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ARTICLE DE RECHERCHE

Are AR shopping services valued the same way throughout Europe? A four-country Q-investigation

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ABSTRACT

Augmented reality creates new affordances for shopping-related interactions because it allows consumers to experience a product within the context of their choice and in a customized way before making a purchasing decision. There is a need to evaluate the potential of this technology and its features in order to integrate it strategically into e- and m-commerce activities. Given that technologies are now developing on a global scale, research should take a multiple country approach. The present study provides qualitative cross-country insights into four European nations and provides guidelines on how to conduct Q-investigations within comparative settings. The results suggest that both divergence and convergence phenomena occur calling for a differentiated approach to target users and to the development of applications.

Keywords: augmented reality, shopping services, cross-country study, Europe, Q-method

RÉSUMÉ

La réalité augmentée permet aux consommateurs d'interagir avec un produit dans le contexte de leur choix et d'une manière personnalisée avant l'achat, créant de nouvelles affordances. Il est nécessaire d'évaluer le potentiel de cette technologie et de ses caractéristiques pour pouvoir l'intégrer de manière stratégique dans les activités de commerce en ligne et commerce mobile. Etant donné que le développement des technologies s'effectue à une échelle globale, une approche investiguant différents pays doit être privilégiée. Cet article apporte un éclairage sur la perception de la réalité augmentée dans 4 pays européens et offre un guide pour mener des études comparatives avec la méthode Q. Les résultats suggèrent que des phénomènes de divergence et de convergence sont à l'œuvre, appelant à une approche différenciée pour les différents utilisateurs européens dans le cadre du développement et de la promotion d'applications de réalité augmentée.

Mots-clés : réalité augmentée, méthode Q, Europe, étude comparative, services de consommation

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INTRODUCTION

Is Augmented Reality just a technological gimmick or is it a value-added feature of current and future digital shopping services? For some years, this has been a recurrent question for practitioners and has become a topic of increasing interest for academics. In fact, an analysis via Google Adwords shows that people's interest in Augmented Reality (AR) is still growing, with over 686,000 search queries in August 2015, vs 452,340 in September 2013. Academic production about AR has increased threefold since 2011. This significant trend covers mostly technological aspects. However, more managerial and behavioural issues are yet to be sufficiently explored. In particular, the most recent studies dedicated to users' perception of AR point to a lack of in-depth studies on user experience, perception and assessment of Augmented Reality Services (Olsson et al., 2013, Kourouthanassis et al. 2014, Rese et al. 2014).

While e-commerce and m-commerce are still developing in European countries, competition is increasing and the need for differentiation is growing. Augmented Reality is considered by practitioners as having this differentiating potential. Augmented Reality (AR) technology enriches the real world by overlaying virtual objects on top of the user's view of the environment in real-time in such a way that they form a new environment, as seen through a camera and presented on any fixed or mobile display (Azuma 1997, Höllerer and Feiner 2004, Vallino 1998). Although technology has always been used in order to build consumer relationships (since the advent of Internet: merchants' websites, online retailing, buying robots, email promotions, sms-advertising, etc.), augmented reality proposes services that are supposed to facilitate consumer decision processes and enhance experience by blurring the frontiers between what is real and what is virtual. In the medium term, augmented reality could allow people to add virtual information to a real, albeit remote environment, in which they are connected through their mobile devices. It is thus creating a new environment that could become a permanent substitute to our analogical environment. Such a perspective obviously raises many questions that pertain to the underlying "philosophy" of human enhancement (Kleinpeter, 2013). These technologies are considered to be of particular interest as they represent "the most up-to-date form of the ambiguity relating human with technologies" (Kleinpeter, 2013, p. 12). In addition, this substitute to our analogical environment bears consequences in terms of information flow: individuals can connect to objects anywhere, anytime, gaining by virtually interacting with them, before deciding to buy them. The role of more traditional media sources and commerce outlets, their complementarity to augmented reality, is under question. It is also important to document how people perceive and learn to use technologies such as augmented reality in their infancy, to guide their development and to reflect on the phenomena before other more invasive technologies are used to connect people to places, objects and other individuals on a permanent basis.

The aim of this paper is not to develop a philosophical piece about augmentation but rather to qualitatively investigate how potential users of AR react toward this technology in a shopping context. AR Shopping services present both hedonic and functional features, but are these features perceived as enhancing any side of the shopper experience? What are the perceptions of users and how do potential users relate to this technology? Are

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they homogenous from one country to the next? This question deserves particular attention. While culture cannot be perfectly equated to countries, it is partially related. Culture affects users' requirements, as it provides a context for user behaviour (Thanasankit, 2002). A recent piece of research by Tuunanen and Kuo (2015) shows that users' cultural contexts and underlying value systems help to understand requirements towards technology. To understand the potentials of AR in Europe, we must consider several cultural contexts, geographical locations, and adopt an approach documenting both individual assumptions and values.

The contributions of this paper are twofold. First, from an empirical point of view, it documents and strengthens the empirical background in the areas of AR, e- and m-commerce. Based on these empirical observations surrounding AR, avenues for further developments are identified and a theoretical framework for studying AR is proposed. Secondly, from a methodological point of view, this study offers a rigorous example of how to conduct cross-country Q investigations and opens an avenue for future qualitative cross-national studies in IS/IT, adding to current methodological knowledge.

The paper is divided into five sections. Firstly, we review works relating to Augmented Reality and user experience and pinpoint how e-commerce can benefit from AR potentials. Secondly, we discuss our research question and relate it to the underlying assumptions when conducting cross-country and cross-cultural studies. The third section describes our specific method, the Q-method, and presents a stepwise view of how to implement it in cross-country research. Obtained results are described in Section four. In the last section, empirical results are discussed in relation to the research question, and a framework for studying AR services is suggested. The limitations of the study and future research avenues are also described.

RELATED LITERATURE

We briefly circumscribe augmented reality and qualify user experience (1.1.) before a more in depth discussion of previous research dedicated to studying consumer experience with AR services (1.2.).

1.1. Augmented reality and user experience

The term 'Augmented Reality' and its definition have been clearly outlined since the late 1990's, although overlaying the virtual content on top of the view of real environment was already being demonstrated back in the 1960's by Ivan Sutherland. Augmented Reality (AR) is part of a larger entity of Mixed Reality (MR), which refers to the merging of real and virtual worlds producing new environments where physical and digital objects co-exist and interact in real time. Mixed reality is defined as a continuum of real and virtual environment (Milgram and Kishino, 1994), as seen in Figure 1.

