UNIVERSITÄT BAYREUTH

Bayreuther Arbeitspapiere zur Wirtschaftsinformatik

Christoph Buck, Chris Horbel, Tim Kessler

A FOUR-FACTOR FRAMEWORK OF CONSUMERS' PERCEPTION OF MOBILE APPLICATIONS IN CONTEXT

A FOUR-FACTOR FRAMEWORK OF CONSUMERS' PERCEPTION OF MOBILE APPLICATIONS IN CONTEXT

ABSTRACT

Mobile applications are not only integral to the functioning of smart mobile devices (SMD) but also one of the most commonly used technological interfaces within smart networks of connected devices. In order to market these value propositions, companies have to understand how consumers perceive apps in order to present an interface that is well received and allows for the highest benefits for companies and customers alike. From a technical perspective, apps are complex software products, but consumers do not seem to perceive them as such, because they see apps through the "lens" of context. Thus, the context in which apps and associated services are purchased and used considerably influences the way consumers interpret apps and derive value from them. Therefore, this article sheds light on consumers' perception of apps and the role of context in shaping this perception. Based on Yoo's (2010) framework of experiential computing, we develop a framework in which context is structured into four dimensions: personal, technical, functional and social. The framework can be used to get a better understanding of consumers' app perception and related experience and to successfully develop and market apps, provide smart services based on adequate information systems, design app stores, or regulate the legal environment. Moreover, the framework can be applied to other mobile or digital offerings and serve for a better understanding of the perception of value propositions like smart services and devices.

Keywords: Mobile Applications; Experiential Computing; Context; Perception; Consumer Behavior

A FOUR-FACTOR FRAMEWORK OF CONSUMERS' PERCEPTION OF MOBILE APPLICATIONS IN CONTEXT

1. INTRODUCTION

Mobile applications (apps) are integral to the functioning of smart mobile devices (SMD) like smartphones or tablets and are key elements for the interface design and functionality. For many online-based or technology-related value propositions, apps therefore are one—if not the most commonly used—of the technological interfaces within a smart network of connected devices. In order to market these value propositions, companies have to understand how consumers use and perceive apps in order to present an interface that is well received and allows for the highest benefits for companies and customers alike.

From a technical perspective, apps can be characterized as complex software products embedded in mobile ecosystems, which have access to users' private data. While some consumers take possible downsides (e.g., privacy and data security issues) of using apps into account before they decide to download them, for many the possible conveniences of an app based (smart) service will outweigh such concerns (Tam et al. 2010). Looking at the way consumers download and use apps, it can only be assumed that consumers do not carefully consider these characteristics in their decision-making processes (Besmer and Lipford 2010). For example, many consumers do not extensively search for information about the application, but buy or download and use apps rather impulsively as an answer to an immediate need or to establish an interface connection with technical gadgets (Buck et al. 2014).

The technical characteristics of apps can be exploited by the app provider or other users of app-generated data in a way that is not desired by the consumer. Linked with other information stored in a SMD, they allow providers to receive an extensive picture of their interests, needs and thoughts. This problem is even more serious since many consumers are not (fully) aware of the technical characteristics and capabilities of apps because there is a difference between the technical and consumers' perspective on apps (King et al. 2011). This calls for suitable mechanisms in order to accommodate for consumers' security and privacy needs while enabling easy access to relevant information.

The observation that consumers seem not to consider the technical characteristics of apps to a large extent, but perceive apps in a different way, cannot be neglected. Therefore, perception must be understood in order to be able to successfully develop and market apps, provide smart services based on adequate information systems, design app stores, or regulate the legal environment.

Consumer perception is considerably influenced by the context in which a buying decision is made and in which apps and associated services are used, i.e., it is affected by the set of information, places, objects, and actors that characterizes the consumption situation and is relevant for the interaction between a user and an application (Dey 2001). Environmental cues including physical, technical and social factors considerably determine consumers' decision making processes. In addition, consumers' perception depends on personal factors, e.g., a consumers' previous experience, knowledge in a product category, or personality.

The importance of context for customers' perception and behavior is also reflected in growing streams of research in marketing and consumer behavior that focus on how firms and

customers collaboratively create value (Arnould and Thompson 2005, Vargo and Lusch 2008). Context influences the value created for customers as the resources (e.g., social resources, symbolic resources, institutional resources)which can be integrated in a value creation process are determined by the context (Akaka et al. 2015).

Even though apps and desktop software share a number of common technical characteristics, consumer buying and usage styles are completely different. It can therefore be assumed that the contextual factors of app consumption differ considerably from the consumption contexts of other technical products. Since apps are used as customer interfaces for a plethora of smart services and value propositions based on connected devices like smart home or connected living (e.g., Nest, Sonos, Philips Hue, August Smart Lock, etc.) and wearables (e.g., Jawbone, Apple Watch, Fitbit, Athos, etc.), understanding consumers' perception of apps is also fundamental for the providers of integrated or networked technological offerings.

This article aims to shed light on the consumer perspective of apps by discussing how apps and their acquisition and usage are perceived by consumers. While acknowledging that a multitude of factors influences consumers' perception and behavior (Ajzen 1991), the focus of this article is on the context of app consumption as an important determinant of consumers' perception and subsequent behavior. The result of this analysis is a four-factor framework which broadens the perspective of Yoo's (2010) conceptualization of 'environment' in his framework of experiential computing. We propose to structure the context of app consumption in four dimensions: personal, technical, functional and social. This will provide the grounds for a more thorough understanding of consumers' perception of apps as it enables us to see apps through the consumer's lens. The framework can serve firms to predict consumers' buying and usage behav-

ior of apps and enable them to tailor their offerings to consumers' needs. The improved understanding of users' perception in context therefore also enables companies to design apps that are used as a technical interface to other networked devices that are the basis for innovative business services.

