two crucial dimensions for successful co-production of the service (Meuter et al, 2005). Third, increased participation requires a changing role of employee and customer (Bowen, 2016; Larivière et al, 2017), and an increased need for coordination between the two parties.	states in their daily life? (Lynch, 2007; McColl-Kennedy et al., 2017a; McColl-Kennedy et al., 2017b; McColl-Kennedy et al., 2017c; McColl-Kennedy et al., 2012) In fluid arrangements, who takes the role of the decision maker? Where is the legitimacy of this role located and who is responsible for the service outcome(s)? Who takes responsibility for addressing problems that may occur (e.g. service recovery)?

Table 3

A Service Research Agenda for Integrating the Digital, Physical and Social Realms to Enhance Customer Experiences

Challenges Across All Three Realms	Exemplar Questions
Connectivity Across the Three Realms	• What roles can actors in the service system in data management processes within and across realms? • What organizational units and functions participate in or support data management processes within and across realms? • Where in the service system should an individual actor's data reside? • What are ways of sharing information so that actors in a service system understand their partners' goals, resources and capabilities?
Legitimate Access to Sensitive or Personal Identifiable (PII) Information	• What is legitimate access to PII data for a specific actor in a service system? • How can organizations ensure that consumers' privacy and safety is protected throughout the systems as well as within the organization? • How can governance mechanisms (e.g., community, regulatory) protect individual and societal well-being? • How do individuals weigh their perceptions of the organization's reputation, trust in the organization, perceived control over how their information is used, and perceptions of the risk of information misuse and harm? • Under what circumstances will individuals allow use of their information?
Substitution of Digital and Social Resources for Physical Resources	• How should managers analyze trade-offs in allocating resources across realms? Specifically, when can resources from one realm (e.g., digital realm) substitute for resources in another realm (e.g., social) – and when are resources complements rather than substitutes? • How are digital, physical and social elements incorporated into customers' emotions, judgment and decision-making processes? • How should organizations resolve trade-offs between efficiency and effectiveness in the deploying digital resources versus physical or social resources? • Under what conditions do high digital/social services contribute towards or destroy well-being?
Blurring of Participant Roles	• What resources and capabilities are required for different roles in the service system? How can organizations guide customer and employee perceptions of their roles and develop their capabilities to enact them? • What are the trade-offs in balancing proactive and reactive approaches to creating integrated service experiences and how do you balance human and non-human interactions? • What role do interactions with mobile devices play in the holistic customer experience? How does a mobile device mediate

	social presence within a service network? • How can organizations manage the shared customer experience in which the customer interacts with multiple entities, including multiple functional areas of the firm? • How do customers' assess perceived control and risk in situations where the roles of actors in a service network are not well-defined? How can assessments of risk be mitigated?
Congruency Across Realms	• How can firms support and enhance customized and personalized service experiences through digital, physical and social elements? • What are some effective ways for organizations to manage the customer experience across the three realms over time to enhance brand engagement and brand equity? For example, when are specific service metrics, service bundles and service sequences helpful in creating and delivering service experiences? • When do service encounters enhance (or detract) for the holistic customer experience? What contextual factors influence how customers' form their evaluations in these situations? • How can (and should) actors reconfigure offerings within a service network to improve congruency and fit, thereby enhancing the customer experience? • How do value-creating practices and norms create congruency across realms?
Dynamic Capabilities and Resources	• How should organizations deliver feedback and increase perceptions of control so that customers are willing to participate in service experiences? How can education and training (for customers or employees) be leveraged in these situations? • Under what circumstances is global optimization (versus local optimization) of resources necessary to co-create superior customer experiences? • What can organizations offer to encourage high quality customer participation? What are customers' preferences in these situations? • Under what conditions is it possible to co-create services dynamically (in real time) versus asynchronously? For example, how can customized service be triggered by contextual cues?

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