Applications of AR, like many other technologies, were primarily designed for military and industrial purposes (Azuma et al., 2001). The wider public encountered AR applications only recently with the first applications appearing in 2008 (Carmigniani et al., 2011). These rare applications, on the one hand, call for more research into understanding user experience and on the other hand, understanding the operational and commercial potential. In AR research user perception has not been a core interest to date. For example, the literature survey by Dünser,

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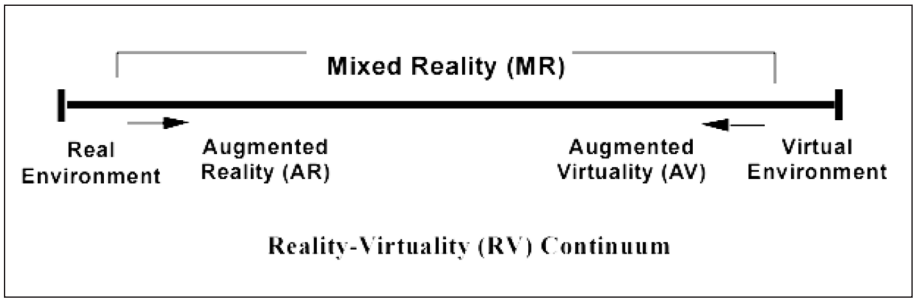

Figure 1: Reality-virtuality continuum (Milgram and Kishino, 1994)

Grasset and Billinghurst (2008) concerning user evaluation techniques used in AR research between 1992 and 2007 showed that only approximately 10% of AR research publications included formal or informal user evaluations.

The term 'experience' is found in several disciplines from marketing and design to MIS research (user experience or UX). Due to its multidisciplinary nature, there are many definitions for the concept of user experience and in addition, there is no cohesive theory of experience. The experiential approach to consumption was first discussed in marketing by Holbrook and Hirschman (1982) who identified symbolic, hedonic and aesthetic dimensions of consumer experience. Further research has established a link between hedonic experience and product evaluation (Mano and Oliver, 1993). Each of the dimensions identified is multi-faceted. For instance, Aurier and Passebois (2002) focus on aesthetic experiences and their emotional, intellectual, and advocacy-related dimensions to explain how a customer relationship is built. This multi-dimensional approach equally appears in design literature which focuses on emotional and hedonic aspects of experience with technology (Hassenzahl, 2003). Desmet and Hekkert (2007) describe three levels of experience: aesthetic experience, experience of meaning, and emotional experience. Buccini and Padovani (2007) divide experiences into six categories: experiences related to the senses, experiences related to the feelings, social experiences, cognitive experiences, use experiences, and motivational experiences. For the HCI community, the challenge is to go beyond the task performed with the technology (concepts of usability and performance echoed in the TAM) and to move towards a more holistic understanding of usability, accounting for non-instrumental needs (Gaver and Martin, 2000), fit with goals and hedonic aspects (Hassenzahl, 2003). There is general agreement about the idea that UX is situated, context-dependent and subjective (Law et al, 2009). Hassenzahl and Tractinsky (2006) summarize the notion based on three threads: what goes beyond the instrumental (holistic, aesthetic, hedonic), what is linked to emotion and affect (subjective, positive, antecedents and consequences), and the experiential (dynamic, complex, unique, situated, temporally-bounded). Analysing UX requires both a multidimensional and a phenomenological perspective, in which the user expresses his own felt experience of the technology (McCarthy and Wright, 2004). This means one should aim to get a deep understanding of users' perceptions from a multidimensional perspective, using the accounts of experience made by users.

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Notwithstanding the emphasis on hedonic experiences in literature, one should remember that the various categories of experience can cover both hedonic and utilitarian aspects. This is particularly important to understand consumer experience with technology. Childers et al (2001) show that both utilitarian and hedonic elements of experience must be taken into account to explain online shopping adoption. Elements related to the technology but also trust towards websites influence the attitude towards online purchase (Van der Heijden et al, 2003). Holistic approaches integrating intrinsic and extrinsic sides of experiences are developed. For instance, Shin (2009) highlights the role of perceived quality of content, which can be understood both in a functional and a hedonic sense, in shaping acceptance. Venkatesh et al. (2012) integrate hedonic motivations to the UTAUT model, which focused on utilitarian values, to predict consumer technology acceptance. This new model called UTAUT 2 also integrates individual factors such as experience with the technology, which has been shown to influence acceptance and use (Carlson and Zmud, 1999). The hedonic aspect of experience has been recognized as a strong element of technology acceptance, with perceived enjoyment and perceived ease-of-use being stronger determinants than perceived usefulness (Van der Heijden, 2004).

Therefore, our study adopts a multidimensional view of experience. It investigates the functional, hedonic, emotional, motivational and contextual aspects of experience, to explain potential users' subjective perception of AR.

2.2. Consumer's experience of AR services

Over the last 7 years, augmented reality years, augmented reality has entered the field of marketing, communication and m-commerce with big brands such as Coca-Cola[1], Pepsi[2], Benetton[3], Calvin Klein[4] and Ikea[5] integrating AR into their campaigns. However, very little research has been published which focuses on AR in e- and m-commerce and on the consumer's perception of AR shopping services.

One of the anticipated strengths of AR applications is the WOW-effect it brings through a high level of interactivity and playfulness. However, the possible long-term effects leading to enhancing customer satisfaction appear to make AR a promising relationship tool. Bulearca and Tamarjan (2010) studied the possible long-term effects of augmented reality experiential marketing. They concentrated on the case of an online optician, who uses AR when trying on glasses. In their study, AR application was found to be valuable for users as it could save time and could be practical and convenient. It was also perceived as playful. AR produced a positive effect on brand attitude and it enhanced the sense of trust towards the brand because it allowed the users to personally try the products. Seisto et al.

[1] http://appshaker.co.uk/coca-cola-and-wwf-help-conserve-the-arctic-home-augmented-reality/

[2] http://www.afaqs.com/news/story/34090_Zapak-develops-augmented-reality-based-advergame-for-Pepsi

[3] http://criticalnewmediagroup.wordpress.com/2012/02/27/its-your-time-benetton-and-augmented-reality/

[4] http://www.mediapost.com/publications/article/124766/#axzz2YAYp44Yd

[5] http://www.wired.com/gadgetlab/2012/07/ikeas-augmented-reality-catalog-lets-you-peek-inside-the-malm/

(2012) studied user acceptance towards a game-like AR application in a print magazine advertisement. In their study, the most important issue for the participants was the perceived value of the service, in this case a discount coupon could be shared with a friend. In the target group of the study, the fashion magazine readers, games or game-like applications were not of spontaneous interest.