The article is organized as follows. We start with a description of the actual technical characteristics of apps and their role as means for everyday life computing. Afterwards, we illustrate how apps are perceived by consumers and discuss reasons, why this perception differs from the objective technical characteristics. We then focus on the context of app consumption as a central determinant of consumers' perception and experience of apps. We propose an extension of Yoo's (2010) framework of experiential computing which includes the concepts of context and perception. We suggest structuring the multitude of potential contextual factors into four dimensions to allow for their analysis by app providers. We conclude with a summary of the findings, a discussion of their implications and suggestions for future research.

2. A FUNCTIONAL AND TECHNICAL CHARACTERIZATION OF MOBILE APPLICATIONS

2.1 Apps as everyday life computing

Apps, like traditional software, can be characterized as closed and not integrated software packages, which are dependent on their underlying OS (Egele et al. 2011). Apps are "application software programs, which use web and cloud applications and run on SMDs. They can be purchased and installed depending on their operating system and perform (highly fragmented) eve-

ryday tasks. Importantly, apps are embedded in mobile ecosystems, i.e. OS-based platforms which provide profile-bound ubiquitous services for mobile devices" (Buck et al. 2014).

Apps can be seen as the embodiment of ubiquitous computing, i.e. the creation of environments saturated with computing and communication capability, integrated with human users (Weiser 1991). While ubiquitous computing focuses on hardware components, today's apps are the logical consequence of experiential computing, the "digitally mediated embodied experiences in everyday activities through everyday artifacts with embedded computing capabilities" (Yoo 2010).

Apps in combination with SMDs and external sensors and connected devices can be regarded as today's archetype example of ubiquitous computing. At the same time, this development has considerably contributed to the emergence of a new type of users of computing. These new users highly integrate apps in their everyday lives, which leads to fundamental changes in the ways in which users interact with computing devices and systems (Venkatesh et al. 2012).

SMDs provide an interface for a vast plethora of external and internal sensors and technical features. Combined with ever-increasing processing power, storage capacity, communication bandwidth, and ever-present WiFi access, mobile technology turned the vision of ubiquitous computing into reality. The combination of tangible computing, the digitalization of everyday artifacts, and the global infrastructure already became manifest in the everyday live integration of apps.

Thus, apps are the most common user interface to merge the broad opportunities given by the connected sensors and device. Dependent on the underlying permission and functionality of the app, it connects several kinds of data, enable new value propositions and provide effective

digital solutions for needs previously addressed in a non-digital way. Apps can be used to perform every kind of task and users benefit while handling their everyday routine. Everyday activities, e.g., comprise navigation, buying lists, communication, scheduling, gaming, information, sports, and learning are almost 'naturally' carried out or supported through the use of apps, or as Apple puts it in one of their slogans: "There is an app for that" (Apple 2014). This slogan addresses the broad scope of applications apps are used for. Apps represent today's most common digital user interface for every kind of digital and smart consumer-centric services

Years ago, IS scholars have begun re-examining the notion of users. Lamb and Kling (2003) point out that the traditional notion of users is not broad enough for the complex social reality of organizational computing. They highlight the importance of contextual and environmental factors and note that users of information systems are socially embedded in networks of relationships that mobilize the exchange of information and the use of information systems. According to Yoo's (2010) line of reasoning, experiential computing is enabled by the mediation of all dimensions of human experiences through digital technology. Therefore, he suggests reconsidering and broadening the notion of users as users of experiential computing that are rather ordinary individuals outside of organizations (Yoo 2010; Venkatesh 2012).

As apps primarily address consumers, we further extend this perspective to users of SMDs and apps and turn the spotlight on consumer mass markets. In order to understand how consumers perceive apps and how their perception influences their behavior, the context, in which consumer decision making processes take place, needs to be analyzed. Hence, the characteristics of the context of the consumption of apps and its impact on consumers' perception must be determined.

2.2 Mobile applications from a technical perspective

With regard to their technical nature, mobile apps can be classified as software. Software is defined as "the entire set of programs, procedures, and related documentation associated with a system and especially a computer system" (Merriam-Webster 2014). The technical architecture of apps is characterized by a distributed system, using client-server principles (Tanenbaum 2013). The SMD transfers information from the backend-server, e.g., storage and computing capacity. The partitioning between client and server can vary depending on the capability of the device and the architecture of the app. Furthermore, software products can be classified into two main groups: standard software and individual software (Kirchmer 2009). Standard software is a pre-developed and completed software package which provides a uniquely defined set of applications for the mass market and can be purchased in the open market. Individual software is developed for a single entity and provides a customized problem solution. Apps are pre-developed software packages which are sold via online stores to the mass market and thus can be characterized as standard software.

Depending on the degree of information transfer, apps can be categorized as either 'thin' or 'fat' clients. Thin clients represent optimized output and input screens on the SMD, whereas the information processing is mostly done by the connected server. Fat clients are 'stand-alone apps' which do not need to communicate with the connected server intensely.

Based on these parameters, apps can be classified on a continuum between native and non-native apps. Native apps match to the underlying operating system (OS) and are developed in the corresponding coding language. As a result, native apps using OS interfaces, have access to broader device functionalities, and are able to store data on the device itself. Furthermore, native

apps have access (given there is no permission control) to stored, personal data like directory, IMEI, GPS, camera, etc.

Due to resource limitations of SMDs, many apps, especially apps with interaction and a broad range of functions, are connected to (backend-) servers. The archetype of such non-native apps can be seen in web apps. For web apps, the web browser provides the runtime environment, the SMD is only a thin client for the input and output interface. The major part of the computer performance is carried out by the server. Web apps are OS-independent, but need permanent web access to provide their services. Web apps have only limited access to the functionalities and sensors of the hardware. As most apps combine the characteristics of both types, they are so-called hybrid apps with a native OS-linked and a non-native web-linked program part (Gerrig 2012).

