St. Petersburg University
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ACCEPTANCE OF AUGMENTED REALITY IN M-COMMERCE: THE ROLE OF CONSUMERS' MOTIVATION, DRIVERS AND BARRIERS

Master's Thesis by the 2nd year student
Concentration – International Business
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ЗАЯВЛЕНИЕ О САМОСТОЯТЕЛЬНОМ ХАРАКТЕРЕ ВЫПОЛНЕНИЯ ВЫПУСКНОЙ КВАЛИФИКАЦИОННОЙ РАБОТЫ

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АННОТАЦИЯ

Автор	Черенко Полина Леонидовна
Название магистерской диссертации	Применение дополненной реальности в мобильной коммерции: роль потребительской мотивации, драйверы и барьеры
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Научный руководитель	Мария Михайловна Смирнова
Описание цели, задач и основных результатов	Цель данного исследования — идентификация и изучение факторов, влияющих на принятие пользователями технологии дополненной реальности в мобильной коммерции, на основе мотивации пользователей. В ходе работы были изучены электронная и мобильная коммерции, а также изучено применение функции дополненной реальности в контексте покупок онлайн посредством мобильных устройств. Был проведён анализ единой модели принятия и использования технологий, и на основе анализа она была отобрана в качестве основной модели для разработки эмпирической части исследования. Классическая модель была дополнена внешними факторами, соответствующими типам мотивации пользователей. Также была разработана статистическая модель для тестирования сформулированных гипотез. Был проведён опрос респондентов в Российской Федерации, данные которого были использованы в эмпирическом исследовании. В результате исследования были получены следующие результаты: — ключевые переменные: личная инновационность и получение удовольствия от процесса позитивно взаимосвязаны с намерением пользователей использовать функцию дополненной реальности; — склонность к гедонистическому типу мотивации лучше способствует принятию и использованию функции дополненной реальности в процессе покупок онлайн посредством мобильных устройств.

Ключевые слова	Дополненная реальность, мобильная коммерция, принятие технологий, модель принятия технологии, мотивации потребителя.

ABSTRACT

Master Student's Name	Polina L. Cherenko
Master Thesis Title	Acceptance of augmented reality in m-commerce: the role of consumers' motivation, drivers and barriers
Faculty	Graduate School of Management
Main field of study	International Business
Year	2017
Academic Advisor's Name	Maria M. Smirnova
Description of the goal, tasks and main results	The objective of current research is to investigate acceptance of technology of augmented reality in mobile commerce with the emphasis on consumers' motivation. In order to achieve the main goal, the author studies electronic and mobile commerce and investigates application of augmented reality in the context of purchasing online through mobile devices. For the research the author uses and modifies technology acceptance model, which serves as a foundation for hypotheses development. The theoretical model was extended with external variables according to types of motivation of potential consumers. To test the hypotheses a questionnaire survey was created and conducted and 125 respondents from Russian Federation passed a survey. The collected data was used for quantitative analysis. Based on the empirical results of the study, it was identified that such factors as perceived innovativeness and perceived enjoyment positively influence the intention to use function of augmented reality while purchasing online. It was proven that tendency to hedonic motivation better contributes to adoption and usage of the function of augmented reality while purchasing online through mobile devices.
Keywords	Augmented Reality, mobile commerce, technology adoption, technology acceptance model, consumers' motivations.

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INTRODUCTION

Augmented reality combines computer-generated digital objects and the real environment and therefore allows real-time interaction (Azuma, 1997). Nowadays, augmented reality is rapidly gaining attention worldwide. At the same time, widespread adoption of smartphones and other handheld devices, their rapid technological development and large capabilities lead to increase in the interest of developers and companies in augmented reality. As a result, many companies are now implementing and using augmented reality. Consequently, Daponte et. al (2014) claimed that technology of augmented reality is swiftly moving from the scientific field to consumer markets. It also can be applied to the retailing industry, where smart or virtual mirrors for consumers' experience were augmented reality front-runners (Demirkan and Spohrer, 2014; Pantano and Naccarato, 2010). Moreover, Pantano (2014) emphasizes the potential of augmented reality in terms of “capturing consumers' attention and influencing their purchasing decision”.

With the recent introduction of augmented reality and due to its availability, retailers started to rely on this interactive technology in order to improve consumers' shopping experience and influence the decision-making process of potential buyers. On the one hand, interactive technology in shopping centers makes use of dedicated devices and software to explain, demonstrate and recommend products. On the other hand, mobile applications with a function of augmented reality can be uploaded and installed on the users' personal handheld devices, providing individuals with the same functions and opportunities which are moreover available anytime and anywhere and therefore making new interactive technology involved in mobile commerce field.

Mobile commerce can be defined as the use of wireless handheld devices such as smartphones to conduct commercial transactions online (Kevin Duffey, 1997). Mobile commerce comprises several characteristics which are (1) accessibility of handheld devices, (2) availability anytime and anywhere, (3) real-time interaction between retailer and consumer (Elliott & Phillips, 2004). Nowadays rapid development of technologies facilitates mobile electronic devices with the large technological capacities, corresponding to the requirement of such interactive technologies as augmented reality, allowing users to upgrade their handheld devices with the additional functions, which can have a significant impact on the behavior of consumers (Gary. S. and S. Y. S. Simon., 2002).

Regarding the potential usage or acceptance of new interactive technologies by consumers in such field as retailing, previous studies, including theoretical considerations and empirical researches have extensively concentrated on the technology acceptance model (Pentano, 2014). Based on the research background, technology acceptance model was recognized as "the most influential and commonly employed theory of information systems" (Lee et al., 2003). Initially, technology acceptance model was created as a very simple one, and relying on four basic variables which are perceived ease of use (PEOU), perceived usefulness (PU), attitude toward using (AT) and behavioral intention to use (BI) (Davis, 1986, 1989). Consequently, it can be extended depending on the context with various (external) variables (Pantano and Di Pietro, 2012).

At the same time, the relative importance of hedonic (enjoyment, playfulness, fun) and utilitarian (information, innovativeness) aspects in acceptance of new information technologies was highlighted by previous studies (Van der Heijden, 2004) and it varies for different kinds of technological applications and therefore has to be considered for improvement to occur.

The research gap and objective

The issue of augmented reality acceptance especially in mobile commerce is not studied deeply because of its recent introduction and relative novelty in general and in retailing field in particular. Current studies are usually concentrated on limited number of factors which can influence the adoption of new interactive technology and are mainly aimed at presence of impact of particular external factors on basic variables of technology acceptance model, often not taking into account the nature of external variables and different influence which external factors can have on the same variable.

It has been a great number of papers published which confirm the important role of motivations in acceptance of new interactive technology among potential users (Van der Heijden, 2004). At the same time, several previous researches investigated role of two types of motivations — hedonic and utilitarian — in acceptance of new information technologies from the related to AR fields, applying technology acceptance model with the particular external variables related to each type of motivation (Hassenzahl et al., 2010). However, there are still not many studies examined technology acceptance model in the context of augmented reality in retail with a focus on two types of motivations. Based on the theoretical and empirical

background, the gap in acceptance of augmented reality in the context of mobile commerce and with the emphasis on the consumers' motivations was identified.

Thus, the general ***research objective*** is to investigate the acceptance of augmented reality in the context of mobile commerce with the emphasis on the consumers' motivations.

Consequently, in order to achieve the main objective, the following sub goals should be fulfilled:

1. To adapt and test technology acceptance model in the context of augmented reality;
2. To extent technology acceptance model with selected external elements, related to two types of motivation — hedonic and utilitarian;
3. To evaluate roles of both motivations in the acceptance of augmented reality;
4. To compare influence of utilitarian and hedonic motivations on the acceptance of augmented reality;
5. To identify potential drivers and barriers in adoption of augmented reality in retail.

Thus, the research questions can be formulated as following:

RQ1: Do enjoyment and innovativeness affect the adoption of augmented reality?

RQ2: What motivation better contributes to the acceptance of augmented reality?

RQ3: What are potential drivers and barriers in augmented reality in retail?

Study and thesis structure

In order to reach research objective and properly feel the research gap, this study has to be focused on the following systematic processes:

- Literature review — the following section gives the insights into the conceptual and theoretical background for mobile commerce, augmented reality and technology acceptance model with a focus on marketing and retailing;
- Theoretical modeling — in the following section a modified technology acceptance model for augmented reality is proposed, developed and tested. The model has to satisfy the main requirements of the research;
- Development of questionnaire — on this stage survey questionnaire will be formulated and analyzed based on the previous studies, and then adapted to the research and integrated in the survey;

- Statistical analysis — in this section collected data will be analyzed statistically and proceed with the recognized tool such as IBM SPSS with the extension called AMOS;

The paper is structured as follows: an introduction, three chapters, conclusion, references and appendixes.

In the introduction, the relevance of the study is justified; research objective, goals, research questions and the structure are presented.

In the first chapter, previous studies related to augmented reality, mobile commerce and technology acceptance model are systematically analyzed.

In the second chapter, the research design and research model are proposed, including the hypothesis formulation and questionnaire development. The empirical research is conducted. Research findings and results of analysis together with theoretical and managerial implications, limitations and avenues for further research are presented.

In the conclusion, the results and recommendations are summarized.

CHAPTER 1. AUGMENTED REALITY IN MOBILE COMMERCE: THEORETICAL BACKGROUND

1.1 Theoretical background on electronic commerce

The theoretical part of the research starts from the revision of previous studies which are related to online marketplace environment and consumers' behavior within this kind of environment. First of all, we start exactly from the definition and overall description of electronic commerce which can be defined as the activity in which consumers get information and purchase products using the internet technology (Olson and Olson, 2000), or as the action of electronically mediated financial transactions between two parties (Ellis-Chadwick, 2011). One of the main features, resulted by relatively recent changes of electronic commerce environment, were described by J. Olson and G. Olson (2000), as opportunities not just of B2C (business to consumers), but also of B2B (business to business) and even i2i (individual to individual) interactions, which make electronic commerce valuable and beneficial both from the customers' and companies' perspective.

With the emergence of electronic commerce, many researches has started to study adoption of this new type of technology, and in particular investigate what factors and variables can drive or inhibit it, applying the models such as the theory of planned behavior (Ajzen, 1991) shown on the Figure 1 and the technology acceptance model to examine attitudes and behavioral intentions of individuals towards online shopping. It worth mentioning, that technology acceptance model is considered to be an extension or evolution of theory of planned behavior.

Theory of planned behavior is a classical and well-researched model that has been shown to predict behavior across a variety of different settings. As a general model, it is designed to explain most human behaviors (Ajzen, 1991) and is considered as one of the most successful theories in social psychology which aspires to explain consumer behavior in different situations, conditions and domains (Klöckner, 2011). It also comes as one of the most reliable and suitable model in examination of consumers' behavior and personal attitudes. According to the Ajzen's theory of planned behavior, the intention of consumers to perform a certain behavior is influenced by three main components — attitude, subjective norm and perceived behavioral control (see Figure 1).

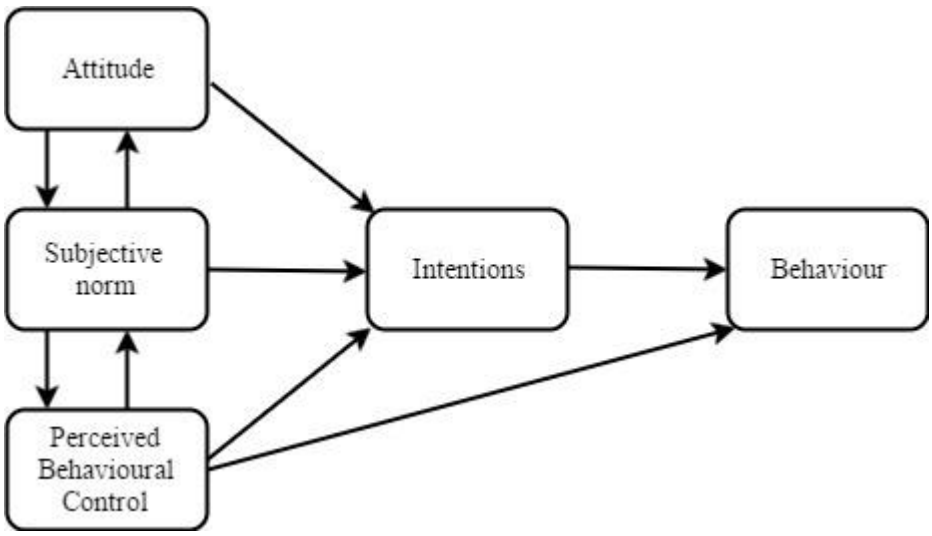

Figure 1 Theory of planned behavior model

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

Talking about online behavior, it is necessary to state the difference between individuals' behavior in electronic and traditional environment, which are the following:

- The spatial and temporal separation between consumers-internet users and internet vendors rises fears of seller opportunism due to product and identity uncertainty (Ba and Pavlou, 2002);
- Personal information can be easily collected, processed, and exploited by multiple parties who are not directly linked to the transaction (Koufaris, 2002);
- Consumers must actively engage in extensive information technologies use when interacting with a vendor's website, which has become the store itself (Koufaris, 2002);
- Possible concerns and doubts about the reliability of the open web infrastructure that internet vendors employ to interface with consumers (Rose, Khoo and Straub, 1999);

As a result of the rapid development of technologies and innovations, online environment in general and electronic commerce in particular went through different changes and acquired different forms and evolved in different directions, one of which is mobile commerce or mobile commerce which come as one of the latest trends on the online marketplace and which attracted great attention from the researchers.