Doubts towards AR have been revealed in the study of Bulearca and Tamajan (2010), which shows perceived differences between the real shopping experience and the AR online shopping experience. In their study, some of the participants felt that online shopping and the use of AR would change their normal shopping habits dramatically and thus, they didn't believe that AR could replace their normal process of "*going in a shop and trying the glasses on yourself in real life.*" In addition, in the context of buying glasses, a significant role was seemingly played by the haptic experience.

AR applications use advanced technology and thus, the ease of use and the trust towards the technology are central concerns. Bulearca and Tamarjan (2010) identified certain doubts towards the ease-of-use, as one has to install an application. According to Kaasinen (2005), putting the service to use is often a major obstacle to the user. In the study of Seisto et al. (2012) ease of use and trust were not considered as barriers for the use of a mobile service with a print magazine, presuming that the magazine has a strong brand and can be trusted. Table 1 lists the pros and cons of AR in the context of Shopping Services.

Consumer experience with AR services has been studied with two approaches. The first researches the antecedents of intention to use AR with an attention to expectations and motivations. The second focuses on the influence of user's characteristics.

The intention to use AR services is primarily linked to immersion within the augmented environment and intuitiveness in interacting with the augmented information, but also relates to curiosity, playfulness, inspiration and creativity (Olsson et al. 2011, 2013). Olsson et al. (2011, 2013) studied potential end users' expectations and requirements of mobile augmented reality service in a shopping mall context. The identified characteristics of user experience were mainly related to pragmatic values like efficiency and empowerment, increased awareness and knowledge, and intuitiveness. Ease-of-use of AR service appeared as a 'must' for users, as well as content relevance, personalization, reliability, all provided in a safe way.

Pros	Cons
Time saving	Requires too large changes in shopping habits
Practical and convenient	Lack of haptic experience
Enhances the trust towards the brand	Doubts about the ease-of-use
Perceived value of the service	
Playfulness	

Table 1: Pros and cons of AR in Shopping Services (Bulearca and Tamarjan 2010, Seisto et al. 2012)

The importance of pragmatic usefulness reappears in different studies regardless of whether it is a hypothetical or real situation. In another study by Olsson et al. (2012) users evaluated five mobile augmented reality scenarios. The highest perceived value was elicited by a scenario which provided practical benefits that cannot be achieved with current mobile services.

Participants in Olsson studies (Olsson et al., 2009, Olsson and Salo 2011 Olsson and Salo, 2012) suggest that satisfying experiences appear to be related to pragmatic aspects such as efficiency in getting information, empowerment with novel tools and ways of utilizing information, and the awareness of the digital content related to one's immediate surroundings. These participants also indicate that in the long run, information content will play a key-role in their experience. On the other hand, the most unsatisfying experiences are seemingly linked to instrumental dissatisfaction.

While Olsson et alii (op. cit.) stress the prominence of functional antecedents, they also find that emotional and hedonic experiences are also expected. Inspiration, liveliness, surprise, captivation and playfulness can be mentioned as examples.) Focusing on mobile touristic AR, Kourouthanassis et al. (2014), also underline the role of emotional dimensions in predicting behavioural intentions. Based on a quantitative survey, their results show that emotions (pleasure and arousal) are influenced by what they call technological properties. Technological properties are drawn from the UTAUT model and rely on effort and performance expectancies. Emotions are then influencing intention to use.

The second line of research is dedicated to the influence of consumer characteristics. Olsson et alii (2013) have observed a slight difference between male and female participants and their expectations toward AR services. The researchers suggest that this is linked to gender differences relating to the overall interest in technology.

Other characteristics of the individual play a role in the assessment of AR service experience. A study conducted by Huang and Liao (2014) focuses on the moderating role of individual innovativeness in AR service assessment. Their results demonstrate that users with high cognitive innovativeness are influenced by usefulness, aesthetics and service excellence, while users with low cognitive innovativeness value playfulness and ease-of-use.

Overall, published literature about consumer experience of AR services is still scarce (Table 2). A general conclusion in terms of explanation is difficult at this stage. While Olsson and his co-authors primarily stress functional dimensions, other researchers point to the role of hedonic and emotional dimensions as well as cognitive characteristics. No clear hierarchy between variables can be delineated.

To date, empirical knowledge about UX and consumer AR services has remained very limited. There is a clear need to investigate this topic further in order to evaluate its potential and develop a theoretical framework that can guide future academic studies.

POSITIONING AND RESEARCH QUESTIONS

While the need for more research about consumer experience of augmented reality application is acknowledged, more focused research questions have to be formulated (2.1.). Furthermore, developing a cross-country study raises methodolog-

Journal	Authors	Year	Main objectives	Method	Sample	Main results
Global Business & Management Research	Bulearca, M. and Tamarjan, D.	2010	Perceived experiential value of AR and link to user satisfaction (convenience, enjoyment, brand attitude)	Focus Groups	20-24	Functional benefits such as time saving, practicality, and convenience were identified. Enjoyment is linked to long term enjoyment and brand attitude, leading to consumer satisfaction. Reliability and trustworthiness of Augmented Reality drive brand attitude.
Journal of Ambient Intelligence and Smart Environments	Olsson T. et al.	2012	Evaluation of augmented reality scenarios in an early phase of development, identify potential use cases of mobile augmented reality services and understand their overall value to users.	On-line survey with 5 different scenarios	260	The most valuable mobile AR services were the ones that showed pragmatic value to the user, e.g., saving time and effort. Privacy and unwanted information flow caused concern.
Personal and Ubiquitous Computing	Olsson T. et al.	2013	Expected user experience of mobile augmented reality services: a user study in the context of shopping centers	Semi-structured interviews	28	Characteristics of UX and user requirements mostly related to pragmatic aspects: efficiency, empowerment, increased awareness and knowledge, intuitiveness. Hedonic characteristics were also anticipated: inspiration, liveliness, surprise, captivation, playfulness, awareness, collectivity, connectedness, personalization.
Electronic Commerce Research	Huang T.L & Liao S.	2014	Cognitive innovativeness and attitude toward using augmented reality	Questionnaire	220	The greater the cognitive innovativeness, the more significant the usefulness, aesthetics, and service excellence. For individuals with low cognitive innovativeness playfulness and ease of use are more significant
Pervasive and Mobile Computing	Kourouthanassis P. et al.	2014	Explore the potential of MAR for tourism	Questionnaire + download data	105	Personal innovativeness plays a significant part in engaging the user to initially adopt the provided tourism services. When the novelty effect wears off, it is the usefulness and consistency of the content that should kick in and further engage the user. In addition, intention to use the system is positively affected through feelings of pleasure and excitement. The role of emotions is of great importance.

Table 2: Literature about consumer experience of AR services

ical and theoretical questions that we will discuss (2.2.).