3. PERCEPTION OF MOBILE APPLICATIONS

3.1 The relevance of context

Consumers' perception and the resulting decision-making processes and behavior are highly affected by the context in which they take place (Gerrig 2012). Consumer behavior is often triggered by environmental cues, i.e. by the consumption context (Dijksterhuis et al. 2005). Research on the "perception-behavior link" shows that consumer behavior is often highly imitative and influenced by the social environment. Furthermore, research on "automatic goal pursuit" implies that goal-directed behavior can proceed unconsciously, only guided by the environment (Aarts and Dijksterhuis 2000). The specific characteristics of the context of app consumption must be analyzed in order to understand consumer behavior. The notion of context, which for-

merly emerged in various fields of research like psychology and philosophy, draws increasing attention in the IS domain (Bolchini et al. 2009, Dybå et al. 2012).

While early attempts resulted in enumerations of examples or choosing synonyms for context (Bauer 2012; Dey 2001), a basic definition of context is: "Context is any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and application themselves" (Dey 2001).

Extant IS research provides several approaches that deal with context from a technical perspective focusing on context awareness. Yoo (2010) criticizes the technical focus of these approaches and presents a framework for experiential computing, which emphasizes the interaction between consumers and four dimensions of the "world", i.e. their environment (time, space, other actors, and artifacts). Furthermore, Bauer (2012) presents a comparison and validation of 13 context meta-models and identifies six overarching context categories which she refers to as context dimensions: "physical world", "individual", "social groups", "activity", "technology", and "change over time".

These recent developments demonstrate that the traditional technical anchoring of the context dimensions discussed in IS alone are no longer regarded a solid foundation for the explanation of consumer behavior in mobile computing. Taking the rapid development of app markets and mobile computing into account, individual perception of apps becomes increasingly important. Yoo's (2010) conceptualization of the environment into four dimensions (time, space, other actors, and artifacts) can serve as a starting point and guideline for understanding how consumers experience the use of apps. However, this framework should be extended to (1) incorpo-

rate the broader notion of context and (2) account for consumers' perception of the contextual elements.

The specific architecture of the app purchase channel can serve as a springboard for the analysis of the context of mobile app consumption because it accounts for the unique purchase situation of apps. Access to applications is only provided through the user's SMD, leading to a strong connection between the device and the app in consumers' minds, i.e. the consumer's perception of apps is strongly influenced by their perception of the SMD itself (Ponemon Institute 2014). OS providers and the leading app stores have strict requirements with regard to the design of apps in order to create a 'one face to the customer' feeling. Hence, from a customer perspective the app store brand is often transferred to the apps that are available there. Consequently, users often perceive apps as 'part' of the SMD and the underlying OS, respectively. However, the actual context of app consumption reaches beyond the predominant exclusive app purchase channel. When deciding on app purchases, consumers are also confronted with and include information from actors outside their mobile ecosystem, e.g., from their social groups or other external sources of information, including reports in various media or external ratings (Buck et al. 2014).

Furthermore, app consumption also includes consumers' app usage behaviors and even the deletion of apps. Consequently, the analysis of the context of app consumption cannot be limited to the technical characteristics of the app purchase channel, but must include all factors that are relevant for consumers' perception of apps and their behavior.

3.2 The dynamics of mobile consumers' perception

While, from an objective technical point of view, apps can be classified as standardized traditional application software, mobile consumers "act and react on the basis of their perceptions, not on the basis of objective reality" (Schiffman et al. 2012). According to Schiffman et al. (2012) perception can be described as "the process by which an individual selects, organizes and interprets stimuli into a meaningful and coherent picture of the world."

Based on the assumption of a limited 'app-literacy' of average mobile consumers and the resulting high information asymmetries, we argue that there is a large gap between objective and perceived reality in the field of apps.

Dynamics of perception constitutes one of the major principles of perception since "raw sensory input by itself does not produce or explain the coherent picture of the world that most adults possess. Indeed, the study of perception is largely the study of what we subconsciously add to or subtract from raw sensory inputs to produce our own private picture of the world" (Schiffman et al. 2012).

However, receivable stimuli when using SMDs and apps are rather limited, due to their classification as binary goods. When using apps, consumers can only receive sensory input via their eyes, ears and skin. These sensory inputs, e.g., the design of apps, noises, vibrations or touch screen response, independent from their objective characteristics, affect consumers' actions, their buying habits, their leisure habits and so forth (Blackwell et al. 2006).

According to the psychological and physiological bases of human perception mobile consumers receive, besides the input of physical stimuli, another type of input which is provided by

themselves in the form of particular predispositions based on previous experiences. "Individuals are very selective as to which stimuli they 'recognize'; they subconsciously organize the stimuli they do recognize according to the widely held psychological principles, and they interpret such stimuli (they give meaning to them) subjectively in accordance with their personal needs, expectations and experiences" (Schiffman et al. 2012).

The three main aspects of perception are: selection, organization and interpretation of the received stimuli. The perceptual selection explains the fact that consumers subconsciously exercise a great deal of selectivity according to individual aspects of the environment they perceive. This can be affected by consumers' past experiences, their expectations and their motives. These factors give rise to four important concepts concerning perception: selective exposure, selective attention, perceptual defense and perceptual blocking (Schiffman et al. 2012; Goldstein 2014).

However, consumers do not experience the numerous stimuli they select separately and discretely. They rather tend to organize them into groups and perceive them as unified wholes. Hence, the perceived characteristics of individual stimuli are viewed as a function of the whole to which the stimulus seemingly belongs (Schiffman et al. 2012).

Thus, perceptual organization, based on the principles of figure and ground, grouping and closure, considerably simplifies life for the individual.

3.3 Reasons for consumers' distorted perception of mobile applications

As discussed above, everyday life integration and the fact that apps perform highly fragmented tasks must also be considered when consumer behavior is to be understood in the context of app consumption.