1.2 Theoretical background on mobile commerce

Previous researches give several definitions of mobile commerce. Some researchers define mobile commerce as a new direction or extension of electronic commerce that is performed by mobile devices or smartphones and Personal Digital Assistants (PDA) using mobile phone networks (Gary and Simon, 2002). For some searchers mobile commerce represents “the delivery of electronic commerce capabilities directly into the consumer's hand, anywhere, via wireless technology” (Duffey, 1997). One more definition is “wireless B2B and B2C exchanges of operational and financial data within a supply chain at different stages of the life cycle of a business relationship” (Elliott & Phillips, 2004). No matter how broad perceptions of mobile commerce are, they all have an obligatory condition - use of mobile handheld devices to conduct transactions via mobile network. Such devices can be described as small and are operated the move, ranging from mobile phones to PDAs (Gary and Simon, 2002). Some hybrid devices also can combine the capabilities of mobile phones and PDAs. The most common examples of B2C mobile commerce applications include mobile financial services (e.g., m-banking, m-payment, and m-brokering), mobile shopping (e.g., m-retailing. m-ticketing, and m-auctions), mobile entertainment (e.g., m-gaming, m-music, m-video. and m-betting), and mobile information (e.g., mobile access to sports news, weather forecasts, maps, etc.) (Khalifa and Shen, 2008).

Based on the various definitions of mobile commerce, mobile purchase can be explained as as any purchase-related activity conducted by smartphones or tablets through mobile Internet (Groß, 2015; San-Martín et al., 2015; Wang et al., 2015). Mobile users may easily browse mobile Internet to plan their pre-shopping activities (e.g. finding address of the store or its working hours), make up, modify, change, or place orders online, and perform purchase transactions using electronic devices without the restrictions of time and location (Ström, Vendel, and Bredican, 2014).

The main driving forces for mobile commerce are frequently mentioned in recent studies and are considered as fast growth of penetration and usage of electronic devices (which are smart phones, PDAs and other handheld devices) (Barnes and Scornavacca. 2004, Massoud and Gupta, 2003). Another research made by J. Zhang (2004), states that growth of mobile commerce is impaled by three major forces which are technology innovation, evolution of new value chains, and active customer demand which all together create a synergy effect which lead to the success of development of mobile commerce.

As far as mobile commerce is developed from electronic commerce with new technological basis such as wireless Internet and handheld devices, it has some similar aspects in functions and processing (Choi, Seol, Lee, Cho and Park, 2008). Considering the similarities, there are nine factors in common: “convenience”, “transaction process”, “system quality”, “content reliability”, “perceived price”, “visibility”, “security”, “customer service”, and “customization” (Choi, Seol, Lee, Cho and Park, 2008).

However, even if electronic commerce and mobile commerce have a lot of in common, there are some fundamental differences between them. Recent studies suggested that transaction and the context of access are the main characteristics which make electronic commerce and mobile commerce different. “Electronic commerce is oriented toward supporting and realizing transactions while mobile commerce may not have the same addressing method due to the wireless protocol limitation” - said H. Xu and J. Yang (2012). Furthermore, in case of electronic commerce, stable internet connection is a vitally important factor and the device for this type of commerce is mainly based on computers. According to Tsalgatidou and E. Pitoura (2001), one of the main features of mobile commerce which distinguish it from electronic commerce are identification of location, adaptability, omnipresence, personalization and broadcasting. I. Clarke (2001) suggested four value propositions that may favor mobile commerce over electronic commerce are convenience, localization, omnipresence and personalization. According to Shankar and Balasubramanian (2009), main features of mobile media and mobile devices are local specificity, portability, and untethered/wireless features. X. Wu, Q. Chen, W. Zhou and J. Guo (2010) proposed that the most important characteristics of mobile commerce are mobility and its real-time nature. Based on the recent researches, such features as location sensitivity, location correlation and ubiquity could be derived from its mobility, whereas other features could be derived from its real-time nature. The characteristics above point out that users are always “online” and therefore possibility to get information and perform transactions at any time and from anywhere contributes to more frequent product consideration, selection and purchasing process.

Apart from advantages of mobile commerce, recent studies also outline technological limitations of mobile commerce compared to electronic commerce enablers. M. Chae and J. Kim (2004) claimed that electronic devices such a smartphones have some usability limitations such as small size of screen which decline the richness of information and limited capabilities of display which require users to remember the content of a web page and then search for more information by clicking and scrolling. (Ghose, Goldfarb and Han, 2012). In addition, mobile devices are also less multitasking in comparison with computers or laptops what result in

increase in information search costs and influence the type of product which customers purchase from the mobile devices (Chae and Kim, 2004). Thus, the consumers tend to use computers when buying products which require heavy information search efforts (Ghose, Goldfarb, and Han, 2012). Moreover, such characteristics as virtuality, lack of control and potential opportunism contributes to big uncertainty and risk which are to some extent are greater while purchasing mobile compared to online purchase (Chen and Lan, 2014). For instance, mobile networks may be more vulnerable to hacker attack and information interception (Morosan, 2014). Mobile coding system is not as intact and robust as online encryption systems (Mamonov and Benbunan-Fich, 2015). It results in consumers' doubts in the security of shopping via mobile. Their concerns are related to vendors' ability to effectively protect their personal information, location and payment information from potential problems (Dai and Palvi, 2009). Additionally, in comparison with wired network, mobile networks have limited bandwidth and less stable connections and as result mobile users may face various technical problems, such as disconnection of servers, navigation issues, and slow or weak connection (Zhou, 2013). Consequently, due to significant differences in network connections and the shopping channels, mobile purchase behavior is different from internet purchase behavior in many ways (Lingling Gao, Kerem Aksel Waechter , Xuesong Bai, 2015).

Being an evolution or new wave of electronic commerce, mobile commerce raised the question if popularity of online shopping via electronic devices increases firm's' sales or clients just move from one channels to another, buying goods through mobile devices instead of laptops (Huang, Lu, and Ba, 2016). Consumers' increasing preferences in mobile channel can be explained by easiness of usage and portability, but even the most modern device can't help to avoid some limitations such as small screen which doesn't allow to do complete a lot of tasks simultaneously (Maity and Dass, 2014, Pantano, 2013 and Wang et al., 2015). However, due to the latest's technologies, many inconveniences can be overcome by introduction of mobile friendly versions of web-sites and mobile apps for smartphones which have suitable interface for products search and purchase (Pantano, 2013, Ramos-de-Luna et al., 2015, Sankaridevi et al., 2015 and Zhao et al., 2015).

Mobile commerce consists of a wide range of activities including transactions with monetary value conducted via the smartphones. These transactions may include both intangible and tangible goods. The most common examples of intangible goods are mobile applications and information delivered to the electronic device in digital format such as wallpapers, ringtones etc. Tangible can be purchased with the help of mobile phone but delivered separately (Chen, 2013).

Possibility of purchasing items before their effective consumption was studied a long times ago, in 2001, by Xie and Shugan (2001), who called this sort of separation an advanced purchase, when buying process can be supported by gift or prepaid cards. Nowadays mobile technologies is a great example of an advanced purchase, when consumers buy items through their smartphones from anywhere where they have internet connection and then get their purchase at home or at pick-up spots and point of sales (Pantano and Priporas, 2015).

Introduction of variety of mobile channels might change the consumer experience ("consequence of the interactions between consumer, product and firm" (Verhoef et al., 2009) in terms of search, purchase, consumption and after-sales behavior (Dennis et al., 2016 and Verhoef et al., 2009) and therefore affect consumers' behavior. Over the last decades some studies started to analyze dynamics in consumers' behavior based on new consumers' experience and effect of technological innovations on consumers' experience from a cognitive perspective. (Pantano and Priporas, 2015) The main motivations to start using mobile devices as alternative way of online shopping are opportunity to save time and money. In the former case, time is considered as the biggest value for customers' and it is the first factor which pushes them to change their shopping behavior. In the latter case, customers' costs are lower due to free delivery or lower price which retailers provide when buying online and collecting products from stores. (Groß, 2015; Pantano, 2013, Varnali and Toker, 2010) Another factor which influences customers' willingness to switch their behavior is a lifestyle, which, however, comes as a barrier for customers, who live alone or work during all day and can't stay at home waiting for the delivery (Gao et al., 2013, Jayawardhena et al., 2009 and Varnali and Toker, 2010).

According to recent studies which is related to customer's' perception of new consumption experience, the new experience is considered by consumers as highly satisfying, since it meets their expectations, (Morgan and Hunt, 1994, Richelieu and Korai, 2014 and San-Martin and López-Catalán, 2013) or at least very convenient in terms of time, which has become one of the drivers of consumers' usage of mobile services, with emphasis on the retail industry (Kang et al., 2015). Moreover, convenience relies not only on saved time or money, but also on possibility of getting personalized service in terms of personalized offers and promotions, as well as on the automatic recognition of customers' location (Chou et al., 2016, Kaplan, 2012). Identification of geographical position is especially appreciated by customers since it allows avoiding uploading extra information. (Strom et al., 2014) Additionally, previous studies highlight the importance of usefulness as a driver of positive consumer attitudes towards the mobile shopping environment (Groß, 2015, Pantano, 2013 and Varnali and Toker, 2010). Overall, based on technology acceptance model for mobile landscape (Gao et al., 2013, Groß,

2015 and Varnali and Toker, 2010), new consumption experience is evaluated by consumers as satisfying, convenient, easy, and fast (Pantano and Priporas, 2015).

1.3 Adoption of mobile commerce

Initially, mobile commerce was expected to grow very fast, as a result of fast expansion of mobile devices and a lot of advantages such as permanent assess anywhere in any time. However, mobile commerce is developing comparatively slowly in comparison with electronic commerce (Mylonakis, 2004). Over the last decades, researchers put a lot of efforts to find out what factors influence acceptance of mobile commerce. According to M. Pastore (2001), it can happen because adoption of mobile commerce may be different from electronic commerce adoption due to differences in consumers' demand and characteristics of artifact.

According to previous studies, acceptance of mobile commerce is influenced in part by a lack of customer demand (Zhang, Yuan and Archer, 2003). One of the main factors which slow down implementation of mobile commerce is user apathy towards wireless data services. Surveys show that customers mostly rely on voice-based, emergency-based, and location-based services (Mahatanankoon and Wen and Lim, 2005). Bouwman, Carlsson, Molina-Castillo and Walden (2007) claim that the physical, cognitive, security and economic factors are crucially important while delivering mobile services to consumers. However, many potential consumers are skeptical and have doubts that their experience can be positive and satisfactory. High subscription fees and slow download speed come as critical barriers to the success of mobile commerce (Samtani, Leow, Lim and Goh, 2003). Other technical characteristics that can negatively affect mobile commerce adoption might be user interface limitations, slow or sluggish network connections, information security, or even the threat of government regulations (Wen and Mahatanankoon, 2004).

In addition to mentioned impediments, Pruthikrai Mahatanankoon and Joaquin Vila-Ruiz (2007) suggest five more factors which provide a complementary consumer-based perspective. They are Consumer Unawareness, Device efficiency, Demand for Conventional Business Transactions, Interoperability Concerns and Personalization Needs (Pruthikrai Mahatanankoon and Joaquin Vila-Ruiz, 2007)

At the same time, study of M. Khalifa and K. Ning Shen (2008) demonstrates that perceived consequences have a positive effect on the individual attitudes and intentions to adopt mobile commerce. In their research M Khalifa and K. Ning Shen (2008) identified five

consequences that were perceived to be important by potential mobile commerce adopters which are cost, convenience, privacy, efficiency and security.

Ko, Kim, and Lee (2009) proposed that ease of use, usefulness, enjoyment, and instant connectivity affect perceived value, which then influence mobile shopping intention. A survey conducted by Yang (2010) and concerning adoption of mobile purchasing services represents that both utilitarian and hedonic performance expectancy, attitude, social influence, and facilitating conditions are critical determinants of behavioral intentions of consumers to use mobile shopping services. The quality of mobile shopping systems was further examined by Chen (2013) who found out that the quality of system, information and service are the major determinants of mobile shopping system use and customer satisfaction, which in turn are direct antecedents of purchase intention. San-Martin and López-Catalán (2013) in his research observed that combination of trust and two personal variables (i.e. involvement and innovativeness) have a positive effect on the satisfaction of mobile shoppers, whereas impulsiveness affects it in a negative way. Zhou (2013) suggested that trust, flow and perceived usefulness are also significant factors which positively affect mobile purchase intention. Recent study conducted by Chen and Lan (2014) showed that mobility, convenience and information richness have roles of antecedents of perceived usefulness, perceived ease of use, and trust. With the use of modified technology acceptance model, Groß (2015) indicated that apart from traditional factors which are used in technology acceptance model, perceived enjoyment and trust in mobile vendor has a significant impact on consumers' intention to be involved in online shopping via mobile devices, which, in turn, determines mobile shopping behavior in general. Determinants of mobile shopping continuance were also examined by Hung et al. (2012) with the use of modified ECM (Error Correction Model) model. Results demonstrated that satisfaction and trust are the main determinants as to whether consumers have any intention to continue mobile purchase.