3.1. Research questions

Based on the review of related works, we can see that AR is a technology that has the potential to create sharp changes in user's shopping experience therefore impacting commercial and communication practices towards consumers. Because this technology is sophisticated and demanding in terms of investments, firms need to ascertain its genuine potential and evaluate whether economies of scale may be obtained with applications that would be disseminated on a large geographical basis. As little academic and empirical knowledge is available, the consequential question is whether AR shopping services may have a potential on a pan-European scale? This question also entails theoretical facets such as: which subjective facets are at work in the interpretation of technology, the formation of perceptions and usage intentions towards AR? What are their configurations? Are there certain differences across countries even if internet and mobile devices are widely available in European countries?

To sum up, two research questions can be formulated:

RQ1: Can a pan-European approach of AR shopping services dissemination be used?

RQ2: What are the underlying facets of user's perceptions of AR shopping services? And what are their configuration?

3.2. Conducting cross-country studies – A positioning

Research using several countries as a sample basis is inevitably tinged with the notion of cross-cultural and cross-national comparison. Therefore, there is a need to position our study regarding IS comparative research traditions before describing our research design and results in more depth.

Hunter (2006) has underlined that when conducting cross-cultural qualitative investigations, researchers need to reflect upon underlying assumptions. Consequently, criteria are developed in order to assess international research. In particular, Hunter suggests that two important dimensions require attention.

The first one pertains to the *emic* vs. *etic* research approach. The *emic* approach corresponds to constructs that are originally developed on a mono-culture basis and then confronted in international settings. On the contrary, the *etic* approach aims at directly developing universal constructs by comparing different cultures from the outset. This *etic* versus *emic* distinction is relevant when developing new concepts. Some researchers consider that pseudo-etic approaches (close to a hybrid approach, Earley and Singh, 1995, p. 332) are more relevant as they allow the development of quasi-universal concepts on a subset of countries and then their testing on a wider, international basis (Earley and Singh, 1995). The present study, is not directed at developing new concepts. However, it adopts a somewhat *pseudo-etic* approach in terms of data-gathering and qualitative material development. More precisely, the initial development of the research material was conducted on two countries (France and Russia) and this basis was then used in order to explore two additional European countries (Italy and Finland).

The second important issue in conducting international research pertains to the convergence-divergence hypothesis.

Hunter (2006, pp. 76-77) indicates that convergence studies emphasize the common trends that make phenomena more and more invariable across cultures. Divergence on the contrary suggests that national cultures resist homogenization and that differences still exist that should be identified and taken into account. Myers and Tan (2003) have suggested that the concept of national cultures – although relevant in IS studies – should be reassessed with a more dynamic view. They stress that most cross-cultural studies in IS assume that "*cultural differences are in some way aligned with the territorial boundaries of the nation state*" (Myers and Tan, op. cit., p. 2) which is not necessarily accurate. All these considerations call for a cautious approach to comparative studies. The current study focuses on four countries that demonstrate cultural differences. However, we do not claim to research cultural divergences. Rather, we consider that both convergence and divergence can occur, especially as we deal with emergent technologies (such as AR) that are disseminated at a rapid pace in international consumption and utilisation settings. This study thus adopts a cross-country, not a cross-cultural, approach.

In practical terms, we investigate four countries with different profiles in terms of technology access and diffusion. France, Finland and Italy are members the European Community and Russia is considered in an enlarged view of Europe. All these countries were accessible as they were part of a European collaborative project (hence facilitating duplication). In terms of technology access, as can be observed in Table 3, the four countries are well-developed as more than half of the population has Internet access. Two of them (Russia and Italy) are slightly below the European average (78%). As for mobile internet access, the figures are lower with sharp contrasts between the four countries. These characteristics offer varied (but not completely unbalanced) situations in which our investigation can take place on a relevant basis.

METHOD

The method selected for investigating user's perception is the Q-method. Here, we describe the specificities of this method, the overall research design, and the data analysis approach for comparative studies.

4.1. Overview of Q-Method

The Q-method (see q-method.org and Brown, 1993), was developed by the psychologist Stephenson (1935; 1953) as an approach to capture people's subjective views of phenomena. Subjectivity is conceptualized as what "*emanates from a particular vantage point*" (Brown, 1993). The Q-method constitutes a qualitative approach.

The Q-method rests on two important pillars. One is theoretical and refers to concourse theory, the other is methodological and uses q-sorting procedure and q-factorial analysis (Gauzente; 2010).

First, the concourse theory posits that meaning is dependent upon context and therefore not given *in abstracto*. The concourse can be defined as the volume of available statements on a topic and is "*the common coinage of societies large and small, and is designed to cover everything from community gossip and public opinion to the esoteric discussions of scientists and philosophers*" (Brown, op. cit.). Meanings exist for each individual and vary depending on circumstances,

Country	Internet access (2014) % of population	Mobile Internet access (2012) % of population
Finland	92	56
France	84	44
Italy	62	16
Russia	59	30
European average	78	27

Sources: (Eurostat, 2012, 2014 ; Yandex, 2013, http://www.internetlivestats.com/internet-users/russia/, 2014)

Table 3: Characteristic of studied countries in terms of internet access

but can also be shared with others, thus making interpersonal communication possible. The first step to conduct a q-study is to generate these meanings. Stephenson suggests that initial qualitative interviews or literature reviews should be conducted to generate as many meanings as possible concerning one topic (Gauzente, 2013). They can then be formulated as pictorial, or in our case, textual assertions. The totality of the assertions constitutes the q-sample.

The second step is to complete the q-sort grid, i.e., respondents rank-order assertions according to the degree with which they represent their subjective view of one topic. The forced ranking distribution means that only a small amount of assertions can be selected as highly positively or negatively representative. The majority of meanings will be neutral. This process forces respondents to choose and structure their point of view.

The respondents are designated as the p-sample. Q-method is, in essence, a qualitative method and so it is designed to deal with a small number of participants (Van Exel and De Graaf, 2005). Single case studies are even possible (Stephenson, 1974), as it aims at representing the point of view of individuals in an extensive manner. Factors identified through the analysis are viewpoints of the people defining the factor. These factors are part of the universe of meaning and identifying such views is the objective of Q method. The views that are identified are operant as they guide people's behaviour and are not just a plausibility. Assessing the weight of each view is not the objective of Q-method and such a typological approach would be a misunderstanding of the underlying logic of the method. Comparing factors or views is thus possible, no matter how many people share the view. (McKeown and Thomas, 2013). The result of the q-sorting process by the participants is a q-sort.