Both aspects contribute to specific consumer buying styles, which can be characterized as limited (e.g., buying another app from a known provider), habitual (e.g., buying habitually from the same app store) or impulsive (e.g., buying an app because of a sudden realization of a specific need) and lead to only low levels of information search during the decision-making process (Blackwell et al. 2006).

The high acceptance of apps results from the nearly perfect match between consumers' interests and needs and the opportunities arising from the technical integration of apps. Apps are third-party offerings and only rarely purchased from the same party repeatedly. However, the perception of apps is organized in a special way. Within the mobile ecosystem, a wide range of apps are offered via the OS-integrated app store. App stores are classical examples for two-sided markets, in which the store solely has intermediary functions and provides the infrastructure. While the consumer in fact buys the app from the app publisher, the app store suggests a different scenario. The visual standardization of the apps and the similar processing of nearly all transactions may lead to the perception of a homogeneous app offering by the provider of the ecosystem. A possible explanation for such distorted perceptions may be provided by the principle of the perceptual organization of figure and ground, which implies that stimuli ('figures') are more likely to be noticed when they are in contrast to their environment ('ground') (Belk 1975).

Consequently, it is getting more difficult for consumers to become aware of stimuli if there are no large contrasts between the stimuli and the environment. In the context of app consumption the 'ground' can be seen in the mobile ecosystem, which forces the app publishers to follow the strict standards of the platform. These standards include rigid design templates and security reviews which lead to a homogeneous product presentation of apps. Moreover, the entire

purchase transaction, including the search process, download, and payment handling, takes place in a standardized environment. As a result, the lines between the app as the 'figure' and the 'ground' become blurred and the app is not greatly distinguishable. Consequently, the app is not perceived as a third-party-application but as part of the mobile ecosystem.

Furthermore, consumers tend to group stimuli to form a unified picture because "the perception of stimuli as groups or chunks of information, rather than as discrete bits of information, facilitates their memory and recall" (Schiffman et al. 2012). Experiences and previous knowledge are not related to the final product (the app) but driven by the ecosystem. Consumers repeatedly buy apps, but usually these are very different software products from various publishers. However, many consumers do not realize this diversity concerning the publishers because they group apps of various publishers in their perception.

Additionally, individuals have a need for closure, i.e. a preference for complete pictures. Hence, they organize their perceptions in a way that they form a complete picture, even though the pattern of stimuli they are exposed to might be incomplete. Individuals have the capacity to consciously or unconsciously fill in the missing pieces (Schiffman et al. 2012). This might explain why consumers frequently seem to purchase apps without having complete information about them. They fill their knowledge gaps on the basis of their past experiences, expectations, motives or assumptions.

Apps are further characterized by a high fragmentation of the range of functions they provide. As a consequence, consumers minimize apps to small daily helpers. This may lead to habitualization when purchasing apps since consumers tend to prefer familiarity with daily products (Blackwell et al. 2006). Habitualization generally leads to an adjustment of the risk preference as

it can be understood as a learning process. With positive, repeated experiences, a cognitive relief occurs; the perception of potential risks decreases and the habitual purchase process is strengthened.

The very special technical and functional context of apps leads us to the conclusion, that apps are not perceived as what they are: highly complex software products. In the following, we will demonstrate the possible consequences of this perceptual gap by focusing on consumers' perception of privacy and security issues regarding apps. We show how perception can lead consumers to a selective and distorted perception regarding their privacy and security when downloading apps and that this can result in severe misinterpretations.

3.4 Consumers' privacy and security perception

With the download of an app, consumers potentially give away their personal data without knowing what the publisher or the OS provider is using it for. Although a considerable amount of information on the use of consumers' data is provided within the app stores, it is questionable if consumers use and evaluate the information in a suitable manner. The minimized information consumption and its misinterpretation are caused by the distorted perception of apps and therewith by the distorted risk perception.

We could assume that the apps are promoted on external sources like websites and commercials and may already be used by family, friends, and colleagues. In this case, the expectations and motives of the potential app consumer are probably highly affected by information from sources outside of the actual ecosystem, in which the application is implemented, i.e. from the consumption context. These external stimuli may lead to high functional expectations and deter-

mine the motivation for downloading the app. Such a decision-making process is driven by selective perception. As consumers actively seek for information that they find pleasant or rely on information sources they like, they are confronted with a selective exposure of information regarding privacy and security. When downloading the known apps, consumers can be expected to have a high awareness of stimuli that meet their needs and interests, e.g., functional requirements with regard to the support the app provides in increasing their experience (Stoll et al. 2008). Privacy and security information, e.g., the trustworthiness and credibility of the app publisher or the personal information that is used and stored by another party, can be seen as stimuli which are of minor relevance to the consumer he downloads the app. This selective attention to the relevant privacy and security information is supported by the perceptual organization of figure and ground mentioned above.

In addition, selective attention may result in perceptual defense and perceptual blocking of privacy and security information which do not fit with the situational needs. Selective perception and the perceptual organization may lead to perceptual distortions regarding privacy and security when downloading an app. This is caused by the perceptual interpretation in the decision-making process.

First, consumers tend to attribute the app qualities, e.g., the trustworthiness and credibility, to certain people or institutions. However, these parties are not part of the buyer-seller relationship between the consumer and the app publisher.

Second, consumers frequently use stereotypes, i.e. pictures of meanings of stimuli, which determine their expectations. It can therefore be assumed that they use their experiences with similar apps as stereotypes which form their assumptions on what from external sources known

apps will be like and how their privacy and security will be treated, even though they have no previous experience with the app publisher.

Third, first impressions of using the mobile ecosystem and downloading an app tend to be lasting. The download-process and the design or layout of apps is highly standardized by the ecosystem provider. According to the figure-and-ground principle, consumers build a first impression of the app download which does not take into account that almost every app download is a transaction with a yet unknown partner.