1.4 The concept of augmented reality

Previous studies provide several explanations of augmented reality or in other words enhanced reality. The concept of augmented reality represents a combination of computer-generated digital entities and the real environment in a view, which represents integrated objects as one environment, where the digital objects appear as a layer overlapping the real world environment (Azuma, 1997). Technology of augmented reality is based on the underlying virtual reality technology "but does not replace the real environment, rather augmented reality uses the

real environment as a background" (Fonseca et al., 2014). In other words, augmented reality technology allows individuals to see dimensional virtual objects imposed upon the reality and "enriches the sensorial perception of a person" (Daponte et al., 2014).

Previous studies ascribed augmented reality with the following characteristics: combination of both real and virtual content aligning with each other; interactivity and performance in real time and virtual objects recorded with the real world (Adhani and Rambli, 2012) Based on the mentioned characteristics, augmented reality is able to immediately reflect user's facial emotions, pose, and environment on the device's screen, and is also able to simultaneously reflects any body movements of the user without any hitches and lags, allocating virtual objects directly on the individual's figure, providing the same effect as if user was trying it on reality (Pantano and Timmermans, 2014).

Researchers identified several features which are important for user interface technology (Rekimoto and Nagao, 1995). Adhani and Rambli (2012) highlighted factors such as wireless communication, interaction technologies, tracking and registration. Mekni and Lemieux (2014) in their research noted visualization and real time rendering, data storage and access technologies. Technology of Augmented Reality in particular consists of "displays, trackers, and graphics computers and software" (Van Krevelen and Poelman, 2010). At the same time, rapid development of processors, displays and equipment of electronic devices (such as photo and video camera, internet connection bandwidth, GPS and sensors) have lead to rise in the interest of using augmented reality on mobile devices (such as smartphones and electronic tablets) (Daponte et al., 2014) and introduction of a number of augmented reality applications for computers and smartphones (Daponte et al., 2014, Mekni and Lemieux, 2014, and Van Krevelen and Poelman, 2010).

1.5 Augmented reality: Experiential value and consumers' sustainable relationship behavior

The most common areas where augmented reality has been applied are entertainment and games, education, tourism and medicine. However, many researchers recognize marketing as potential and promising area for augmented reality applications (Adhani and Rambli, 2012; Gervautz and Schmalstieg, 2012; Mekni and Lemieux, 2014) and even identify it as "largest application opportunity for augmented reality" (Gervautz and Schmalstieg, 2012).

Retailers can use Augmented Reality to achieve deeper engagement of customers due to "virtual trial and product education" together with gamification to boost users' experience (Baier et al., 2015). By demonstrating additional content and therefore providing extra information about products, augmented reality applications can support users in their purchasing process and even affect customers' decisions (Adhani and Rambli, 2012), especially when users can use their own pictures while interacting with items and "dress their virtual model with the items they prefer" (Blazquez, 2014).

In the literature perceived value is described as the essential output of a marketing activity and a major motivation for customers to involve into marketing relationships (Holbrook, 1994). Mathwick et al. (2001) proposed that experiential value might help retailers to create and manage relationships between consumers and service providers and if a company aims at building long-lasting relationships with its customers, it has to consequently complement each purchase experience with unique value proposition (Spiegelman, 2000). As an example for it, some clothing retailers prefer to position themselves not just as providers of just a service or product, but as provider of an unique experience (Fogg, 2003). Hence, an interactive technology might provide individuals with interactive simulation experience and become a convincing technology which persuade users rather than just add usage functions (Fiore, Ann Marie, Kim and Lee, 2005). Such interactive experience might enhance using motivation and persuasion effects due to its richness in consumers' hedonic and utilitarian values (Mathwick, Malhotra and Rigdon, 2001).

Taken together, augmented reality by creating interactive simulation experience cannot just provide consumers with product information which is very resemble to the information received from direct examination of product in order to reduce product risk, but also deliver multisensory simulation experience such as visual and haptic to enrich playful shopping experience. It has to be presented as a form of persuasive technology that can build and provide experiential value rather than just a functional technology (McCarthy and Wright, 2004). On the one hand, such experiential value not just mitigates the potential risk that can result in low intention to buy, but also enhance consumers' confidence in online shopping (Mathwick, Malhotra, and Rigdon, 2001). On the other hand, from the side of e-retailers, such shopping experience which is simulated by the use of augmented reality not just increases consumers' perception of the value of advanced purchases, but also adds value in the form of visual satisfaction, enjoyment, playfulness, and efficiency which all together rise individual's willingness to buy online in a simulated shopping experience (Kim and Forsythe, 2008). This also coincides with the perspective of relationship marketing paradigm that perceived benefits or

values are the most crucial factors in customers maintaining and investing in a relationship with interactive technology.

Moreover, possibility of using augmented reality apps at home as well as in stores enhance customers' experience as far as it adds fun to use augmented reality interactively (Gervautz and Schmalstieg, 2012). One more applications' possibility in the context of marketing is navigation system which helps "to localize stores and in-store-navigation, warehouse space optimization, brand recognition and promotion, or support of sales team members" (Gervautz and Schmalstieg, 2012).

To reach good user experience from interactions between users and systems, users have to be motivated to accept such interaction (O'Brien, 2010). In order to understand users' needs and motivations, recent studies investigated consumers' motivations (both hedonic and utilitarian) in the context of user engagement with online shopping. Hedonic motivations are based on individual's' own experience while interacting directly with the particular technology, whereas utilitarian motivations are based on the interests of utility during the interaction. O'Brien in his recent study of users' engagement with online purchasing investigated utilitarian aspects such as gratification and value along with hedonic aspects such as aesthetics and enjoyment. Augmented reality is capable enough to cater customers who are hedonistically motivated. The reason of ensuring this kind of experience such as augmented reality to customers is to incite hedonic aspects of user's behavior which enhance the decision making process and raise the experimental value. Intentional activation of hedonic aspects (for instance playfulness, involvement in an activity, sense of control, enjoyment and temporal disposition) for persuading customers to make a purchase was previously investigated by Huang et al. (2013). At the same time, Wells et al. (2005) in his research found out that users' utilitarian motivation are more significant than hedonic motivations for a conventional electronic commerce portal and suggested that most of the internet portals are designed for utilitarian consumers (rational and goal oriented) who purchase via web sites when they have clear idea of the item they want to buy.

1.6 Technology adoption of augmented reality: Technology acceptance model

As far as consumers' acceptance is crucial for the future success of emerging technologies, technology acceptance became one of the most mature and important fields in information system research. In the context of this research field, the technology acceptance model of Davis (1986) is the most remarkable model.

The technology acceptance model is widely used to identify how and in which cases organizations and individuals might adopt or accept a new technology (Lin, Shih, and Sher, 2007). To be more precise, technology acceptance model might be used to order to identify or even predict factors and variables which may play a great role in motivation of customers to build a loyal relationship with an interactive technology, including such technology as augmented reality (Chiou and Shen, 2012).

The original technology acceptance model, which is proposed by Davis (1986), is basically relies on a simple Stimulus-Organism-Response model which was refined with the Theory of Reasoned Action (TRA) of Fishbein and Ajzen (1975). In the context of technology acceptance model (see Figure 2) Davis (1986) claimed that the motivation or intention of consumers to use the particular information technological system might be interpreted by the hidden factor which is Attitude Toward Using (AT), and Attitude, consequently, from the Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). In this way, both PU and PEOU come as rewards and benefits of using a particular technology (Chiou and Shen, 2012), and they both directly affect the Attitude Toward Using, which, consequently, influence the Behavioral Intentions of individuals. Moreover, Behavioral Intention to Use is also affected directly by Perceived Usefulness. Perceived Usefulness in the technology acceptance model reflects relative advantage of innovation adoption, which is the extent to which a new technology is perceived as better than its precursor. At the same time, Perceived Ease of Use reflects complexity, which is the degree to which an innovative technology is perceived as difficult to understand and use. Attitudes Toward using comes as “the degree of evaluative affect that an individual associates with using the target system in his/her job”. Finally, Behavioral Intention to use is defined as a person's perceived likelihood or "subjective probability that he or she will engage in a given behavior" (Committee on Communication for Behavior Change in the 21st Century, 2002).

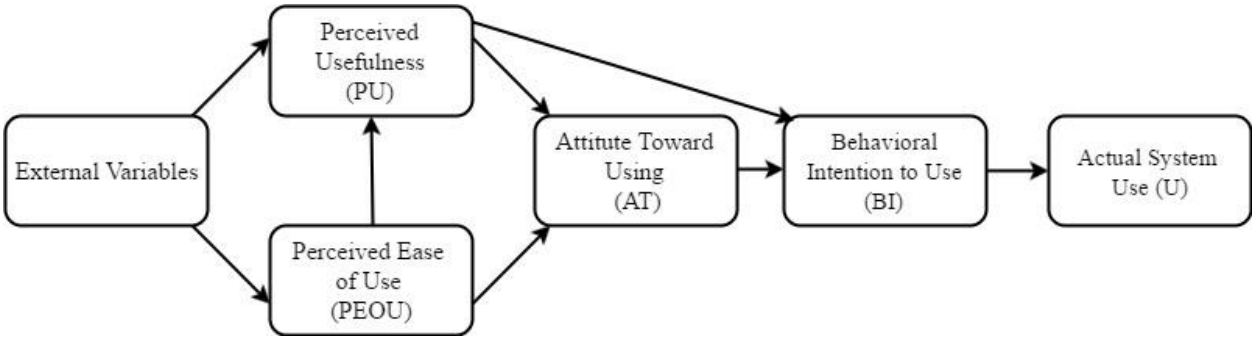

Figure 2 Technology Acceptance Model

Source: Davis, F. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. MIS Quarterly, 13(3), p.319.

As was mentioned above, the consumer's' intention to interact with technology is highly affected by the perceived usefulness and the ease of use of the information system (Chiou and Shen, 2012). Perceived ease of use means that the consumer is not required to deplete too many cognitive resources during the use of technology (Carvalho, Guimarães, Ferreira and Freitas, 2012). In this instance, behavior and intentions to use a given technology are not influenced directly by perceived ease of use, but instead is affected indirectly through perceived usefulness (Carvalho, Guimarães, Ferreira and Freitas, 2012). At the same time, it is evidenced by recent studies that perceived usefulness is described as how and what users think about probability of improving performance on tasks by using a particular technology and in this case perceived usefulness refers to the ability of the augmented reality to help customers to make a purchase decision. In comparison with perceived usefulness, perceived ease of use is indirect in affecting behavioral intentions to use a given interactive technology (Carvalho, Guimarães, Ferreira and Freitas, 2012).

According to the relationship marketing paradigm, to get benefits of using an interactive technology (which are assessed both by perceived usefulness and perceived ease of use), individuals tend to maintain a sustainable relationship behavior with an interactive technology (Chiou and Shen, 2012). Thereby, perceived usefulness (PU) and perceived ease of use (PEOU) can be considered as the most important and significant factors which stimulate individuals' loyal relationship behavior with regard to use an interactive technology such as augmented reality. Particularly, perceived usefulness (PU) affects sustainable relationship behavior for using technology directly, whereas perceived ease of use (PEOU) has an indirect effect on this behavior. Additionally, Premkumar and Bhattacherjee (2008) also proposed that perceived usefulness (PU) has a significant effect on continual usage of information technology when perceived ease of use (PEOU) falls short of significant and direct effects.

Davis (1989) developed and tested measurement scales for PU and PEOU, offering six items for both constructs. Subsequently, number of used items varies across studies, but four out of six usually are more frequent (Legris et al., 2003). For the measurement of AT Davis (1989) used a scale proposed by Ajzen and Fishbein (1980). The scale consists of five bipolar adjectives each has seven-point rating scale with an extreme values on the edges and neutral value in the middle i.e. a semantic differential scale (Osgood et al., 1957). Apart from demonstrating high-quality measurement in terms of reliability and validity, such scale is characterized as "easy to administer and score, takes only a few minutes to complete, and is applicable to a wide range of objects" (Zaichkowsky, 1985).