Then, factor analysis is used to analyse the data. Instead of analyzing individuals, assertions or statements are analysed (that is the correlation matrix relies not on assertions but on individuals), so this procedure is called q-factor analysis. As a result, a map of the representations that people have is obtained, which helps to identify the different visions that people share. Factor analysis is thus used to identify underlying q-factors which correspond to shared visions. It should be em-

phasized that, the q-factors shouldn't be assimilated to groups of people as in typological approaches. The factors are not a statistical representation of groups in the general population. Q factors are shared views, shared interpretations of one topic (here augmented reality in the shopping process) that are operant[6], i.e., guide individuals' behaviour.

Q-method is an appropriate method within the framework of our study. As Kendall and Kendall (1993) or Thomas and Watson (2002) stated in the context of IS research (for an overview of Q in IS research, see table 4), this method is a powerful one in order to bring to light deep perceptions and representations of a social phenomenon. First, it ensures that minimal influence is exerted by researcher(s) on respondents and sorting process. Second, it allows readers to go back to data and work through the logic of analysis and interpretation. By making results open for debate, the research gains credibility and validity.

In the domain of emergent technologies and their dissemination in consumer markets, early assessment of their potential is of foremost importance for all actors. For this reason, perceptions and early representations require exploration. In order to uncover these early perceptions and representations, a qualitative q-investigation is of undeniable value.

4.2. Data generation and study design

Three steps have to be followed in order to conduct a comparative q-study. First a concourse and a sample of statements have to be defined. Second, a process for data collection in the different countries has to be determined. In the third place, statistical choices have to be made in terms of data analysis.

4.2.1. Concourse generation and q-sample elaboration

According to Concourse theory (Stephenson, op. cit.), the different meanings associated with a topic should be firstly identified. Since the focus of this study is on an emergent technology (at least from the shopping point of view), the need to gather individual perceptions is of prime importance, it is a priority over technical or specialized knowledge available in academic and professional literature. Thus two information gathering sessions were held in France and Russia.

More specifically, focus groups were set up which were based upon the nominal group technique (Delbecq et al., 1975). The focus groups comprised young marketing professionals and students aged from 21 to 35 years old (10 in France and 10 in Russia). The choice of this sample was based on the fact that this age group has a high smartphone penetration rate, and comprises the population targeted by brands providing augmented reality applications. Added to this, as respondents had a background in marketing, participants were more attentive to branded augmented reality, which guaranteed a higher motivation to participate in this study. This reasoned sampling is in line with previous AR studies where sample selection criteria relied either on product involvement (Bulearca and Tamarjan, op. cit.) or on a propensity to be potential early adopters of new technology (Olsson et alii, op. cit.). Finally, all respondents showed an open attitude to technology overall, but had not used augmented reality prior to the study.

[6] About the concept of operantcy see Gauzente (2013, p. 76-77).

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Totally in discordance with my view of AR			**Don't agree or disagree**			**Totally in accordance with my view of AR**
-3	-2	-1	0	1	2	3
2 statements	3 statements	4 statements	6 statements	4 statements	3 statements	2 statements

Table 4: Q-sort statement distribution

As AR is not yet widespread in either country, three videos have been shown. The videos were drawn from Youtube and selected for their representativeness and variety of AR shopping services:

- one is using AR for online advertising (demonstrating a camera; http://www.youtube.com/watch?v=P9N-d04dW2-M)
- one is in-shop product virtual visualisation (lego box; http://www.youtube.com/watch?v=PGu0N3eL2D0)
- one is mobile product pre-visualisation (glasses trial; http://www.youtube.com/watch?v=agwFbTwg9HA)

The groups had to write down their first impressions of AR and the different applications they saw, to characterize their perception of the technology. Further to this, they shared what they had written, and explained what they meant. All thoughts were discussed by the group. As a consequence, additional statements emerged. At the end of the process, duplicate ideas were eliminated leading to a q-sample of 24 statements. The statements are representative of the full concourse created by the respondents and phrased by respondents during the groups. Statements were understood as one indivisible unit of meaning by respondents, even though some include two propositions. It is of interest to note that the statements we obtained largely cover aspects of user experience that were also identified in the literature, such as hedonic qualities (playfulness, enjoyable), immersive qualities, and functional qualities (easiness to use, usefulness). Moreover, certain other topics emerged, linked to one's willingness to keep up with human contact instead of using AR and ideological beliefs linked to the technology, but also on the novelty of the technology (wow effect), or an ability to compromise on use and non-use of the technology ("I would use AR only as an exception, if I hadn't a second to spare to go into a store").

The q-sorting instrument was then built in accordance with the methodological recommendations of Stephenson (1953) and Brown (1972). Given that 24 statements have to be rank-ordered following a quasi-Gaussian distribution, the q-sort instrument stands as in Table 5.

A set of complimentary items was introduced in order to facilitate interpretation (see Appendix A). More specifically, questions regarding respondent sex, number of mobile applications, online shopping experience, brand following on social networks, and brand sites consultation were included.

Q-method in Information Systems research

Only a few IS studies have used Q method since the late 80's (N=17). However major journals have published research using this method (among others: MISQ, I&M, CAIS, JIT, OMEGA) and IS researchers using it advocate a wider use of this powerful approach (Dos Santos & Hawk, 1988; Thomas & Watson, 2002). In her recent synthesis on Q-method in Information Systems Research, Gauzente (2013) identifies three types of utilization of Q. The first one pertains to profile identification and fit evaluation, the second one relates to the identification of structuring trends as an alternative to Delphi technique and the last one concerns the deep understanding of attitudes, representations, and perceptions. Compared to other qualitative research methods, Q is providing several distinctive features (Gauzente, op. cit.): (1) the method is transparent as the research process is reproducible (Q-set is available for re-use); (2) the construction of operant factors relies on statistical analysis and explicit criteria casting aside researcher bias (at this stage); (3) the abductory interpretation of qualitative data is open to contradictory analysis as the whole process is traced; (4) the richness of different viewpoints – together with nuances - is respected.

Table 5: Q-method in ISR

4.2.2. Q-sorting across countries

The first data gathering took place first in France (Paris) and Russia (Moscow) a few weeks after the focus group discussions and statements generation with the same p-sample. The Italian (Genoa) and Finnish (Helsinki) data were gathered a few months after the first stage, in 2012. To ensure that the data were comparable, the Italian and Finnish sample (identical characteristics: young marketing professional and students, with 10 Italians and 11 Finnish) were shown the same videos of Augmented Reality and open questions were included at the end of the survey instrument in order to gather potentially new statements. No additional comments were made suggesting that the statements are deemed exhaustive across the four nations. A summary of the study design is presented in Figure 2.