Fourth, consumers tend to jump to conclusions "before examining all the relevant evidence" (Schiffman et al. 2012). In terms of privacy and security risks when downloading an app, consumers might not seek the necessary information concerning the publisher and the software product itself, but conclude that the app is trustworthy because they trust the i.e. brands, companies, or institutions and download the app without reviewing the relevant information.

This could fifth be supported by the halo effect. Consumers could evaluate the third-party application by only relying on one or a few dimensions, for example the ecosystem-affiliation and recommendations of other consumers (Nisbett and DeCamp Wilson 1977).

As discussed earlier, through habitualization the perceived risk of purchasing an app decreases when consumers buy more apps. In addition, perceived risk is reduced through multidimensional trust relationships. To reduce the risk of a bad buy, consumers try to collect information from their social environment. Furthermore, two different concepts of trust have to be distinguished: organizational trust and system trust. Trust in the ecosystem (system trust) can outshine the information asymmetries between the app publisher and the consumer (Nisbett and

DeCamp Wilson 1977). Consumers might not thoroughly assess privacy and security issues because of the user experience that is facilitated through the ecosystem-integration.

This leads to a shift in consumers' perception, which causes a fundamental gap between the nature of mobile apps and the app-perception from a consumers' perspective. Thus consumers do not need sophisticated information to overcome the existing information asymmetries, as they are generally not aware of them. This fundamental change in software perception is caused by the habitualized purchase process and the perception of apps comparable to fast moving consumer goods or standardized services. As a result, consumers' risk evaluation can be distorted which might at least partly explain consumers' 'ignorance' with regard to privacy and security issues when purchasing apps (Felt et al. 2011).

4.   A CONTEXT FRAMEWORK OF MOBILE APPLICATIONS

The above considerations illustrate that the understanding of apps' technical characteristics is not sufficient in explaining how consumers use apps in their everyday lives. Instead, consumers' perception of apps is central. One aspect should be given particular attention in these considerations: compared to the users of technically quite similar 'traditional' desktop software products, users of apps are to a great extent private and individual consumers, i.e. they do not act as members of organizations. In addition, the app itself is very often not the focus of the user's attention. Instead, apps are often a 'tool' to carry out some focal activity. Thus, the use of apps might only take place "on the periphery of other activities" (Yoo 2010, p. 217). Consequently, apps can be interpreted as the current embodiment of experiential computing with the logical consequence that computing becomes 'invisible' (Yoo 2010).

In his framework of experiential computing, Yoo (2010) suggests that individuals' experiences can be understood as interactions between a subject and its environment. Time, space, other actors and artifacts are the dimensions that characterize this environment and experiential computing takes place when digital technology is used to mediate the human-environment interaction. Thus, understanding experiential computing requires understanding the users' environment. Similarly, Dybå et al. (2012) suggest, that researchers should use a context 'lens' and first analyze the 'who, what, when where and why' in order to understand how and why individuals perform certain activities.

This perspective is supported by growing streams of research from the fields of consumer behavior and marketing – consumer culture theory (CCT) (Arnould and Thompson 2005) and service-dominant logic (Vargo and Lusch 2008, 2015). Both research streams emphasize the significance of the context of value creation for shedding light on market-related experiences (Akaka et al. 2015). In general, context can be defined as the situational opportunities and constraints that affect behavior as well as their interrelationships (Johns 2006). It often has significant impact on the way we interpret our environment: a change in context causes a transformation in the actor's perception of the reality, even when the reality is not changed (Bolchini et al. 2009). It is widely agreed that each purchase decision is affected by the environmental context in which it takes place (Vargo et al. 2011). Consumers perceive an offer of a provider depending on the context in which they make their purchase decision or use the app. Hence, both the 'actual' characteristics of the app and contextual factors shape consumers' perception, whereby the 'actual' characteristics can be changed, (mis-)interpreted, neglected, be given more or less weight, etc. In the case of mobile apps, for example, consumers often ignore (some of their) technical character-

istics, do not fully understand their implications, or do not give them high priority in their decision-making processes. As a result, there can be a considerable gap between the actual technical characteristics and consumers' perception of an app, which results from the mediation of consumers' perception by the context.

Due to the considerable perceptual gap in app consumption and the novelty of this ecosystem environment it is worthwhile to shed light on its specific contextual factors to better understand consumers' perceptions in order to predict their behavior in mobile markets and tailoring the offers to their needs. While the conceptualization of the environment into four dimensions (time, space, other actors, and artifacts) (Yoo 2010) provides a good basis, it should be enhanced by applying the broader concept of context, which inherently includes consumers' perception of their environment.

In the following, we therefore propose a consumer-centric framework (figure 1) which structures the context of app consumption into four dimensions, discusses their interrelationships, and demonstrates how these dimensions influence consumers' perception of apps. This framework will complement current findings and enable researchers and practitioners to get a better understanding of consumer behavior in mobile markets.

Insert figure 1 about here

The first context dimension, the *personal context*, is pivotal for our perspective on consumer behavior regarding apps. As opposed to the organizational view on computing, which sub-

ordinates a hermeneutical or alterity relationship between technology and users, the personal context incorporates the individual relationship of consumers, their apps, and the used mobile device. Thanks to the ability of performing everyday tasks on the basis of the resources of the used device, apps can be highly integrated in consumers' everyday life. The more this integration advances, the more it leads to high and increasing lock-in effects.

According to the everyday life integration, the relationship to the used device is massively changing in terms of the sphere of privacy. Consumers permanently carry their SMDs with them. This leads to a shift of computing technology regarding the sphere of privacy since SMDs and apps are practically worn at the body and capture a privacy sphere similar to wristwatches, purses, and handbags. Calendar apps, for example, are often not only used by consumers to structure their days, but rather tell the story of their business and private lives. They include highly personal data, remind users of their tasks, and are highly integrated with other applications and support their functions.