1.7 Technology adoption of augmented reality: determinants

To reach good user experience from interactions between users and systems, users have to be motivated to accept such interaction (O'Brien, 2010). In order to understand users' needs and motivations, recent studies investigated consumers' motivations (both hedonic and utilitarian) in the context of user engagement with online shopping and therefore with the respect to user acceptance, information technologies were differentiated into hedonic and utilitarian systems respectively (Van der Heijden, 2004). This concept was transferred to interactive information technology systems within the conception of user experience (Hassenzahl et al., 2010). In this context, utilitarian characteristics are based on the interests of utility while interacting and aims at assisting individuals in their performance (Hassenzahl et al., 2010). In this case, functionality of the system has to be the main focus whereas design should not be distractive (Van der Heijden, 2004). Moreover, while exploring consumers' expectations and demands of augmented reality apps, Olsson et al. (2013) recognized that the main value of augmented reality app was identified as "in providing useful additional information related to places, people, public transportation or basically any momentarily relevant issues nearby". As for hedonic characteristics, they are based on user's' experience during the interaction with technology and aim at providing the feelings of enjoyment and fun while interacting (Hassenzahl et al., 2010). For examples, Van der Heijden (2004) suggested "hedonic content, animated images, a focus on colors, sounds, and aesthetically appealing visual layouts" suggested by Van der Heijden (2004) and O'Brien (2010) proposed "aesthetics and enjoyment for user engagement with online shopping". In addition, Olsson et al. (2013) in his study regarding augmented reality applications (which already was mentioned above) found out, that users were "expected to offer playful and entertaining momentary experiences", but "artistic and amusing content" should be avoided. Accordingly, with regard to marketing and retailing, gamification and aesthetic design are very important aspects (Pousttchi and Hufenbach, 2014). In this way augmented reality is capable enough to cater customers who are hedonistically motivated. The reason of ensuring this kind of experience such as augmented reality to customers is to incite hedonic aspects of user's behavior which enhance the decision making process and raise the experimental value. Intentional activation of hedonic aspects (for instance playfulness, involvement in an activity, sense of control, enjoyment and temporal disposition) for persuading customers to make a purchase was previously investigated by Huang et al. (2013). At the same time Wells et al. (2005) in his research found out that users' utilitarian motivation are more significant than hedonic motivations for a conventional electronic commerce portal and suggested that most of the internet portals are designed for utilitarian consumers (rational and goal oriented) who

purchase via web sites when they have clear idea of the item they want to buy. Accordingly, Fiore et al. (2005) proposed that that image interactivity technology, such as augmented reality, provides consumers with both utilitarian and hedonic values and these values positively influence the willingness of consumers to continue using particular interactivity technology.

Based on the background studies and taking into account the existence of two motivations and therefore two perspectives on technology of augmented reality which are, however, were not investigated before, we can state the following research questions:

RQ1: Do enjoyment and innovativeness affect the adoption of augmented reality?

RQ2: What motivation better contributes to the acceptance of augmented reality?

RQ3: What are potential drivers and barriers in augmented reality in retail?

As far as augmented reality is an emerging technology especially on the retail market, the technology acceptance model is an appropriate method to investigate acceptance and future usage intentions.

Analyzed previous researches with a help of scientific databases EBSCO and Scopus and with a number of keywords such as “augmented reality”, “AR”, “online shopping”, “retailing”, “TAM”, “technology acceptance model”, “consumer acceptance”, 13 studies were found for the period from 2008 to 2016 (see Table 1). Majority of them included a hypothesized research model engaging augmented reality app and related fields such as “augmented reality smart glasses” or “virtual reality”.

Table 1
Research on the acceptance of augmented reality apps and related fields in retailing in chronological order

Author(s)	Technology tested	Model used	Variables/Investigated constructs	Data collection
Lee and Chung (2008)	AR app	--	Convenience, quality assurance, customer satisfaction, PE.	Survey with 102 respondents
Kim and Forsythe (2008)	AR app	TAM	Technological anxiety, PEOU, PU innovativeness, PE, BI, post-use evaluation.	Survey with 491 respondents
Oh et al. (2008)	AR app	--	Pleasure, arousal, product attitude, purchase intention, satisfaction, choice confidence, PEOU, PE, decision-making enjoyment, decision confidence.	Survey with 92 respondents

Table 1 (cont.)
Research on the acceptance of augmented reality apps and related fields in retailing in chronological order

Author(s)	Technology tested	Model used	Variables/Investigated constructs	Data collection
Domina et al. (2012)	AR app	Flow Theory, TAM	PE, perceived control, perceived concentration, PEOU, consumer innovativeness (novelty seeking, independent judgement), intention to shop.	Survey with 119 respondents
Pantano and Servidio (2012)	AR app	Human-Computer-Interaction model	Store perception, PEOU, PU, PE, consumer satisfaction.	Survey with 150 respondents
Olsson et al. (2013)	AR app	--	User experience, central user requirements.	16 interviews with 28 customers
Poncin and Mimoun (2014)	AR app	TAM	Shopping value, emotions, perceived store atmosphere, patronage intention, satisfaction.	Survey with 140 respondents
Spreer and Kallweit (2014)	AR app	TAM	PU, PEOU, PE, BI, information offer, information completeness.	Survey with 96 respondents
Huang and Liao (2015)	AR app	TAM	Presence, PU, PEOU, perceived playfulness, perceived aesthetics, service excellence, sustainable relationship behavior.	Survey with 220 respondents
Stoyanova et al. (2015)	AR app	--	Personal emotions, usability and appearance of interface, attitude toward brand, position toward brand (purchase, recommend).	Survey with 150 respondents
Javornik et al. (2016)	AR app	--	Perceived augmentation, BI, playfulness, convenience.	Survey with 102 respondents
Javornik (2016)	AR app	Theory of interactive media effects	Perceived augmentation, flow, affective responses, cognitive responses, BI.	Survey with 60 respondents
Kim and Hyun (2016)	AR app	TAM	System quality, service quality, information quality, telepresence, BI.	Survey with 114 respondents
Philipp A. Rauschnabel (2016)	AR smart glasses	TAM	Social norms, functional benefits, expected ease of use, brand attitude, privacy brand image, attitude toward using, technology innovativeness, knowledge about smart glasses.	Survey with 201 respondents

Source: based on the results of scientific databases EBSCO and Scopus, 2008-2017

Regarding hedonic aspect of the acceptance of technology, some studies included "playfulness" and "perceived enjoyment" as investigated element. At the same time, exactly "perceived enjoyment" was reviewed as one of the most significant attribute of model of technology acceptance. It was determined as "the extent to which the activity of using the computer is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated" (Davis et al., 1992). Playfulness within the confines of online shopping environment can get the form of fun and escapism, providing users with opportunity to temporarily escape from reality and fell enjoyment while purchasing products (Mathwick, Malhotra and Rigdon, 2001). Accordingly, apart from contributing evaluation of a product, augmented reality attach playfulness to the online shopping experience for example in a form of exciting atmosphere (Kim and Forsythe, 2008) thereby creating more positive attitude while buying online (Tang, Biocca and Lim, 2004).

In regard to utilitarian aspects of augmented reality, a few previous studies were concentrated on perceived innovations as investigated element. However, exactly characteristics related to consumer's innovativeness may significantly influence acceptance of innovative interactive technology (Liu and Carlsson, 2010). Liu et al. (2001) defined personal innovativeness as "individual's disposition toward trying any new information technology" and added it to their research model. Previous surveys showed that people with higher level of innovativeness are more likely to demonstrate positive beliefs about innovations than those who have lower level of the same characteristic. Innovativeness and novelty seeking were examined by Dabholkar (2001) who explored their moderating effect on the relationship between beliefs (ease of use, performance, and fun) and attitude toward interaction with technology-based self-service. In addition, Kim and Forsythe (2008) proposed that two consumers' features which are technology anxiety and innovativeness may directly influence individuals' intention to try new interactive technology, regardless of their attitude to use new technology. Particularly, individuals with high level of cognitive innovativeness are more inclined to adopt new innovation technology, whereas those who have low level lack interest, knowledge and engagement with regard to new technology and therefore are less likely to accept new interactive technology (Carvalho, Guimarães, Ferreira and Freitas, 2012). As far as cognitive innovativeness may play a great role in acceptance of new interactive technology, it can be considered as significant attribute of technology acceptance model.

In addition to present background, based on previous researches both perceived enjoyment and perceived innovativeness were deeply investigated in the context of electronic and mobile commerce. With a help of scientific databases EBSCO and Scopus and with a

number of keywords such as “m-commerce”, “e-commerce”, “acceptance”, “TAM” and “retail” and for the period from 2009 to 2017, many studies which explore perceived enjoyment and perceived innovativeness as the additional elements of technology acceptance model were found (see Table 2).

Table 2
Research on the acceptance of electronic and mobile commerce in retailing in chronological order

Author(s)	Technology tested	Model used	Variables/Investigated constructs	Data collection
Joaquín Aldás- Manzano (2009)	Mobile app	TAM	Personal innovativeness, mobile affinity, compatibility, PU, AT, PEOU	Survey with 470 respondents
Shih-Chi Chang (2015)	Mobile app	TAM	Personal innovativeness, PEOU, perceived enjoyment, perceived cost, perceived risk, AT, PU	Survey with 477 respondents
Zoran Kalinic (2015)	Mobile app	TAM	Social influence, personal innovativeness, customization, mobility, PU, PEOU	Survey with 224 respondents
Cristian Morosan (2016)	Mobile app	TAM	Consumer innovativeness, perceived security, perceived personalization, perceived privacy, trust in organization, PU, AT, PEOU, BI	Survey with 556 respondents
Hee Jin Hur (2016)	Mobile App	TAM	Technological innovativeness, PEOU, fashion innovativeness, perceived playfulness, PU, perceived ease of use of image search applications, perceived usefulness of image search apps	Survey with 1288 respondents
Monica Law (2016)	Web-site	TAM	Personal awareness of security, Personal innovativeness, PU, PEOU, AT	Survey with 514 respondents
F. Muñoz-Leiva (2017)	Mobile app	TAM	Perceived trust, perceived risk, social image, PU, PEOU, AT	Survey with 103 respondents

Source: based on the results of scientific databases EBSCO and Scopus, 2009-2017

As a consequence of previous studies on the acceptance of augmented reality and technologies from related fields as shown in Table 1 and Table 2, it seems reasonable and justified to apply a reliable and well-structured technology acceptance model and to extend it with two selected, context specific external variables for augmented reality, namely PI (perceived innovativeness) and PE (perceived enjoyment).

Consequently, based on the analysis of previous studies, we found out that as far as augmented reality is an emerging technology, its' acceptance for consumers' is not fully investigated and the further expansion of technology acceptance model is required. Moreover, it is evident from the literature review that factors which affect consumer's acceptance have to be overview from the perspective of two motivations — hedonic and utilitarian.

1.8 Research strategy and hypotheses development

According to technology acceptance model, perceived usefulness (PU) and perceived ease of use (PEOU) are considered to be the main elements which determine the attitude toward using (AT) the technology system (Davis, 1989; Davis et al., 1989). At the same time, AT is hypothesized to influence behavioral intention (BI) to use technological innovation and moreover PU is also proposed to positively affect BI directly without forming an attitude regarding to new innovation. Furthermore, PU is affected positively by PEOU. Described relationships were verified by several researchers and proved as being performed properly (Legris et al., 2003).

According to theoretical research done in paragraph 1.6 and 1.7, we claim that technology acceptance model is applicable and suitable to predict individuals' usage intention for augmented reality technology in the context of mobile commerce, and therefore we can suggest the following hypotheses according to classical technology acceptance model (Davis, 1989):

Hypothesis 1a: Perceived Ease of Use has a direct positive influence on Perceived Usefulness.

Hypothesis 1b: Perceived Ease of Use has a direct positive influence on Attitude Toward Using.

Hypothesis 1c: Perceived Usefulness has a direct positive influence on Attitude Toward Using.

Hypothesis 1d: Perceived Usefulness has a direct positive influence on Behavioral Intention to Use.

Hypothesis 1e: Attitude Toward Using has a direct positive influence on Behavioral Intention to Use.

It worth mentioning, that previous studies came to contradictory opinions regarding the relative importance of the two key determinants of technology acceptance — PU and PEOU. In his studies, Davis (1989) found out that initial effect of PEOU on BI was strong enough, but over time it becomes weaker. Regarding interface improvement, A. Keil (1995) showed that PEOU cannot "compensate for low usefulness". At the same time, several studies demonstrated an equal or even stronger effect of PEOU than PU on information technology acceptance (Yousafzai et al., 2007). At the same time, the setting of system usage seems to play a role (Wu and Lederer, 2009), but even in voluntary settings the impact of PU was stronger (Venkatesh, 2000). Generally, Yousafzai et al. (2007) claimed that PEOU is "not a dominant predictor of usage and intentions in technology acceptance model". Regarding the presence of augmented reality in marketing and retailing fields, PU is proposed to have stronger impact on the acceptance of new technology than PEOU due to the hedonic and utilitarian aspects of augmented reality discussed previously. It results in the following hypothesis:

Hypothesis 2: The Perceived Usefulness of augmented reality apps has a stronger influence on Attitude Toward Using than Perceived Ease of Use.