Data analysis: Q-factor analysis for comparative purposes

Q-factor analysis is the method of data processing that should be used here. The factorial analysis is based upon the correlation among persons instead of assertions. The factors obtained are synthetic views of the topic upon which each statements occupies a specific position (cf. coordinates). The interpretation of the factor results does not obey traditional criteria although these can comfort analytical choices (for instance, choosing factors with Eigenvalues higher than 1). The most important criteria are meaningfulness and interpretability (Brown, op. cit.).

The guidelines for conducting comparative q-factors analysis are scarce and there exist only a few q-studies that aim at cross-country comparisons of IT or European country comparisons (Hasan and Meloche, 2013; Schrøder, 2004). The q-method forum suggests that comparative analyses should be conducted in two steps (Brown, online forum). Firstly, factorial analysis per country should be undertaken in order to identify the different country visions. These visions should then be factor-analysed in a second-order factor analysis. The second-order q-factors are then interpreted in relation to the national q-factors involved. In our case,

we analysed the 10 French q-sorts, the 10 Russian ones, the 10 Italian ones and the 11 Finnish ones separately, and identified 13 different views (factors). The representative q-sort for each of these views has been selected for comparative analysis, i.e., the 13 factors were included in the second-order factor analysis.

In the present study, the individual nation-analysis shows differences between countries (see Table 6). Italy is the country where only two different visions of AR appear while France and Russia exhibit four different visions.

Since the interpretation of each of these first-order factors would require a significant amount of space, this article concentrates on the second-order comparative results. Second order results reveal six q-factors. Some of them are completely trans-national while others are more specific. Table 7 summarizes the country characteristics of the second-order factors.

RESULTS

The final analysis yields six q-factors (the factor loadings are indicated in Appendix B). In order to interpret the factors, there is a need to visualize the meaning structure of each factor. Each factor can be represented as a synthetic q-sort where the different statements occupy a specific position. Appendix C draws the 6 synthetic q-sorts. Additional information also helps to ascertain factor interpretation. While the tests for differences between factors are not necessarily statistically significant, certain observations are relevant and deserve qualitative attention (see Table 8). The relationship between AR perception and use of applications, interaction with brands online, could be further investigated in future studies. The six views on AR we observe from the six synthetic q-sorts are described below. The numbers in parenthesis after the quotations denote the ranking of the corresponding assertion in the 2nd order Q-factor analysis.

Country	Finland	France	Italy	Russia
Number of Q-factors	3	4	2	4
% of explained variance	71	73	60	76

Table 6: First order Q Factor Analysis (individual nations)

2nd order Q-Factor	View #1	View #2	View #3	View #4	View #5	View #6
Involved nation q-factor	Fi2, Fr1, Fr4	It2, Ru3	Ru2	Fi1, Fr3, It1, Ru1	Ru4	Fi3, Fr2
% of explained variance (Total= 81%)	18	13	11	18	9	12

Note: Fi: Finland, Fr: France, It: Italy, Ru: Russia;
Fi1 means Finnish factor number 1;
View #1 entails the Finnish factor number 2 and the French factors 1 and 4.

Table 7: Second-order Q-factors characteristics

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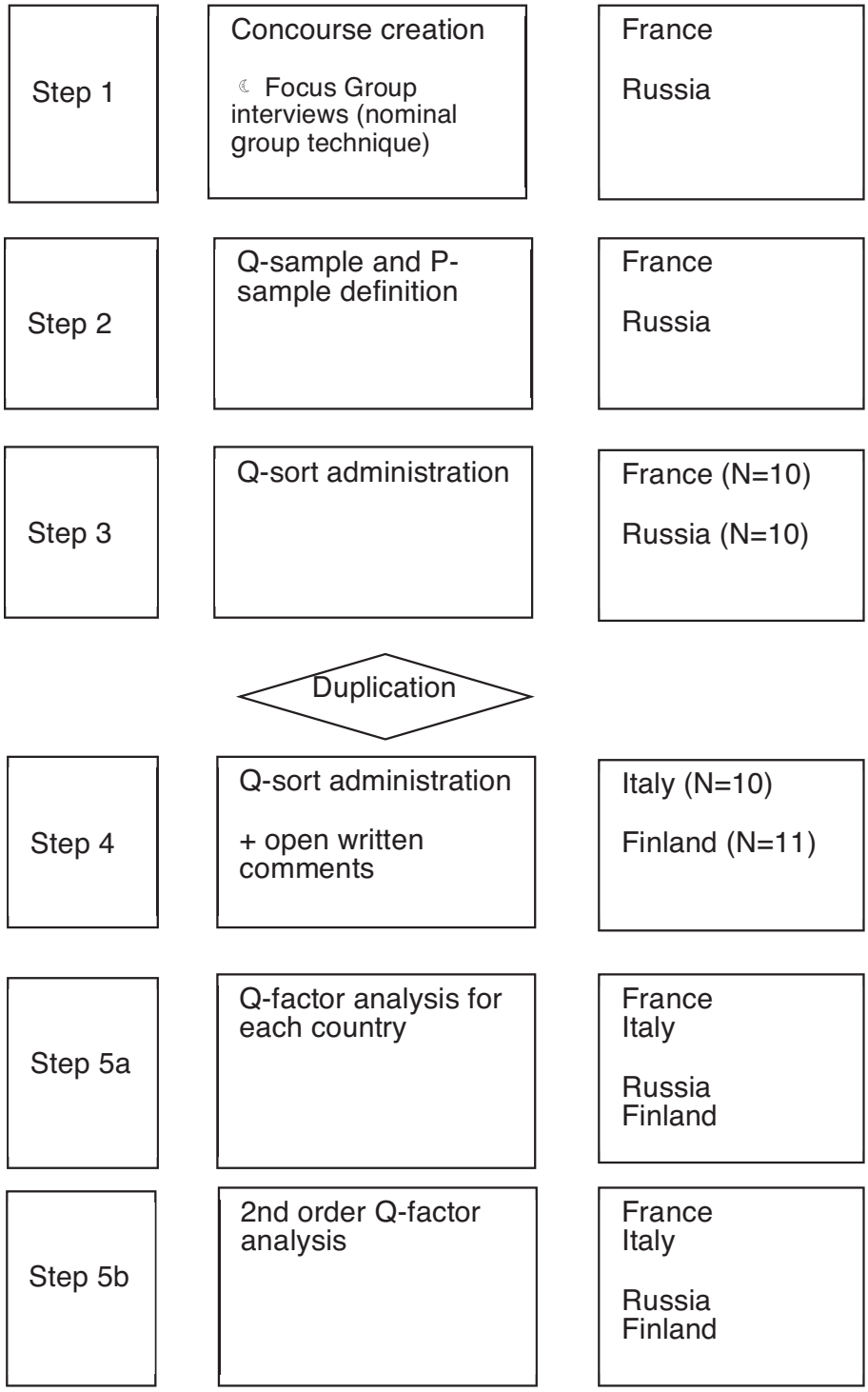