As suggested by the concept of value-in-use (Vargo et al. 2011), the personal context further includes the individual characteristics of the consumers as these determine which personal resources are available to them when they buy and use apps. In particular consumers' previous experience and their app literacy determine to what extent they are able to understand the complexity of apps as software products and perceive them accordingly. Consumers' experience also highly determines the ways in which apps are used. Some consumers might only use the most basic functions of a calendar app (e.g., structuring their daily schedules), whereas more experienced users will make use of the various opportunities to integrate it with the functionalities of other apps and even other software and hardware products.

The *technical context* dimension in this framework is also seen from a consumer-centric perspective and refers to the concept of integration. To participate in the addressed IT ecosystem, consumers have to fulfill two fundamental requirements: one is hardware-driven and the other one is software-driven. The first, hardware-driven context requirement is the use of the SMD as a system entry device. Moreover, many apps also need to have access to the resources of the used SMD to perform their tasks.

The second requirement is the software-driven constraint in using SMDs and apps. SMDs are delivered with a pre-installed rudimentary operating system (OS) which constitutes the connection to the mobile ecosystem on the consumer side. Apps are embedded in mobile ecosystems, i.e. OS-based platforms which provide profile-bound ubiquitous services for mobile devices. Consumers have to register with a verified personal profile when they want to use the SMD and thus, when using apps. Furthermore, apps have to fulfill strict standards imposed by the OS-provider and based on the respective standard development kit made available by the OS-provider. These standards include the monopolistic distribution channel via the OS-integrated app store, intra-app store presentation requirements (e.g., structure, design, access privileges) and general policies (e.g., security regulations, guidelines for updates, licenses).

The *functional context* dimension addresses the concept of usability – not in a technical way, but from the consumer's perspective. For the first time in computing history, highly fragmented software is made accessible to the mass consumer market. Based on the technical context, apps can be used right away and do not force the consumer into a complex installation procedure. Apps are offered in the ecosystem-integrated app store. Consumers can search and download them in their familiar environment. The ecosystem integration allows consumers to build up their

individual set of apps without carrying along a bundle of needless software features. Consequently, consumers are able to acquire apps that completely match with their needs and are usable from the moment of download.

Finally, the *social context* considerably determines consumers' perception of apps and their experience of using them. Social context specifically refers to the dependency of individuals' perception on their relative position in society, i.e., the importance of their relationships and interactions with others (Edvardsson et al. 2011). The social context not only influences consumer behavior, if they directly interact with others. It can also affect decisions and behaviors indirectly, for example through social norms or assumptions about others' evaluations of activities. Hence, social context often determines perception and behavior at a subconscious level.

In addition, consumers' perception of apps and usage behavior also depends on the structural dimension of the wider social context (Edvardsson et al. 2011). These structures, i.e., institutions (e.g., norms, meanings, symbols, laws, practices) and institutional arrangements (interrelated sets of institutions) are not only essential to facilitate interaction and collaboration within social systems, but also influence how consumers interpret apps and determine value from them (Vargo and Lusch 2015).

For example, combining the simple individual activity of running with the use of a running app (e.g., RunKeeper) or a smart wearable and sharing the activity with the social network can transform it into a social experience that has many layers of meaning (Yoo 2010). As examples from instant messaging, gaming, and other collaborative or communicative apps show, not participating can even lead to social marginalization. Moreover, in mobile ecosystems consumers are confronted with high information asymmetries and unknown social relationships. App stores

host thousands of anonymous apps and consumers have to trust in unverified sources of information.

5. DISCUSSION

By focusing on consumers' perception and building upon the extensive knowledge that has been developed in consumer research and related fields, e.g., psychology, anthropology, and sociology, we follow Yoo's (2010) suggestion to broaden the scope of the IS field by including perspectives of other research domains. These perspectives were integrated into the development of a framework which structures the characteristics of the app consumption context into four dimensions: personal, technical, functional, and social context factors.

Now we discuss the application of the framework to consumers' privacy and security issues and discuss how context and perception could affect consumers' adaption of several smart services in their everyday life activities (in terms of ubiquitous and experiential computing).

With the download of an app, consumers potentially give away their personal data without knowing what the publisher or the OS provider is using it for. Although a considerable amount of information on the use of consumers' data is provided within the app stores, it is questionable if consumers use and evaluate the information in a suitable manner. The minimized information consumption and its misinterpretation are caused by the distorted perception of apps and therewith by the distorted risk perception. This kind of perceptual distortion could also affect the acquisition and exploitation of smart services such as components of smart homes and fitness trackers because of their tracking, storing and aggregating capabilities and their underlying interconnectivity. Based on the superficial benefits of the services, consumers expose highly sensitive

personal data and intimate insights into their everyday life. From this perspective, the consumption of smart services is paradox. While from a security perspective, app-based smart services are considered interconnected applications, partially equipped with extensive and critical access privileges, consumers do not perceive them as such.

The described paradox regarding the buying decision and the information privacy depends on the context in which it takes place. Due to the extensive information asymmetry between app publishers or providers of smart services and users, the purchase decision should be characterized by extensive and intensive information processing. Information should be collected and evaluated in order to make a cognitively controlled choice (Aarts and Dijksterhuis 2000; Blackwell et al. 2006). In terms of apps, the purchase decision seems to be a limited purchase, where consumers do no longer search for and analyze all accessible information. They concentrate on certain key information, e.g., the price, user reviews and recommendations. Consumers' emotional and cognitive involvement related to the purchase is rather low (Buck et al. 2014).