1.9 Extension of technology acceptance model

Originally, technology acceptance model implies that external variables are already proposed to indirectly impact the intentions of individuals through affecting PEOU and PU. Nevertheless, Legris et al. (2003) while applying technology acceptance model found out that there is "no clear pattern with respect to the choice of the external variables considered". Personal enjoyment from interaction with technological system and personal innovativeness were recognized as two major factors affecting the attitude of individuals toward electronic and mobile commerce (Chen and Tan, 2004; Chen and Wells, 1999; Hausman and Siepke, 2009). Perceived enjoyment (PE) was suggested as a main behavioral belief apart from PEOU and PE to affect the individual's attitude and eventually the intention to use a technological system (Childers et al., 2002; Davis et al., 1992; Van der Heijden, 2004) and moreover strongly depends on the technological system and time of usage (Sun and Zhang, 2008). Additionally, Ha and Stoel (2009) underlined the unclear relationship between the three behavioral beliefs and considered PU as the final determinant of the attitude toward using websites for online purchasing. Moreover, PE was claimed as an antecedent of PU. Individual's need of escapism, diversion, aesthetic enjoyment, or emotional release" (Ducoffe, 1996) may be satisfied by the ability of technology to be playful, entertaining and enjoyable. Furthermore, according to Sun

and Zhang (Sun and Zhang, 2008), PE "is supposed to increase the deliberation and thoroughness of cognitive processing and lead to enhanced perceptions of extrinsic motivations such as PU".

Based on the present background, we can formulate the following hypotheses regarding the interdependence of PE and PU:

Hypothesis 3: Perceived Enjoyment of augmented reality applications has a direct positive effect on Perceived Usefulness.

Personal innovativeness as an external variable which was considered to predict adoption of new information technologies such as Internet banking and mobile banking (Aldas-Manzano et al. 2009; Sulaiman et al. 2007), mobile services (Kuo and Yen 2009; Zarmpou et al. 2012), mobile payment (Kim et al. 2010), wireless Internet services (Lu et al. 2005), and mobile marketing (Bauer et al. 2005). In his researchers Limayem et al. (2000) and Citrin et al. (2000) discovered that personal innovativeness has positive impact on the adoption of online shopping, both directly and indirectly, through individual' attitude and intention to use. Moreover, Kuo and Yen (2009) investigated that PI positively affect both PEOU and PU of 3G mobile value-added services.

For the reason that augmented reality is still at an early stage of implementation and adoption and might be considered by most consumers as an innovation, it is justified to test its influence on intention to use. Therefore, we formulate the next hypotheses:

Hypothesis 4: Perceived Innovativeness of augmented reality applications has a direct positive effect on Perceived Usefulness.

Hypothesis 5: Perceived Innovativeness of augmented reality applications has a direct positive effect on Perceived Ease of Use.

Moreover, as far as previously stated hypotheses H3 and H4 evaluate influence of Perceived Innovativeness and Perceived Enjoyment on Perceived Usefulness and based on the state that the main aim of technology of augmented reality is to provide users with additional information which can be helpful in purchasing process, we consider that Perceived Innovativeness has stronger impact on Perceived Usefulness that Perceived Enjoyment and therefore we formulate the following hypothesis:

Hypothesis 6: Perceived Innovativeness has a stronger influence on Perceived Usefulness than Perceived Enjoyment.

1.10 Research model

Based on the relevant literature review and previous empirical studies, we formulated hypotheses and accordingly proposed a new extended technology acceptance model for measuring the antecedents of behavioral intentions concerning augmented reality use in mobile commerce context, taking into account motivations of potential users. The extended research model is demonstrated in Figure 3.

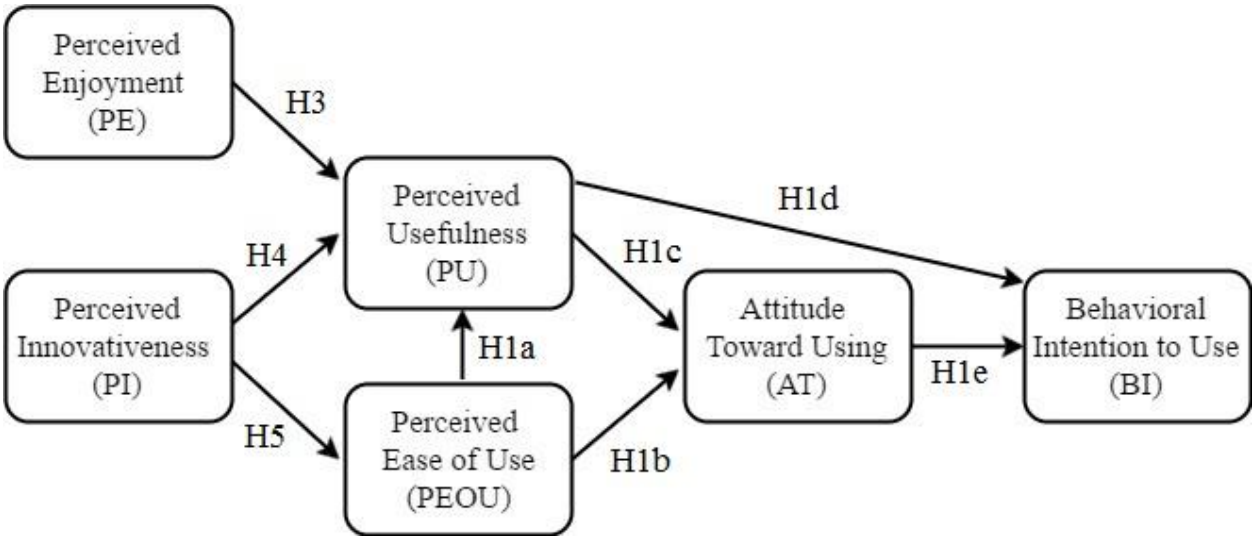

Figure 3 Extended technology acceptance model

Source: Author's own research

This model contains six variables: four basic variables which are perceived usefulness, perceived ease of use, attitudes toward using and behavioral intention, and two external variables which are perceived enjoyment and perceived innovativeness. From the conceptual aspect, the model shows the extent to which perceived enjoyment and respondents' perceived innovativeness provided by the use of augmented reality influence the usefulness and ease of use of augmented reality. In addition, the model examines the effects of perceived usefulness and perceived ease of use on attitude toward using.

CHAPTER 2. AUGMENTED REALITY IN MOBILE COMMERCE: EMPIRICAL RESEARCH, FINDINGS AND RESULTS

2.1 Research design and sample structure

In order to evaluate the extended technology acceptance model shown in Figure 3 and to test proposed hypotheses, survey methodology with questionnaires with 7-point Likert scale (Likert, 1932) were designed and conducted. As mentioned in the last section, the research model includes six variables. Each variable was measured by at least two statements/questions. Respondents expressed their opinions on a seven-point Likert scale (1 — strongly disagree, 7 — strongly agree). The statements were formulated based on the relevant literature review and adapted to the research context. Perceived Enjoyment was measured through three statements, and Perceived Innovativeness was measured by using four statements. Perceived Usefulness was measurement with three statements, Perceived Ease of Use was measured through four statements, Attitude Toward Using was measured by the use of three statements, and finally Behavioral Intentions were measured through three statement. There were also questions related to hedonic or utilitarian belongings, questions about familiarity of respondent with the concept of augmented reality and mobile commerce and questions related to respondents' previous experience in interaction with interactive technology and in online shopping and also one question about frequency of online purchasing. The questionnaire also included general questions regarding sex, age, country, education and level of income of respondents. In total questionnaire included twenty statements regarding evaluation of variables for technology acceptance model and twelve other questions described above.

As a part of survey, in the beginning of questionnaire, respondents were offered to watch two videos with the demonstration of using augmented reality applications. As examples of applications IKEA and Converse applications were used. In both video applications represent catalogues with the function of augmented reality applied in handheld devices and used to provide consumers with the additional information about products (which are respectively furniture and shoes in our cases). After watching the videos, participants were offered to answer the questions based on the watched content and their feelings, thoughts and expectations about it.

2.2 Sample description

The questionnaire was offered to 160 respondents with the age from 15 to 45, living in Russia. 125 participants responded to the survey. Thus, rate of response is counted to be equal 0.78 or 78%.

The sample consists of 125 respondents, what is more than 100, and thereby, according to the central limit theorem, is sufficiently large and therefore normally distributed (Field, 2013). The description of respondents' demographic characteristics is provided in Table 3. Note, that the sample contains a slightly higher percentage of women (62.4%) than men (37.6%). Most of the respondents are in the age group of 23–29 years (60.8%). Generally, the sample consists mainly of people under 30 years of age (97.6%). The group of respondents aged 30 years and over comprises only 2.4% of the total sample. In terms of the level of education, the majority of respondents from the sample have a university degree (81.6%). Regarding the level of income, majority of respondents has either average or high level of income (42.3% and 49.5% respectively). Country of citizenship of all respondents is Russian Federation.

Table 3 Demographic description of sample

	No. of respondents	%
Gender		
Female	78	62.4
Male	47	37.6
Age		
15-22	46	36.8
23-39	76	60.8
30-45	3	2.4
Education		
College degree	2	1.6
Undergraduate (bachelor)	20	16
Undergraduate (master)	57	45.6
Bachelor’s degree	25	20
Master’s degree	20	16
Academic degree	1	0.8
Level of income		
Extremely low	0	0
Low	1	0.9
Average	47	42.3
High	55	49.5
Very high	8	7.2

Regarding the characteristics which reflect the extent to which respondents are familiar with the main concepts, they are presented in the Table 4. Survey showed that the majority of respondents (55.2%) is relatively familiar with the concept of augmented reality, or at least know something about it (25.6%). Moreover, more than a half of respondents (65.6%) make purchases online from time to time and almost a quarter (24%) do it on the regular basis.

Table 4 Sample description

	No. of respondents	%
Familiarity with the concept of augmented reality		
Completely unfamiliar	24	19.2
Know something about it	69	55.2
Know a lot about it	32	25.6
Frequency of purchasing online		
Purchase very rare	13	10.4
Purchase sometimes	82	65.6
Purchase often	30	24

2.3 Statistical analysis

Statistical data analysis was performed by using the Statistical Package for Social Sciences (SPSS 13.0) and AMOS 18.0 software. In the first step, fit measurement of the model was tested by applying confirmatory factor analysis. A ratio of chi square to df was determined, as well as the following fit indices: Comparative Fit Index, Incremental Fit Index, Tucker–Lewis Index, and Root Mean Square Error of Approximation. Convergent validity and discriminant validity were also tested, as well as the composite reliability (CR). We estimated the internal consistency of the statements used to measure the latent variables of the model based on Cronbach's alpha. Structural equation modeling was used for hypothesis testing.

2.4 Measurement model

We started our statistical analysis from application of the item-to-total correlation method in order to determine the degree of correlation between the statements and the construct to which

they belong. Fit measurement of the model was tested by using confirmatory factor analysis. The final model resulted in an adequate fit. The $\chi 2$: df ratio is 1.76, which is smaller than the threshold value of 3 recommended by Bagozzi and Yi (1988). Moreover, the values of other relevant fit indices are higher than the respective minimum threshold values. Comparative Fit Index, Incremental Fit Index, and the Tucker–Lewis Index are higher than the threshold value of 0.9. Although the Root Mean Square Error of Approximation is 0.079, this is still within the acceptable range of 0.05 to 0.08 (Hair et al. 2006). The values of the fit indices are given in Table 5.

The average variance extracted (AVE) of each latent variable in the model is higher than 0.5. Therefore, the model meets the requirements for convergent validity. More precisely, all AVEs are within the range of 0.64–0.80. The AVE of each construct is higher than the squared correlations between the given construct and other constructs. In this respect, the model variables meet the established criteria for discriminant validity. Furthermore, the CRs of each variable exceed the threshold value of 0.7 (Fornell and Larcker, 1981). Table 6 shows the correlation coefficients between all variables in the model, as well as the AVE and CRs of each variable. Finally, it is important to emphasize that the values of Cronbach's alpha of all constructs are higher than the threshold value of 0.7 (Nunnally, 1978). This also confirms the adequate internal consistency of the statements that were used to measure each variable.

Table 5 Fit indices of the model

Fit indices	Recommended value	Measurement model
$\chi 2$: df	< 3	1.76
CFI	> 0.9	0.952
TLI	> 0.9	0.937
IFI	> 0.9	0.953
RMSEA	< 0.08	0.079

Table 6

Intercorrelation matrix, average variance extracted (AVE), and composite reliabilities (CR)

	CR	AVE	MSV	MaxR(H)	PEOU	PE	PU	PI	AT
PEOU	0,879	0,647	0,189	0,891	**0,804**				
PE	0,892	0,805	0,717	0,946	0,294	**0,897**			
PU	0,847	0,735	0,587	0,959	0,310	0,738	**0,857**		
PI	0,831	0,624	0,215	0,967	0,313	0,342	0,332	**0,790**	
AT	0,894	0,738	0,717	0,974	0,435	0,847	0,766	0,464	**0,859**

PEOU — Perceived Ease of Use; PE — Perceived Enjoyment; PU — Perceived Usefulness; PI — Perceived Innovativeness; AT — Attitude Toward Using.