Figure 2: Summary of the study design

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	Sex	Number of mobile applications	Online shopping experience	Brand following on SNS	Brand sites consultation
Chi-square test	ns	Ns	Sign at .01	Ns	Ns
Meaningful observation	ns	Of the 12 people having more than 10 apps, 7 share the F#4 view	Of the 24 participants that shop online, 9 share the F#1 view and 9 the F#4 view	Ns	Of of the 24 participants that look at brands websites, 12 share the F#4 view

Table 8: Differences between 2nd order Q-factors along descriptive information

View#1 - The functionalist view (Finnish#2 and French#1 & 4)

Respondents sharing the first view are linked by their pragmatic understanding of AR and its functionalities. For them, it is the buying context that makes AR a useful tool both in-store or out. "*Seeing an object through AR, it's good only when you can neither see the object nor open the box*" (+2), "*AR can be good to first see a product and then go into a shop: it prepares the act of buying*" (+3).

They have a positive perception of AR, all the more because they understand the technology. "*I don't understand how it works, it's too complicated. I don't want to try*", (-3). Moreover, AR is an enjoyable way of looking at products because of its *fun and playfulness* (+1). This leads users to consider AR use not only as an exception (-1).

Despite this, they need to touch products (+2) and do not believe that seeing them via AR is enough to buy: "*Seeing a product through AR is not enough to make me buy it*" (+2).

It appears that AR is a complement and facilitator in making the buying decision. AR may help them in store with specific situations and support visualizing of products before going to the store, but is not a determinant in the shopping process. It is worth noting that all respondents who share view #1 are online shoppers. Half of them follow brands online and already use different tools to prepare their online shopping experience. As they are already in the habit of surfing the web and online shopping, respondents have attributed AR to another context in which they don't yet have a tool, while they didn't value the possible advantages of using AR online, as shown by their appreciation of the statement "*seeing yourself with seeing yourself with the product on scale*" (0).

View # 2 - The physical experience view (Italian#2, Russian#3)

View # 2 adopts an open-mind towards AR as a technology. Respondents sharing this view believe AR is useful and like this technology as it is *playful and funny* (+1), but not for shopping.

In fact, they prefer shopping in real stores and the physical experience of going into shops, touching the items and

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being served by a person. For them it is more enjoyable, as shown by their rating of "*It's better to go into stores than to live behind your screen and try things with AR*" (+3), and "*When pre-visualizing a product through AR at home, one lacks the pleasure of going into a store as well*." (+2)

Given this, they do not like shopping online and they do not see where AR fits into their shopping process: it is the only group in this study that does not imagine preparing shopping with AR, *"AR can be good to first see a product and then go into a shop: it prepares the act of buying"* (-2). Therefore, they can't consider buying through AR *("Seeing a product through AR is not enough to make me buy it", (+2)*).

View # 3 – The rejecting view (Russian#2)

Respondents sharing view #3 reject AR as they do not understand it, don't feel the need of using it and are not even attracted by it.

In fact, they do not understand how the technology works, AR seems complicated to them as they strongly agree with the statement *"I don't understand how it works, it's too complicated. I don't want to try* "(+3). This is valid no matter which platform is used (mobile or webcam).

Moreover, they don't know whether it is useful or not. Their relationship to technology is somewhat distant. They believe that only people who know the technology can use it (+2), while it's unnecessary for them (+1). They also don't like the technology in itself: they don't see it as a playful tool (-1), don't like the idea of projecting situations or themselves with AR (-1) and don't even consider it as an exception (-3).

View # 4 - The self-centred view (Finnish#1, French#3, Italian#1, Russian#1)

Firstly, it is worth noticing that this view is the only one shared by respondents from all four countries included in the study. View # 4 is a very positive perception of AR in shopping and is strongly correlated to View #1 in that sense (0.31). In fact, respondents understand and trust the technology. They make the connection between them and the technology: they identify clear benefits of seeing themselves with products. *"It's good because it allows you to have pictures of yourself with the product you can share online"* (+2); *"It's interesting because you can see yourself with the product on scale"* (+2).

They also make the connection with in store and purchase situations, showing they understand why and where they could use AR. *"Seeing an object through AR, it's good in a shop when you can neither see the object nor open the box"* (+3), *"Seeing a product through AR is not enough to make me buy it"* (-2)

This positive perception of AR can be explained by the fact that respondents, similarly to View#1 with a functional stance on AR, already use a wide range of digital tools: they all either shop online, follow brand websites or use mobile applications. They are already in the habit of using functional and facilitating tools: 12 people who participated in the study had more than 10 mobile applications and 7 share this positive view of AR. Besides, when it comes to shopping, respondents sharing view #4 already use the Internet to visit brand websites (half of these share this view of AR) and shop online (9 out of 24 online shoppers in this study share this view). This means they are already in the habit of going online and might need im-

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proved services, here with a focus on the visualization of them with the product, which is something they cannot get online with AR. These needs and openness facilitate their understanding of the situations in which they could use AR, which are to prepare the buying process and to buy products.

View # 5 - The ambivalent view (Russian#4)

View # 5 entertains an ambivalent view of technology. On the one hand, respondents think that the value of AR would be in activating the user and interacting with the product, on the other hand, they don't think they need AR and they have some doubts about their ability to use it. They are open to virtual and projections *("It is not interesting in order to see real objects, but to visualize how some situations could evolve (our physical appearance, a location, an illness…)"* (+2)), and to AR as a *'playful and funny'* technology, however they need more immersion ("*AR is good only when it actively involves us in the demonstration and the trying of the product*" (+3)) to be won over to it. AR applications for shopping are not of much interest for them as they do not perceive the link to online shopping *or the need of seeing products on scale* (-3). They understand it could help to save time, but don't believe they need this technology and the given benefits at this juncture.

View # 6 - The enthusiastic view (Finnish#3, French#2)

View #6 corresponds to a positive perception of AR and more specifically AR in shopping. Respondents sharing this view are already online shoppers and relate the technology to "*people who order on the Internet*" (+3).

AR could enhance their shopping process and comprising several facets: enjoyment, visualization of products on scale, time-saving: *"It's interesting because you can see yourself with the product on scale", (+3); "It's playful and funny" (+2); "Seeing products through AR saves time. It's quicker than searching for the product in store" (+1).* As such, they could integrate it for regular use into their shopping journey *"I would use AR only as an exception, if I hadn't a second to spare to go into a shop", (-2).*

They also understand the technology and trust it to be reliable as far as visualization is concerned, "Using AR *to visualize a product is stupid, because one cannot be sure it (the product) will look like this", (-3).*

The results indicate that AR could fit very well into their current shopping behaviour. They are not highly committed to going into shops, and they think it is ok to shop on-line. "*It's better to go into stores than to live behind your screen and try things with AR*" (-1); "*I would use AR only as an exception, if I hadn't a second to spare to go into a store."* (-2); "*When pre-visualizing a product through AR at home, one lacks the pleasure of going into a store as well as the advice of the salesperson*." (-2).