While the factors that characterize the context of app consumption can be broadly structured into four dimensions, it should be kept in mind that there are interdependencies between these dimensions. Personal and social context characteristics are often closely related as for example both types of characteristics are highly important for the perception and use of communication applications, such as social media apps. At the same time, the decision to purchase and use such applications is highly influenced by the availability of the app for different OS, i.e. a technical context characteristic, because consumers in one social group might be users of various OS, but nevertheless want to use the same app for communication purposes.

We discussed that consumers' perception and the resulting decision-making processes regarding the consumption of apps are highly affected by the context in which they take place. However, in contrast to most of previous IS research, we suggest that the context of app consumption cannot be limited to the technical characteristics of the app purchase channel, but must include all the factors that are relevant for consumers' perception of apps and their resulting behavior.

The three main aspects of perception are: selection, organization and interpretation of the stimuli app consumers are exposed to. These aspects lead to a fundamental mismatch between the determined nature of mobile apps and the app-perception from a consumers' perspective. This leads to a paradox: consumers do not need sophisticated information to overcome the existing information asymmetries between themselves and the app publishers, as they are generally not aware of them. This fundamental change in software perception is caused by the habitualized purchase process and the perception of apps comparable to fast moving consumer goods or standardized services. Due to the very special technical and functional context of apps, they are not perceived as what they are: highly complex software.

As we know from research in the field of consumer perception, there is a gap between objective circumstances and the subjective perception of product consumption (Blackwell et al. 2006). We therefore propose that the context in which app consumption takes place, is a central explanation for the existence of the perceptual gap regarding apps. Our four-factor framework highlights our major considerations: We assume that the risk perception is distorted by an inadequate perception of apps. In app purchase decisions, information asymmetries are objectively high, but consumers do not act accordingly in the marketplace.

The context appraisal can also be transferred to consumers' perception of smart services that are based on networked technologies. Value propositions in the range of smart home connect gadgets that regulate the room temperature and control the light, sound system, and different household appliances. Wearables and fitness trackers assist consumers with tracking their sports activities, sharing their exercises with a community of like-minded people or documenting their health level and using health and fitness-related smart services. While the decision for certain smart home applications can be determined by the technical and functional context since these value propositions are dominated by their technological capabilities, the necessity to comply with standards, and their usability and ecosystem integration. The customer's decision for wearables and fitness trackers is rather determined by the personal and social context. Direct physical contact with the respective gadget, ostentation, and peer-group pressure are some of the main context aspects for these value propositions.

Admittedly, the context is slightly different with these examples. Consumers invest a considerable amount of time and money for the selection and purchase of smart home solutions and wearables that satisfy their needs. Therefore their decisions to buy and use these solutions should be deemed more judicious. However, they are still framed by the individual context and apps are the most common interface.

Consequently, companies have to understand how consumers use and perceive these value propositions in order to successfully market them and present an interface that is well received and allows for the highest benefits for companies and customers alike.

6. CONCLUSION AND LIMITATIONS

This article has discussed apps as probably the most widely applied form of ubiquitous and experiential computing. By focusing on consumers' perception of apps in order to understand their purchase and usage of apps, we answer Yoo's (2010) call for expanding the IS research community's domain "by embracing the ubiquitous impact of computing in everyday life".

Our line of reasoning relates to and is backed by the research in fields such as consumer psychology and philosophy and we provide a suitable four-factor framework of context dimensions that helps understanding and categorizing the impact on users' perception. While the findings are very intuitive in general, our paper is strictly conceptual and there might still be some relevant impact factors that are not covered by the framework and its dimensions. Information privacy literature, for example, discusses the impact of information collected (functionality offered) on users' perception of information privacy with respect to IT offerings (Smith et al. 2011). Consequently, consumers might also not necessarily minimize apps to small daily helpers, but instead perceive apps differently depending on the functionality offered and the information collected.

Furthermore, the dimensions of our framework and the resulting impact on perception need to be tested empirically. While the contextual dimensions described in the framework are rather general, the actual contextual factors, their relative weight for consumers' perception and decisions, and their specific characteristics, can vary depending both on the app itself, but also on the consumer. Future research should therefor apply the framework to various apps and different user groups using both qualitative and quantitative empirical methods in order to validate and refine the framework. This could also be an important step towards the development of a frame-

work that can help to generally describe the consumption contexts of technical products and services.

While it is widely agreed that context is an important determinant of perception, this appraisal should also be further validated for app consumption. We provide a clear agenda for future research in this context. Applying the four-factor framework, future research should investigate the outlined gap between technical characteristics of apps and consumers' perception with an empirical mixed method approach. Based on the theory of figure and ground an app-generated experimental design should be applicable.

REFERENCES

Aarts, H. & Dijksterhuis, A. 2000. Habits as knowledge structures: Automaticity in goal-directed behaviour. *Journal of Personality and Social Psychology*, 78(1): 53–63.

Ajzen, I. 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50 (2): 179–211.

Akaka, M. A., Vargo, S. L. & Schau, H. J. 2015. The context of experience. *Journal of Service Management*, 26(2): 206-223.

Apple Inc. 2014. *Apple Trademark List*. URL: https://www.apple.com/legal/intellectual-property/trademark/appletmlist.html (Accessed 5 October 2015).

Arnould, E. J. & Thompson, C. J. 2005. Consumer Culture Theory (CCT): Twenty Years of Research. *Journal of Consumer Research*, 31(4): 868-882.

Bauer, C. 2012. A Comparison and Validation of 13 Context Meta-Models. *ECIS 2012 Proceedings*, Paper 17.

Belk, R.W. 1975. Situational Variables and Consumer Behavior. *Journal of Consumer Behavior*, 2(3): 157–164.

Besmer, A. & Lipford, H. 2010. Users' (Mis)conceptions of Social Applications. *Proc. GI 2010*, ACM Press (2010): 63–70.

Blackwell, R.D., Miniard, P.W. & Engel, J.F. 2006. *Consumer behavior* (10th ed.). Mason, Ohio: Thomson/South Western.