2.5 Structural Model

In order to test the hypothesized relationships among the variables we used structural equation modeling. The fit indices indicate that the structural model fits the data reasonably well. The $\chi 2$: df ratio is less than 3. All other relevant fit indices are also within an acceptable range (Comparative Fit Index equals 0.952 > 0.9; Tucker–Lewis Index equals 0.937 > 0.9; Incremental Fit Index equals 0.953 > 0.9; Root Mean Square Error of Approximation equals 0.079 < 0.08). The conception of the structural model indicates a total of 8 tested relationships. This model conception enabled us to determine statistical significance for the effects of Perceived Enjoyment and Perceived Innovativeness on Perceived Usefulness and Perceived Ease of Use. Moreover, we made a test for the influence of Perceived Ease of Use and Perceived Usefulness on Attitude Toward Using.

In general, the results demonstrate that nine out of ten hypotheses are supported (see Table 7).

Hypotheses H3–H6 analyzed the effects of Perceived Innovativeness and Perceived Enjoyment on Perceived Usefulness and perceived Ease of Use. The findings indicate that both Perceived Enjoyment (estimate = 0.826, $p < 0.05$) and Perceived Innovativeness (estimate = 0.156, $p < 0.05$) emerged as statistically significant antecedents of the Perceived Usefulness. This supports hypotheses H3 and H4. Moreover, Perceived Enjoyment stands out as a variable that has the stronger effect on Perceived Usefulness than Perceived Innovativeness. Thus, we cannot support hypothesis H6. However, it indicates that the greatest usefulness of augmented reality in terms of achieving satisfactory results is perceived precisely by those respondents

whose needs in playfulness and pleasure are met by the services offered with a help of augmented reality. Additionally, it can happen because the use of augmented reality is not yet fully taken off, and those respondents who may be considered as pioneers in the use of these service and who are willing to learn about new technologies, still do not clearly see the benefits of augmented reality in terms of how it can improve personal performance, productivity, and effectiveness. Furthermore, results show that Perceived Innovativeness has statistically significant effect on Perceived Ease of Use (estimate = 0.326, $p < 0.05$). This supports hypothesis H5. Perceived Ease of Use significantly influence both Perceived Usefulness (estimate = 0.108, $p < 0.01$) and Attitudes Toward Using (estimate = 0.089, $p < 0.01$).

Assessment of hypotheses H1a-H1e shows that such variables as Perceived Ease of Use (estimate = 0.089, $p < 0.01$) and Perceived Usefulness (estimate = 0.922, $p < 0.01$) have a significant effect on Attitude Toward Using. These findings confirm hypothesis H1b and H1c respectively. Note, that Perceived Usefulness has a stronger impact than Perceived Ease of Use on Attitude Toward Using that supports hypothesis H2. Moreover, results demonstrate a significant impact of Perceived Ease of Use on Perceived Usefulness (estimate = 0.108, $p < 0.01$). Therefore, hypothesis H1a can be concerned as supported.

Finally, the effects of Perceived Usefulness and Attitude Toward Using on Behavioral Intention (hypotheses H3a and H3b) were tested. Both variables significantly affect consumers' intentions to continue using augmented reality services in the future and their willingness to recommend particular services to their friends and relatives. This finding supports hypothesis H1d (estimates = 0.168, $p < 0.01$) and H1e (estimate = 0.130, $p <0.01$).

Consequently, all hypotheses related to classical technology acceptance model (H1a - H1e) are supported, what satisfies the requirements of application of technology acceptance model for particular interactive technology such as augmented reality.

Table 7 Test results of hypothesized relationships

Hypotheses	Estimates	Conclusion
H1a: Perceived Ease of Use → Perceived Usefulness*	0.108	Supported
H1b: Perceived Ease of Use → Attitude Toward Using*	0.089	Supported
H1c: Perceived Usefulness → Attitude Toward Using*	0.922	Supported

Table 7 (cont.) Test results of hypothesized relationships

Hypotheses	Estimates	Conclusion
H1d: Perceived Usefulness → Behavioral Intention to Use*	0.168	Supported
H1e: Attitude Toward Using → Behavioral Intention to Use*	0.130	Supported
H2: The Perceived Usefulness → Attitude Toward Using stronger than Perceived Ease of Use*	--	Supported
H3: Perceived Enjoyment → Perceived Usefulness**	0.826	Supported
H4: Perceived Innovativeness → Perceived Usefulness**	0.156	Supported
H5: Perceived Innovativeness → Perceived Ease of Use**	0.326	Supported
H6: Perceived Innovativeness → Perceived Usefulness stronger than Perceived Enjoyment**	--	Not supported

* Significant at 0.05 level
** Significant at 0.01 level

Based on the received results, their analysis and interpretations provided above, we can make the following conclusions:

- Technology acceptance model was successfully adopted for the technology of augmented reality and can be considered as sufficient tool for evaluation of acceptance of this interactive technology;
- Perceived usefulness has stronger influence on attitude toward using than perceived ease of use has. It can be explained by the recent introduction of augmented reality and as a result, the use of new interactive technology is not fully investigated, and even early adopters do not have clear understanding how to interact with augmented reality;
- Both perceived innovativeness and perceived enjoyment has a significant direct impact on perceived usefulness and therefore on attitude toward using and on behavioral intention to use augmented reality. In other words, both perceived

innovativeness and perceived enjoyment influence the acceptance of new technology. Moreover, perceived innovativeness also affect perceived ease of use of the new technology;

- Perceived enjoyment has stronger influence on perceived usefulness in comparison with the impact which perceived innovativeness has. The reason for it can be novelty of technology what means that functional benefits can be not as clear and obvious as characteristics such as fun and playfulness. Moreover, we can claim that on this stage of technology development, enjoyment contributes to better acceptance of augmented reality than personal innovativeness. Taking into account, that enjoyment reflects hedonic aspects and innovativeness belongs to utilitarian aspects, we may consider that people with hedonic motivations are more inclined to adapt augmented reality than those who follow utilitarian views.

Based on the conclusions above, we now can give answers for two research questions. In regard to the first question, which was related to influence of enjoyment and innovativeness on the adoption of augmented reality, we can state that both factors — enjoyment and innovativeness — have a direct impact on the acceptance of augmented reality in the context of mobile commerce. Regarding the second research question, we can state that hedonic motivation better facilitate to the acceptance of augmented reality in context of mobile commerce. However, the answer for the second question still requires additional support which can be provided after the comparison of respondents with two types of motivations.

2.6 Comparison of respondents with hedonic and with utilitarian motivations

Based on the questionnaire results we can state that the average respondent is partly familiar with the concept of augmented reality, which is demonstrated by the mean of 4.26 from descriptive statistics analysis. The reason for it can be early stage of augmented reality development and therefore low awareness among population about new interactive technology. At the same time frequency of purchasing online also stays on the average level (mean = 4.52).

However, comparing respondents with hedonic motivation with the respondents with utilitarian motivation we found out that those who are hedonists are in average more familiar with the technology of augmented reality (mean = 4.37 in comparison with the mean = 3.47). Moreover, while analyzing groups in the context of each element of technology acceptance model we investigated that groups differ for the number of factors (see Table 8). Apart from the

Perceived Enjoyment, which, consequently from the group's characteristics and the results of analysis, is higher for respondents with hedonic proclivity, value of Perceived Innovativeness and Usefulness are also more significant for these group and therefore all of these leads to better attitudes toward using and higher behavioral intentions to use new interactive technology among the people who follow hedonic motivations. At the same time, for the utilitarian group of people mean is significantly less for the most factors, excluding perceived ease of use. It worth mentioning, that results represent that mean of attitude toward using and behavioral intention is significantly higher for group of people with prevailing hedonic motivation. It also supports the statement that they are more likely to adapt new interactive technology.

Table 8 Comparison of means of variables of two groups based on the type of motivation they follow

	People with prevailing hedonic motivation	People with prevailing utilitarian motivation
Perceived Enjoyment	5.50	3.64
Perceived Innovativeness	4.69	3.35
Perceived Usefulness	5.19	3.91
Perceived Ease of Use	5.72	5.27
Attitude Toward Using	5.64	3.84
Behavioral Intention	5.29	3.80
Familiarity with the concept	4.37	3.47
Frequency of online purchasing	4.56	4.20

Based on the observations above, we can state that hedonic motivations contribute to the higher acceptance of technology of augmented reality, whereas existence of utilitarian motivations has slightly less influence on the adoption of new interactive technology. It is also supported by our hypothesis which claims that Perceived Playfulness has a stronger influence on Perceived Usefulness, which consequently stronger affect attitude toward using and behavioral intention, than Perceived Innovativeness, where we consider perceived playfulness as an attribute of hedonists and perceived innovativeness as an attribute of utilitarian persons. Thereby,

regarding the second research question, we can confidently state that hedonic motivation better contributes to the acceptance of augmented reality in the context of mobile commerce.

2.7 Potential drivers and barriers

Based on the conducted research and its results, there are the following observations which may help to identify potential drivers and barriers in acceptance of augmented reality:

- Perceived usefulness has stronger influence on attitude toward using and therefore on behavioral intention that perceived ease of use has. Consequently, it may mean that unclear ease of process, complicated instructions how to interact with system or lack of simplicity can come as one of the barriers in adoption of augmented reality. Moreover, lower value of ease of use can be caused by lack of education and skills, which is another barrier in adoption of augmented reality.

- Perceived enjoyment has stronger influence on perceived usefulness in comparison with the impact which perceived innovativeness has. Thus, if enjoyment facilitates acceptance of augmented reality, all its attributes such as gamification of process, form of fun and pleasant environment can be considered as drivers for adoption of new information technology.

To summarize, main drivers can be identified as gamification of process, form of fun and pleasant environment and barriers can be defined as unclear ease of process, complicated instructions how to interact with system, lack of simplicity and lack of education and skills. Accordingly, it gives the answer for the third research question which we now consider to be solved.

2.8 Theoretical contribution

Regarding a theoretical perspective, the results investigate factors affecting the adoption of augmented reality in retail. As far as augmented reality is a relatively new and emerging technology, prior studies by using the technology acceptance model have not examined all several factors which influence the adoption of augmented reality. We extended technology acceptance model by including two external variables which are Perceived Enjoyment and Perceived Innovativeness. We chose these factors based on idea of two motivations of consumers — hedonic and utilitarian, investigating on what extent each motivation affects the adoption of new interactive technology and which of them has more significant effect.

One obvious aspect concerning augmented reality is that this technology is still in an early stage of technology diffusion and exists within the introductory stage of the product lifecycle. A design of technology is concerning to be emerging in the industry. Therefore, the most likely adopters of this new technology would be innovators and early adopters. This is reflected in our results as the variable perceived innovativeness turned out to be one of the strongest predictors of augmented reality adoption intention.

In the present early stage of the life cycle of augmented reality technology, functional benefits together with positive feelings seem to be the core reason why consumers are interested in adopting this new interactive technology. However, the consumers who expect augmented reality to make their experience more pleasant and joyful have a more positive attitude toward augmented reality and thereby seem to be more likely to adopt the technology.

Moreover, from the theoretical implications, our model provides the opportunity to investigate relationships among latent variables. First, innovativeness was shown to be a statistically significant driver of both Perceived Usefulness and Perceived Ease of Use. Because augmented reality is an activity that has not yet been sufficiently used by many customers, playfulness may be of great importance in situations where individuals do perceive the usefulness of this type of service. Additionally, compared with innovativeness, enjoyment also significantly affects Perceived Usefulness; moreover, it has even stronger effect than innovativeness. On the one hand, it is clear that more innovative users more easily acquire skills required for using augmented reality services. On the other hand, if interaction has a form of game, individuals are able to more easily perceive all advantages augmented reality. However, when it comes to playing and having joy and fun on the use of augmented reality services, enjoyment and playfulness as personality characteristics are of greater importance than innovativeness.

Perceived Usefulness in the designed model emerged as a strong antecedent of attitudes toward using. This finding matches the results of previous studies (Kim et al. 2010; Zhang et al. 2012). The effect of Perceived Ease of Use on attitudes toward using is weaker, but is still statistically significant. A similar result has been confirmed by Kim et al. (2010), Wei et al. (2009), Wu and Wang (2005), and Zarmpou et al. (2012). Thus, we conclude that the simple procedure of acquiring the skills necessary to use augmented reality services, and the advantages they provide in terms of improving users' work performance, productivity, and effectiveness, influence people's willingness to continue to use these services in the future and to recommend them to their friends and relatives.

2.9 Managerial Contribution

The present findings of this study might be useful to business stakeholders (augmented reality service providers, retailers, marketing analysts, etc.) in formulating suitable strategy for the future development and implementation of augmented reality technology and in building long-term customer relations.

First of all, while creating application including augmented reality technology, retailers should take into account the observed aspects of enjoyment and playfulness — that is, application should include elements of game and even probably allow users to escape from reality for a while — to create a favorable overall environment for the adoption of augmented reality technology and to increase individual's intention to use. As far as our study has confirmed that Perceived Enjoyment has a significant influence on Perceived Usefulness, retailers should consider applying gamification in the process of using technology aimed at increasing customers' willingness to be involved and to repeat the received experience.

