



Enabling smart retail settings via mobile augmented reality shopping apps



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ABSTRACT

Retail settings are being challenged to become smarter and provide greater value to both consumers and retailers. An increasingly recognised approach having potential for enabling smart retail is mobile augmented reality (MAR) apps. In this research, we seek to describe and discover how, why and to what extent MAR apps contribute to smart retail settings by creating additional value to customers as well as benefiting retailers. In particular, by adopting a retail customer experience perspective on value creation, analysing the content of MAR shopping apps currently available, and conducting large-scale surveys on United States smartphone users representing early technology adopters, we assess level of use, experiential benefits offered, and retail consequences. Our findings suggest that take-up is set to go mainstream as user satisfaction is relatively high and their use provides systematic experiential benefits along with advantages to retailers. Despite some drawbacks, their use is positively associated with multiple retail consequences. MAR apps are seen as changing consumer behaviour and are associated with increasingly high user valuations of retailers offering them. Implications for more effective use to enable smart retail settings are discussed.

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1. Introduction

A “smart” retail setting can be a beneficial way for a firm to generate greater customer and business value (Pantano and Timmermans, 2014). One “smart” approach that is increasingly recognised as having potential to create value for customers and retailers alike is the use of augmented reality (Huang and Liu, 2014; Pantano, 2014) in smart retail environments (Di Rienzo et al., 2015). Augmented reality is a smart technology that adds value to retailers by being able to influence customer engagement (Pantano, 2009) as well as purchasing decisions (Pantano, 2014) and can be varyingly used in-store and out-of-store including at home (Valkynnen et al., 2011).

Such studies, along with the broader research on augmented reality theory (Schmalstieg and Hollerer, 2016), mobile services (Saarijärvi et al., 2014) and experiential customer value (Huang and Liu, 2014; Mathwick et al., 2001; Salo et al., 2013) are indicative of the potential for MAR to provide multiple benefits to both customers and the smart retailers that offer them. Yet, a review of the pertinent literature nevertheless finds that there is still much to describe and discover about MAR to enable smart retail. The present study, therefore, seeks to contribute to this aim by focusing on the phenomenon of MAR shopping apps on smartphones and how, why, and to what extent they enable smarter

retailing. Specifically, the present study seeks to address the following research questions:

1. What is the nature of *experiential value* that currently available MAR shopping apps are offering users? Do such apps tend to emphasise particular types and/or combinations of experiential value? E.g., extrinsic and/or intrinsic experiential value?
2. To what extent are users expecting MAR shopping apps to provide them with novel experiential benefits in their retail shopping experiences?
3. To what extent are MAR shopping apps changing users' shopping behaviours as consumers? Is greater use of MAR shopping apps associated with increased valuations of retailers offering them?

To address these research questions, we first provide a theoretical background and conceptual development to understand how and why MAR as a service, a mobile service, and an augmented reality-based service, can add value in retail. Three hypotheses and a conceptual model are developed and presented. Following the description of our methodology, we present and discuss findings of analyses of currently available apps as well as findings of two large-scale surveys of smartphone users in the United States representing early technology adopters. In doing so, we obtain multiple insights into the benefits provided as well as identify some limitations of MAR apps acknowledged by users. Conclusions and implications in support of their more effective use for enabling smart

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retail settings are then provided. Finally, areas for future research are indicated as are limitations of the present study.

2. Theoretical background and development

2.1. Theoretical foundations

As MAR apps in and for retail are a relatively recent research phenomenon but also one of fast-growing interest, the purpose of our study is to describe and discover the phenomenon more completely as opposed to being concerned with its prediction and control (Lavery, 2003). Given research by Saarijärvi et al. (2014) on leveraging mobile services in the context of food retailing and its theoretical foundations of service and m-service, our research, too, shares these foundations as MAR apps are both service-based and mobile. Accordingly, the notion of service as business logic is therefore highly relevant, being aptly articulated by the views of Grönroos (2008, 2011) where value is something that the customer controls (Grönroos, 2008) and where the company goes beyond simple exchange to support customers' value creating processes (Grönroos, 2011). As with Saarijärvi et al.'s (2014) research on m-services, we too see it as critical to understand *what kind of value* customers are able to create – and in the context of this research, value created through their MAR app service usage. Further, as MAR apps are mobile (via smartphones), they are m-services that increasingly liberate customers from time and place constraints and enable additional benefits as a result (Benou and Vassilakis, 2010). Describing and discovering the many ways in which MAR app services are used in retail practices can therefore contribute to not just the development of characterising MAR frameworks and models but also the development of further theory.