Bolchini, C., Curino, C.A., Orsi, G., Quintarelli, E., Rossato, R., Schreiber, F.A. & Tanca, L. 2009. And what can context do for data? *Communications of the ACM*, 52(11): 136–140.

Buck, C., Horbel, C., Germelmann C.C. & Eymann, T. 2014. The unconscious app consumer: discovering and comparing the information seeking patterns among mobile application consumers. *ECIS 2014 Proceedings*: 1–14.

Buck, C., Horbel, C., Kessler, T. & Germelmann, C.C. 2014. Mobile consumer apps: big data brother is watching you. *Marketing Review St. Gallen*, 31(1): 26–35.

Dey, A.K. 2001. Understanding and Using Context. *Personal and Ubiquitous Computing*, 5(1): 4–7.

Dijksterhuis, A., Smith, P.K., van Baaren, R.B. & Wigboldus, D.H.J. 2005. The Unconscious Consumer: Effects of Environment on Consumer Behavior. *Journal of Consumer Psychology*, 15(3): 193–202.

Dybå, T., Sjøberg, D. I. K. & Cruzes, D. S. 2012. What works for whom, where, when, and why?: on the role of context in empirical software engineering. *Proceedings of the ACM-IEEE international symposium on Empirical software engineering and measurement*, Lund, Sweden: 19-28.

Edvardsson, B., Tronvoll, B. & Gruber, T. 2011. Expanding understanding of service exchange and value co-creation: a social construction approach. *Journal of the Academy of Marketing Science*, 39(2): 327-339.

Egele, M., Kruegel, C., Kirda, E. & Vigna, G. 2011. *PiOS: Detecting Privacy Leaks in iOS Applications*. URL: http://www.seclab.tuwien.ac.at/papers/egele-ndss11.pdf (Accessed 18 September 2015).

Gerrig, R.J. 2012. *Psychology and Life* (20th ed.). Harlow: Pearson Education Ltd.

Goldstein, E.B. 2014. *Cognitive Psychology: Connecting Mind, Research and Everyday Experience* (4th ed.). Stamford, CT: Cengage Learning.

Felt, A., Greenwood, K. & Wagner, D. 2011. The Effectiveness of Application Permissions. Proc. WebApps 2011: 75-86.

Howell, J. & Schechter, S. 2010. What You See is What They Get: Protecting Users from Unwanted Use of Microphones, Camera, and Other Sensors. Proc. Web 2.0 Security and Privacy, 2010.

Johns, G. 2006. The Essential Impact of Context on Organizational Behavior. *Academy of Management Review*, 31(2): 386-408.

King, J., Lampinen, A. & Smolen, A. 2011. Privacy: Is There an App for That?. Proc. SOUPS 2011, ACM Press, 2011.

Kirchmer, M. 2009. *Business process oriented implementation of standard software. How to achieve competitive advantage efficiently and effectively* (2nd ed.). Berlin: Springer.

Lamb, R. & Kling, R. 2003. Reconceptualizing Users as Social Actors in Information Systems Research. *Management Information Systems Quarterly*, 27(2): 197–236.

Merriam-Webster 2014. *Full Definition of Software*. URL: http://www.merriam-webster.com/dictionary/software (Accessed 14 September 2015).

Nisbett, R. & DeCamp Wilson, T. 1977. The Halo Effect: Evidence for Unconscious Alteration of Judgments. *Journal of Personality and Social Psychology*, 35(4): 250–256.

Ponemon Institute 2014. *Smartphone Security*. Survey of U.S. consumers. URL: http://aa-download.avg.com/filedir/other/Smartphone.pdf (Accessed 10 October 2015).

Schiffman, L.G., Kanuk, L.L. & Hansen, H. 2012. *Consumer behaviour. A European outlook* (2nd ed.). New York: Pearson Financial Times/Prentice Hall.

Smith, H. J., Dinev, T. & Xu, H. 2011. Information Privacy Research: An Interdisciplinary Review. *Management Information Systems Quarterly*, 35(4): 989–1015.

Statista 2014. Mobile app usage - Statista Dossier, 2014, URL:http://www.statista.com/study/11559/mobile-app-usage-statista-dossier/.

Stoll, M., Baecke, S. & Kenning, P. 2008. What they see is what they get? An fMRI-study on neural correlates of attractive packaging. *Journal of Consumer Behaviour*, 7(3): 342–359.

Tam, J, Reeder, R.W. & Schechter, S. 2010. I'm Allowing What? Disclosing the Authority Applications Demand of Users as a Condition of Installation. Microsoft, 2010.

Tanenbaum, A.S. 2013. *Distributed Systems: Principles and Paradigms* (2nd ed.). Harlow: Pearson.

Vargo, S., Lusch, R., Horbel, C. & Wieland, H. 2011. Alternative Logics for Service(s): From Hybrid Systems to Service Ecosystems. In: D. Spath & W. Ganz (Eds.): *Taking the pulse of economic development. Service Trends*: 123–135.

Vargo, S. & Lusch, R. 2008. Service-dominant logic: continuing the evolution. *Journal of the Academy of Marketing Science,* 26(1): 1–10.

Vargo, S. & Lusch, R. 2015. Institutions and axioms: an extension and update of service-dominant logic. *Journal of the Academy of Marketing Science*, 1-19.

Venkatesh, V, Thong, J. & Xu, X. 2012. Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS Quarterly*, 36 (1): 157–178.

Weiser, M. 1991. The Computer for the 21st Century. *Scientific American,* 265(3): 94–104.

Yoo, Y. 2010. Computing in Everyday Life: A Call for Research on Experiential Computing. *Management Information Systems Quarterly,* 34(2): 213–231.

FIGURE 1

The context framework of app perception

Personal context   Technical context

App perception

Functional context   Social context