Secondly, applications have to be valuable and understandable to users. While developing application with the function of augmented reality, retailers should emphasize those aspects of augmented reality interactivity that facilitates user's engagement, and increase awareness of the ease of use of augmented reality technology, by educating potential users. The use of augmented reality service should be presented as a part of modern consumer's personality so that the value of this service meets user's image and personal concepts. These types of user more easily recognize the benefits of using augmented reality service to improve their productivity and effectiveness in purchasing process. Our findings clearly indicate that Perceived Usefulness and Perceived Ease of Use are important antecedents of Attitude Toward Using and therefore Behavioral Intentions. It is therefore important to help customers to form positive attitudes about the benefits and ease of use of augmented reality applications, which may further imply a higher degree of their readiness to continue to use such services and recommend them to others. Retailers may also find it useful to organize free small trainings of augmented reality usage, as a way of presenting all of its benefits. In this way, not only are relations with existing customers strengthened, but a good foundation is also established to attract new interactive technology users. Because respondents recognize Perceived Usefulness as a stronger ascendant of Attitudes Toward Using than Perceived Ease of Use, thereby it is recommended to emphasize the simplicity and easiness of the process of using augmented reality technology to simplify their purchasing process, and explain clearly to customers the process of using in order to prove that it is clear and understandable.

Moreover, as far as augmented reality technology is on the early stage of its life-cycle, functional benefits may come as the main reasons why consumers can be interested in adoption of new interactive technology. Therefore, retailers should focus on emphasizing the role of functional benefits for users and performing these functions in the best possible way. Potential examples of functional benefit can be opportunity to fit the product (case of clothes and furniture) without going to shop, to go over and fit all products in a very short time and to do it from anywhere.

2.10 Limitations and future research

The conducted study has several limitations and therefore room for improvement and future research. First of all, it worth mentioning that while answering the questions and evaluating statements in questionnaires, respondents express their subjective perceptions of different characteristics of augmented reality as a new interactive technology. It becomes as the main issue, which limits the objectivity of the results of the survey. Moreover, the samples relied mostly on students. This is a typical shortcoming of many researches. However, a student sample is adequate for the goal of model. Secondly, as far as research was conducted in the particular country, and we focused on a pre-market study in Russia, whereas in some countries such as USA, augmented reality service already exists, the results may have limited generalizability in the context of other countries. The next point is limitation regarding the number of variables in the research model, which may reflect many other important aspects such as trust, perceived risk or privacy of users of augmented reality service.

However, the research provides a sound bias for the design of future studies. New research model can be extended and include some additional latent variables. Moreover, considering the increasing trend in the use of augmented reality service, it would be advisable to conduct research in successive time intervals to identify changes in the relationships among variables. It might be also useful to investigate different opinions on the key elements of augmented reality services among different groups of respondents based on socio-demographical criteria such as gender and age. Furthermore, future research might examine marketing of augmented reality, for example, how can advertising be spread through the technology of augmented reality. Future research also can investigate how augmented reality service can be used in business-to-business marketing. These and other important observations have yet to be studied since technology of augmented reality is still on its early stage.

CONCLUSION

Current paper was dedicated in order to research and analyze acceptance of augmented reality in the context of mobile commerce with the emphasis on consumers' motivations. As mobile commerce become more and more important and popular direction in retail, it is vital for the companies to stay innovative and up-to-date in development and implication of new technologies such as augmented reality, which can influence purchasing decision of potential consumers. At the same time, being emerging and recently introduced to the market, augmented reality is not fully explored by companies, making them interested in the new technology, in the way it can affect consumers' intention to try new technology and in the factors influencing their intention. In order to define what factors to select, we analyzed previous studies and found out that there is strong connection between two types of motivations — hedonic and utilitarian — and individuals' readiness to accept new information technology. Accordingly, factors we chose have to be related to particular type of motivation. Therefore, we stated our objective as investigation of the acceptance of augmented reality in the context of mobile commerce with the emphasis on motivation.

Commonly and widely accepted approach to investigate the intention to use new interactive technology is based on the technology adoption models, which help to check and measure factors influencing the extent to which users are ready to accept and use new information technology. We analyzed previous theoretical and empirical studies and based on theoretical and empirical background, technology acceptance model was selected for proceeding in the empirical part of the paper. While selecting external factors which may have an influence on acceptance of augmented reality, we guided by the consideration of connection between motivation and users' intention to use new innovative technology. Based on theoretical background, we selected two factors — perceived enjoyment and perceived innovativeness — which stand behind two motivation types respectively. The extended model allowed us to check whether selected variables such as perceived enjoyment and perceived innovativeness have an impact on the intention to use applications with the function of augmented reality and which of them better contributes to the adoption of augmented reality.

In current research qualitative method was applied. For our study we formulated ten hypotheses — six hypotheses for the basic technology acceptance model and four hypotheses as extension for the model. Data was collected via questionnaires created on the basis of previous studies related to augmented reality or related technologies. For measurement variables from technology acceptance model, each variable was accompanied by three or four statements, which

respondents were offered to evaluate with a help of Likert seven-point scale. Additionally, there were demographic questions and questions which distinguish people with hedonic motivation from people with utilitarian motivation for their further comparison. Collected information was processed via SPSS IBM, with AMOS extension. For analysis we selected method of confirmatory factor analysis and structural equation modeling as it comes as the most suitable and reliable for technology acceptance model.

Statistical analysis showed that the research model satisfied all requirements such as reliability, conversion validity and discriminant validity and can be considered as appropriate and relevant for our study.

Results of statistical analysis showed that in general nine out of ten hypotheses were supported. First of all, all hypotheses belonged to basic technology acceptance model were supported what means that the chosen model is applicable for augmented reality and we can evaluate acceptance of the technology through this model. From the model, we can state that intention to use augmented reality is directly affected by attitude toward using and perceived usefulness, which both are consequently influenced by perceived ease of use. Additionally, attitude toward using is also affected by perceived usefulness. Apart from basic observations, we found out that perceived enjoyment has stronger influence on perceived usefulness in comparison with the impact which perceived innovativeness has. Supposed reason may be recent introduction of augmented reality and, as a result, new technology is still not fully investigated by consumers in terms of how to use and interact with it.

Results also demonstrated that extended technology acceptance model is also appropriate and applicable. Both external variables, which are perceived enjoyment and perceived innovativeness, positively affect behavioral intention of consumers to use augmented reality while purchasing online. Moreover, comparing the influence of those two factors, we found out that perceived enjoyment has affect intention stronger than perceived innovativeness. On the one hand, it again can be explained by the novelty of augmented reality what means that its functional benefits are not completely explored. On the other hand, as far as enjoyment belongs to hedonic motivation, whereas innovativeness belongs to utilitarian motivation, we can state that people who follow hedonic motivation are more likely to accept augmented reality, or, in other words, hedonic motivation better contributes to the adoption of augmented reality.

Additionally, we made a statistical comparison of two groups of people — with hedonic and utilitarian motivations — by comparing means of each variable. Overall, almost group with hedonic motivations have higher means almost for all factors, what indicates that hedonic

motivation facilitates to acceptance of augmented reality, and what coincides with our observation based on analysis of technology acceptance model.

In our paper, we also identified potential drivers and barriers for augmented reality in the context of mobile commerce. As far as we found out that perceived ease of use has positive, but relatively weak influence on behavioral intention, we can state that unclear and unobvious ease of process and lack of simplicity can come as possible barrier for acceptance of new interactive technology. Furthermore, lack of knowledge and skills also can become an obstacle in adoption of new technology. In regard to drivers, taking into account positive impact of enjoyment on intention to use, we may consider that different attributes of enjoyment such as gamification of process, form of fun and pleasant environment come as potential drivers for acceptance of augmented reality.

Discussing theoretical and managerial contribution, as for theoretical contribution, we studied intersection of three directions — augmented reality, mobile commerce and motivations. We provided extended technology acceptance model, identified role of motivation in acceptance of augmented reality, compared them and also identified potential drivers and barriers. Regarding practical implication, knowledge of potential barriers and drivers on the one hand allows mitigating or avoiding negative factors, and on the other hand may contribute to more proper development of strategy for applications with the function of augmented reality according to motivations of potential consumers.

Moreover, it is necessary to mention several limitations of the current research. First of all, data collected by questionnaires has subjective nature. Secondly, sample size and structure is limited in terms of number of respondents and their social-demographic characteristics, such as social status. Thirdly, as far as all respondents are from Russian Federation, there is geographical limitation. Lastly, technology acceptance model may include more external variables such as trust, social influence, perceived risk or privacy of users of augmented reality service.

However, such limitations provide a great room for future studies. Firstly, apart from business-to-consumers relationship, opportunities of function of augmented reality in mobile applications can be analyzed for business-to-business structures. Secondly, research model can be further extended with addition of more external factors which can have impact on behavioral intention. Next point is expansion of social-demographic characteristics of sample and increase in number of participants. Lastly, as far as technology of augmented reality is on its early stage of development, it may require investigation after a time interval in order to identify changes among variables.

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APPENDIX 1 — QUESTIONNAIRE DESIGN

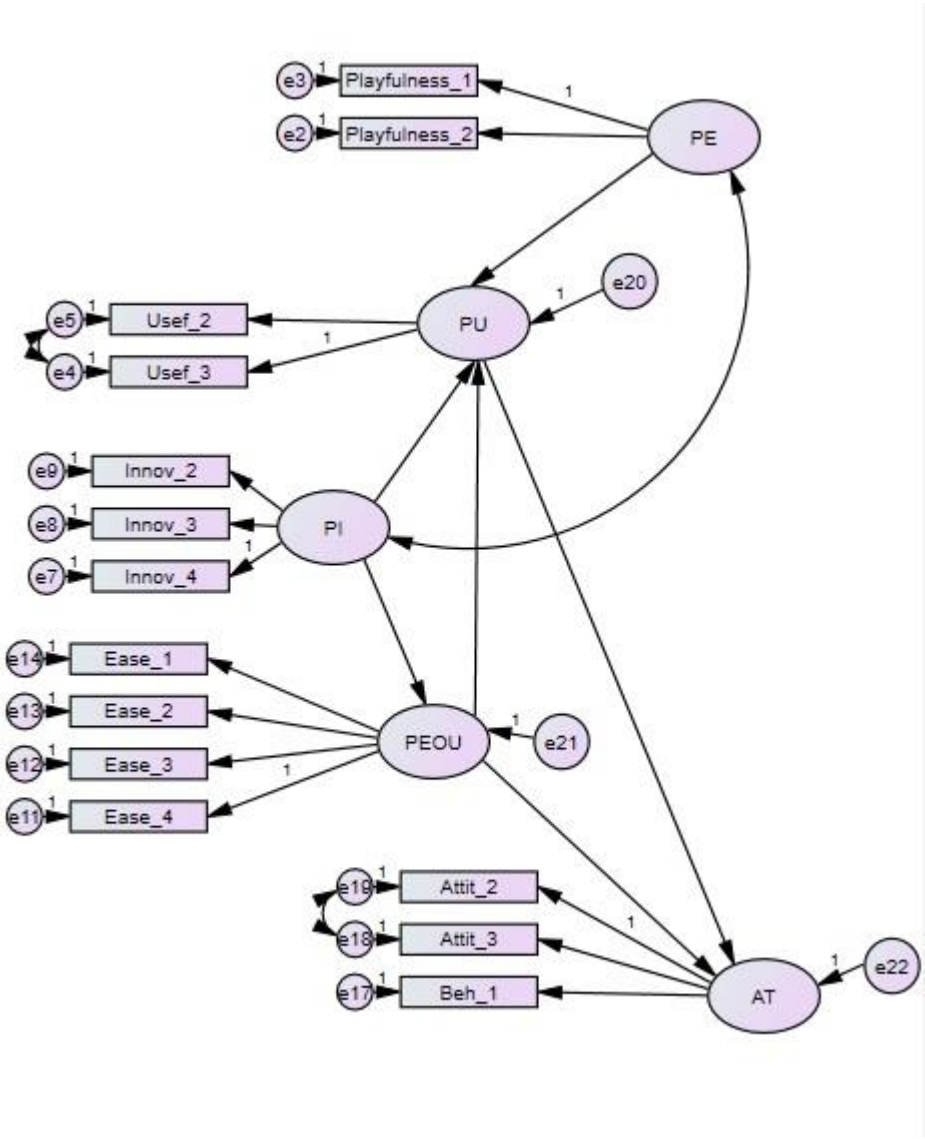
Variable — Statement
Perceived Innovativeness (PI) PI 1 — I am sure I will be one of the firsts who will try augmented reality application. PI 2 — I am really keen into exploring new technologies. PI 3 — I always try to learn as much as possible regarding new technologies. PI 4 — My friends and relatives always ask for my advice regarding technologies.
Perceived Enjoyment (PE) PE 1 — Purchasing online through application with augmented reality seems fun to me. PE 2 — Augmented reality makes purchasing process more pleasant and enjoyable. PE 3 — I would use application with function of augmented reality not just for successful purchases, but also for getting joy during the process.
Perceived Usefulness (PU) PU 1 — In my opinion, augmented reality may improve online purchasing process. PU 2 — I think that augmented reality can make online purchasing more efficient. PU 3 — I think that with a help of augmented reality I can easy and fast find and buy what I need.
Perceived Ease of Use (PEOU) PEOU 1 — I think that application with augmented reality is easy to use. PEOU 2 — In my opinion, to learn how to use application with augmented reality is very simple. PEOU 3 — I think that application with augmented reality does not require a lot of intellectual efforts. PEOU 4 — I think that I can be skilful in managing application with augmented reality.
Attitudes Toward Using (AT) AT 1 — I am positive about applications with the function of augmented reality. AT 2 — The augmented reality app is so interesting that you just want to learn more about it. AT 3 — The use of the augmented reality application is a good idea.
Behavioral Intention (BI) BI 1 — I think I will use the augmented reality app regularly in the future. BI 2 — I think will recommend using the augmented reality application to my friends. BI 3 — If I were to buy furniture in IKEA in the future I would download and use application with augmented reality.