In addition to theoretical foundations of service and m-service, we also view the phenomenon of our research as grounded in *augmented reality theory* and the notion of *experiential value*. Theory on augmented reality (AR) views AR as: 1) combining real and virtual imagery, 2) being interactive in real time and 3) registering virtual imagery with the real world (Azuma, 1997). It is further seen as comprising one part of a “mixed reality continuum” that spans real and virtual environments (Milgram and Kishino, 1994), and is the part where the environment of AR is still real as opposed to virtual. AR therefore presents users with “information that is directly registered to the physical environment” where “the digital information appears to become part of the real world, at least in the user's perception” (Schmalstieg and Hollerer, 2016). In this research, AR is therefore taken to be a live, direct or indirect, view of a physical, real-world environment whose elements are augmented (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data. As a result, AR functions by enhancing one's current perception of reality (Graham et al., 2013). In the context of retail, AR involves any approach that combines computer-generated and real world image and/or location information for a richer, more immersive retail experience (Liao, 2015; Pantano, 2009). With the help of increasingly advanced AR (e.g., adding computer vision and object recognition), where artificial information about the environment and its objects is overlaid on the real world (Chen et al., 2009), the information about the surrounding real world of the user becomes all the more interactive and digitally manipulable. MAR makes information about the surrounding real world of the user all this as well as increasingly liberated from time and place constraints.

In and for retail settings, MAR's immersion is accomplished via smartphone (camera, processor, display, and computer vision-based augmented reality) or other handheld device though it may also involve head-mounted see-through displays (Billinghurst et al., 2015; Huang et al., 2013). Perhaps due to the increasing ubiquity of smartphones, research on MAR is increasing and is viewed as a highly relevant area for future research (Pousttchi et al., 2015).

From a *value* perspective, MAR's ability to add value in and for retail, not to mention contributing to smart cities more broadly (Yigitcanlar and Lee, 2014), is multi-faceted. Prior research (Spreer and Kallweit, 2014; Spreer et al., 2012) finds, for example, that MAR can support shoppers with improved information at the point of sale. Pantano and Naccarato (2010) argue that such advanced technologies in general add value in three ways: retailer advantages such as increased speed for obtaining information consumer behaviour; improvements in service at the point of sale; and positive influences on the consumer shopping experience. Elaborating on the latter, Dziewanowska's (2015) review of the literature on shopping experiences suggests that there are multiple elements to shopping experiences ranging from sensory to escapist experiences. Research by Mathwick et al. (2001) and Bagdare and Jain (2013) also adopts the view that retail shopping is an experience and as such can involve multiple forms of *experiential value*. The importance of an experiential perspective is further supported by research finding that consumer intentions to download and use retail apps in general are even greater among consumers with higher as opposed to lower *experiential* orientations (Kang et al., 2015). Collectively, these studies suggest potential for MAR to provide consumers with richer, more immersive shopping experiences while also benefiting retailers.

A useful means for conceptualising experiential value is Mathwick et al.'s (2001) typology of experiential value, a typology which has roots in Holbrook's (1996) framework or typology of customer value. Experiential and customer value perspectives have since been adopted in studies examining value in shopping and retail, of which Huang and Liu (2014) and Salo et al. (2013) are more recent examples that are closer to the context of this study and where Mathwick et al.'s (2001) and/or Holbrook's (1996) views have been adopted. Building on Holbrook's (1996) work on consumer value, Mathwick et al.'s (2001) view is that experiential value can be characterised by a 2×2 matrix of extrinsic-intrinsic value and active-reactive value. Specifically, the typology of experiential value comprises: 1) an extrinsic-active value quadrant that captures the “consumer's return on investment” or value associated with greater shopping efficiency and economic value in what is to be purchased, 2) an extrinsic-reactive quadrant that captures the value of service excellence, 3) an intrinsic-active value quadrant that captures value in “playfulness” or value associated with the intrinsic enjoyment of shopping and/or shopping as a form of escapism, and 4) an intrinsic-reactive quadrant that captures value in “aesthetics” or value associated with the visual appeal of a retail offer and/or its entertainment appeal.

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2.2. Conceptualising mobile augmented reality's experiential value and contribution to smart retailing

One MAR shopping app that usefully illustrates extrinsic-active value and is offered primarily as a means of providing greater shopping efficiency is a “home finder” app by Gardner Realtors. By using the smartphone camera to explore the user's surrounding area, objects looked at will be overlaid on the camera's display, offering additional interactive content and information that makes it “easier than ever to find your perfect home.” An example of an extrinsic-reactive value app, i.e., one that emphasises service excellence, is the Deichmann shopping app for shoe buying. The app's augmented reality gives its user a digital shoe fitting service and an interactive foot measuring service. Additional services offered by the app (twelve in all) include a fast ordering service, barcode and QR scanning, and a “trendblog” service that gives users access to qualitative customer comments on products. Similarly, a service-focused business-to-business MAR shopping app is the “Dulux Paint Expert: Decorators” app where the augmented reality features let the tradesperson “see realistic Dulux Trade paint colours appear on

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