APPENDIX 1 — QUESTIONNAIRE DESIGN (CONT.)

Familiarity with the concept	How familiar are you with the concept of augmented reality?
Frequency of purchasing online	How often do you purchase online?
Hedonic/Utilitarian	I would use augmented reality app first of all because it is fun — I would use augmented reality app first of all because it makes purchasing process more effective.
Hedonic motivation	I would use augmented reality app first of all because it is fun.
Utilitarian motivation	I would use augmented reality app first of all because it makes purchasing process more effective.

Age	Open question
Sex	Male/Female
Country	Open question
Education	College degree Undergraduate (bachelor) Undergraduate (master) Bachelor's degree Master's degree Academic degree
Level of income	Extremely low Low Average High Very high

APPENDIX 2 — STATISTICAL MODEL



Computation of degrees of freedom

Number of distinct sample moments:	105
Number of distinct parameters to be estimated:	37
Degrees of freedom (105 - 37):	68

Result

Minimum was achieved
Chi-square = 120,782
Degrees of freedom = 68
Probability level = ,000

Regression Weights

			Estimate	S.E.	C.R.	P	Label
PEOU	<---	PI	,252	,082	3,058	,002	
PU	<---	PE	,616	,086	7,133	***	
PU	<---	PI	,127	,059	2,156	,031	
PU	<---	PEOU	,113	,106	1,064	,287	
AT	<---	PEOU	,128	,130	,989	,323	
AT	<---	PU	1,257	,168	7,468	***	
Playfulness_2	<---	PE	1,134	,085	13,310	***	
Playfulness_1	<---	PE	1,000				
Usef_3	<---	PU	1,000				
Usef_2	<---	PU	1,072	,108	9,938	***	
Innov_4	<---	PI	1,000				
Innov_3	<---	PI	1,020	,139	7,358	***	
Innov_2	<---	PI	1,014	,138	7,333	***	
Ease_4	<---	PEOU	1,000				
Ease_3	<---	PEOU	1,132	,113	10,043	***	
Ease_2	<---	PEOU	1,203	,110	10,981	***	
Ease_1	<---	PEOU	1,043	,126	8,296	***	
Beh_1	<---	AT	1,035	,095	10,907	***	
Attit_3	<---	AT	,930	,100	9,260	***	
Attit_2	<---	AT	1,000				

Standardized Regression Weights

			Estimate
PEOU	<---	PI	,326
PU	<---	PE	,826
PU	<---	PI	,156
PU	<---	PEOU	,108
AT	<---	PEOU	,089
AT	<---	PU	,922
Playfulness_2	<---	PE	,932
Playfulness_1	<---	PE	,861
Usef_3	<---	PU	,670
Usef_2	<---	PU	,707
Innov_4	<---	PI	,655
Innov_3	<---	PI	,855
Innov_2	<---	PI	,836
Ease_4	<---	PEOU	,823
Ease_3	<---	PEOU	,809
Ease_2	<---	PEOU	,877
Ease_1	<---	PEOU	,698
Beh_1	<---	AT	,830
Attit_3	<---	AT	,876
Attit_2	<---	AT	,856

Matrices

Residual Covariances

	Attit_2	Attit_3	Beh_1	Ease_1	Ease_2	Ease_3	Ease_4	Innov_2	Innov_3	Innov_4	Usef_2	Usef_3	Playfulness_1	Playfulness_2
Attit_2	,061													
Attit_3	,057	,053												
Beh_1	,082	,043	,065											
Ease_1	,088	,498	,223	,000										
Ease_2	-,097	,257	,080	,092	,000									
Ease_3	-,088	,134	,106	-,103	,000	,000								
Ease_4	,110	,268	,231	-,041	-,037	,061	,000							
Innov_2	,262	,079	,170	,213	-,032	-,150	,091	,000						
Innov_3	,020	-,254	-,092	,057	-,018	-,246	,112	-,001	,000					
Innov_4	,136	-,178	-,129	,116	-,005	-,326	,089	-,109	,110	,000				
Usef_2	,000	,074	,111	,305	,053	,053	,254	,118	-,216	-,183	,023			
Usef_3	-,001	,039	,134	,348	,014	,067	,096	,123	-,153	-,232	,022	,020		
Playfulness_1	,032	,078	-,040	,629	,180	,107	,293	,233	-,155	-,106	,064	-,019	,000	
Playfulness_2	,093	-,004	,023	,553	,176	,044	,241	,204	-,171	-,206	,005	,084	,000	,000

Standardized Residual Covariances

	Attit_2	Attit_3	Beh_1	Ease_1	Ease_2	Ease_3	Ease_4	Innov_2	Innov_3	Innov_4	Usef_2	Usef_3	Playfulness_1	Playfulness_2
Attit_2	,226													
Attit_3	,288	,237												
Beh_1	,328	,188	,213											
Ease_1	,510	3,174	1,211	,000										
Ease_2	-,606	1,762	,467	,566	,000									
Ease_3	-,543	,906	,613	-,631	,002	,000								
Ease_4	,782	2,081	1,536	-,291	-,262	,443	,000							
Innov_2	1,394	,461	,849	1,315	-,211	-,987	,689	,000						
Innov_3	,110	-1,502	-,467	,360	-,123	-1,638	,862	-,005	,000					
Innov_4	,584	-,846	-,523	,575	-,028	-1,717	,541	-,455	,464	,000				
Usef_2	-,001	,389	,503	1,872	,356	,345	1,912	,668	-1,244	-,836	,096			
Usef_3	-,006	,210	,624	2,174	,095	,443	,734	,713	-,897	-1,080	,103	,086		
Playfulness_1	,146	,389	-,175	3,784	1,175	,684	2,170	1,296	-,876	-,475	,319	-,097	,000	
Playfulness_2	,399	-,017	,094	3,176	1,100	,271	1,698	1,077	-,918	-,876	,022	,404	,000	,000

Variances

	Estimate	S.E.	C.R.	P	Label
PE	1,498	,257	5,829	***	
PI	1,263	,329	3,833	***	
e21	,674	,128	5,276	***	
e20	,131	,056	2,352	,019	
e22	,154	,097	1,583	,113	
e2	,292	,094	3,099	,002	
e3	,523	,095	5,524	***	
e4	1,023	,142	7,216	***	
e5	,958	,136	7,065	***	
e7	1,679	,245	6,861	***	
e8	,484	,126	3,829	***	
e9	,560	,131	4,286	***	
e11	,360	,062	5,781	***	
e12	,511	,085	6,001	***	
e13	,329	,071	4,604	***	
e14	,866	,124	6,967	***	
e17	,747	,114	6,572	***	
e18	,406	,091	4,464	***	
e19	,565	,116	4,848	***	

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	37	120,782	68	,000	1,776
Saturated model	105	,000	0		
Independence model	14	1194,265	91	,000	13,124

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	,164	,885	,823	,573
Saturated model	,000	1,000		
Independence model	,765	,298	,190	,258

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	,899	,865	,953	,936	,952
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	,747	,672	,712
Saturated model	,000	,000	,000
Independence model	1,000	,000	,000

NCP

Model	NCP	LO 90	HI 90
Default model	52,782	25,991	87,421
Saturated model	,000	,000	,000
Independence model	1103,265	995,438	1218,514

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	,974	,426	,210	,705
Saturated model	,000	,000	,000	,000
Independence model	9,631	8,897	8,028	9,827

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,079	,056	,102	,024
Independence model	,313	,297	,329	,000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	194,782	204,965	299,429	336,429
Saturated model	210,000	238,899	506,973	611,973
Independence model	1222,265	1226,119	1261,862	1275,862

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	1,571	1,355	1,850	1,653
Saturated model	1,694	1,694	1,694	1,927
Independence model	9,857	8,987	10,786	9,888

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	91	101
Independence model	12	14

APPENDIX 3 — DESCRIPTIVE STATISTICS

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Familiarity	125	1	7	4,26	1,792
Frequency	125	1	7	4,52	1,484
Valid N (listwise)	125				

Descriptive Statistics[a]

Motivation		N	Minimum	Maximum	Mean	Std. Deviation
Hedonist	Age	110	15	46	23,30	3,196
	Valid N (listwise)	110				
Utilitar	Age	15	20	40	23,80	4,648
	Valid N (listwise)	15				

Descriptive Statistics

Motivation		N	Minimum	Maximum	Mean	Std. Deviation
Hedonist	Frequency	110	2	7	4,56	1,437
	Familiarity	110	1	7	4,37	1,718
	Valid N (listwise)	110				
Utilitar	Frequency	15	1	7	4,20	1,821
	Familiarity	15	1	7	3,47	2,167
	Valid N (listwise)	15				

Descriptive Statistics[a]

Motivation		N	Minimum	Maximum	Mean	Std. Deviation
Hedonist	Play_1	110	2	7	5,75	1,258
	Play_2	110	2	7	5,54	1,304
	Play_3	110	1	7	5,22	1,480
	Valid N (listwise)	110				
Utilitar	Play_1	15	1	6	4,20	1,859
	Play_2	15	1	6	3,73	1,870
	Play_3	15	1	6	3,00	1,648
	Valid N (listwise)	15				

Descriptive Statistics[a]

Motivation		N	Minimum	Maximum	Mean	Std. Deviation
Hedonist	Innov_1	110	1	7	4,58	1,763
	Innov_2	110	2	7	5,09	1,193
	Innov_3	110	1	7	5,35	1,267
	Innov_4	110	1	7	3,73	1,636
	Valid N (listwise)	110				
Utilitar	Innov_1	15	1	6	2,47	1,356
	Innov_2	15	1	7	3,73	1,944
	Innov_3	15	1	7	4,47	1,685
	Innov_4	15	1	7	2,73	2,120
	Valid N (listwise)	15				

Descriptive Statistics[a]

Motivation		N	Minimum	Maximum	Mean	Std. Deviation
Hedonist	Usef_1	110	3	7	5,63	1,108
	Usef_2	110	1	7	5,25	1,288
	Usef_3	110	1	7	4,68	1,306
	Valid N (listwise)	110				
Utilitar	Usef_1	15	1	7	3,93	1,668
	Usef_2	15	1	7	4,07	1,751
	Usef_3	15	1	6	3,73	1,624
	Valid N (listwise)	15				

Descriptive Statistics[a]

Motivation		N	Minimum	Maximum	Mean	Std. Deviation
Hedonist	Ease_1	110	1	7	5,23	1,261
	Ease_2	110	3	7	5,65	1,192
	Ease_3	110	3	7	5,83	1,210
	Ease_4	110	2	7	6,15	1,021
	Valid N (listwise)	110				
Utilitar	Ease_1	15	2	7	4,87	1,598
	Ease_2	15	3	7	5,33	1,234
	Ease_3	15	3	7	5,27	1,223
	Ease_4	15	3	7	5,60	1,242
	Valid N (listwise)	15				

Descriptive Statistics[a]

Motivation		N	Minimum	Maximum	Mean	Std. Deviation
Hedonist	Att_1	110	2	7	5,71	1,078
	Att_2	110	1	7	5,50	1,262
	Att_3	110	2	7	5,71	1,244
	Valid N (listwise)	110				
Utilitar	Att_1	15	1	6	3,80	1,521
	Att_2	15	1	5	3,20	1,424
	Att_3	15	1	7	4,53	1,642
	Valid N (listwise)	15				

a. No statistics are computed for one or more split files because there are no valid cases.

Descriptive Statistics[a]

Motivation		N	Minimum	Maximum	Mean	Std. Deviation
Hedonist	Beh_1	110	1	7	5,37	1,439
	Beh_2	110	2	7	5,35	1,316
	Beh_3	110	1	7	5,17	1,367
	Valid N (listwise)	110				
Utilitar	Beh_1	15	1	7	3,60	1,724
	Beh_2	15	1	5	3,40	1,454
	Beh_3	15	1	7	4,40	1,724
	Valid N (listwise)	15				

Descriptive Statistics[a]

Motivation		N	Minimum	Maximum	Mean	Std. Deviation
Hedonist	For_fun	110	1	7	5,03	1,600
	For_use	110	1	7	5,05	1,420
	Valid N (listwise)	110				
Utilitar	For_fun	15	1	7	3,27	1,944
	For_use	15	1	6	3,60	1,882
	Valid N (listwise)	15				