DISCUSSION

The results obtained document our two research questions. Research question #1 pertains to the relevancy of a pan-European approach to AR shopping services dissemination. Based on literature review, we suspect both convergent and divergent views among European users. We have adopted a qualitative design that allows for fine-grained observations. Our analysis clearly shows that both phenomena co-exist. Some subjective views are "transnational" and some are more coun-

try-specific. More precisely, part of the users shares a common self-centred vision of AR shopping services and this holds in all four countries. Parallel to this, certain users are developing very specific visions: two visions are specific to Russian users. Intermediate situations are also observed where users of only 2 countries share a common either functionalist or enthusiastic view (for French and Finnish). This leads to the conclusion that standardized approaches are not necessarily relevant even in the domain of widespread technologies and that careful preliminary investigation is required.

Research question #2 focuses on the identification of the underlying subjective facets of user experience and users' perception of technology. Our qualitative investigation shows that different facets are at work. When analysing the content of each statements, and particularly of the most distinguishing ones, we see that some are more hedonic, others more functional, others pertain to the understanding of technology and some are a combination of two or more aspects. As for the relationships between facets, the idea of a hierarchy of effects (as in classical theories of attitude and behaviour) may be reconsidered. Instead of thinking in terms of hierarchy, it would be preferable to think more holistically, i.e., in terms of configurations or patterns differing from one viewpoint to another. What also differs is the role of each facet, which can be seen through the number of statements appearing as most significant for a point of view and the score of these statements in the factor analysis.

Another outcome of this study is the question of IT adoption and that its use should be reconsidered in light of more subtlety: use or intent to use are coarse conceptual categories and we observe that the reality of how users imagine themselves "using" the technology contains many subtleties from mere trial to daily use or exceptional use if no satisfactory alternative exists. This echoes the idea of UX being a context dependent and situated concept (Law et al, 2009). Jauréguiberry (2012) highlights partial non-use (usage paused) or segmented non-use (usage limited to specific circumstances), which is similar to notions of "exceptional use" encountered in our study. This phenomenon of use/non-use can also be explained by looking at users' motivations, agency, identity and contexts of use (Baumer et alii, 2015). Further research could document the motivations and specific contexts pushing individuals to use AR.

Building upon these considerations, we propose an approach merging the multidimensional understanding of experience (emotions, experiential) and traditional elements of utility (instrumental), which were identified in the UX and consumer literature as explaining acceptance and use. Indeed, the results of the study, in line with prior research in IS, show that both hedonic (Van der Heijden, 2004) and functional (Venkatesh et al, 2012) elements play a role to explain acceptance and use of AR. We suggest that future AR studies adopt an integrated non-hierarchical framework (see Figure 3) where propensity to adopt and use a technology is explained by taking into account, not only facets linked to the technology itself, but also context, constraints (agency), functionality and emotions (motivations); and where propensity to use is not directly and mechanically related to actual use/non-use of the technology.

Therefore, approaches considering individual characteristics and subjectivity are required to understand technology use/non-use.

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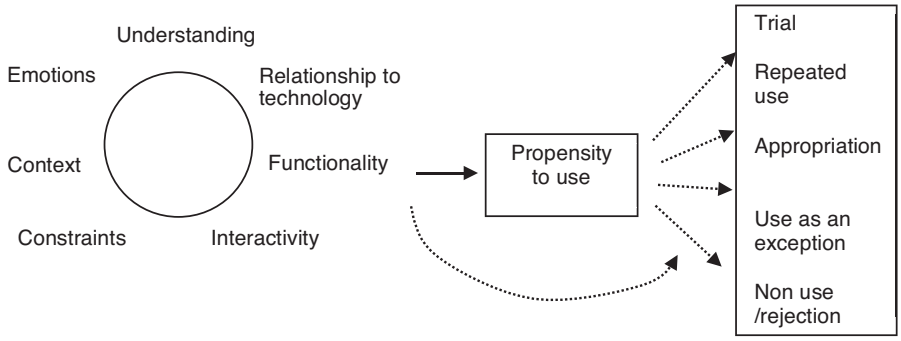

Figure 3: A proposed non-hierarchical framework for studying AR from the individual end-user's perspective

Recent developments of theories on consumer technology acceptance and use have highlighted the importance of hedonic motivation, experience and habit (Venkatesh et al., 2012) moderated by individual characteristics, together with utility-related variables. Our results show that these variables indeed come together, on a more holistic logic, to explain propensity to use. Individual habits and characteristics didn't appear as significant to explain propensity to use. However, future research with larger samples and appropriate methodology should investigate this further in order to document this relationship.

This research opens several research directions. Some of them are derived from the present study limitations. A first limitation pertains to sample characteristics in terms of nature and size. A duplication of this study in other European countries would help in getting an exhaustive picture of how AR shopping services are perceived by different users. A second limitation comes from the AR applications that have been tested and these are all shopping services. Although we selected very different types of product and services, enlarging the picture to other AR services would be of great interest in generalizing the conclusions of our study. Hence including additional features (for example: m-payment, recommendation systems, etc.) could be useful to identify virtuous combinations. An important aspect of the present study design is that it was based on video clips of possible AR shopping services and the users weren't able to test AR applications themselves. One direction for future research should concentrate on agile user-centric development of AR shopping applications

Based on a systematic identification of the motivating and refraining variables of AR services adoption, a more quantitative approach can also be considered. In the same line of thinking, combining different methodological approaches could be of help in order to develop more thorough user-experience explorations (Lazar, Feng and Hochheiser, 2010).

Lastly, beyond AR services adoption, there will shortly be a need to examine how AR shopping services can be integrated in users' daily lives, which would lead to the study of AR domestication.

From a managerial standpoint, in our research, the pragmatic aspects of experience were clearly considered more important than the hedonic aspects.

In practice, this means that the AR applications are more likely to be utilized if they fit users' daily lives and provide new solutions that haven't been available earlier. This is slightly different from the conclusion in the literature where curiosity was seen as the dominant factor in the willingness to try the service. For example, in this research on-line shoppers who had smartphones were more willing to fit virtual products utilizing AR and had a more positive perception of AR in a shopping context. Although the country differences were generally very small, there were differences for example in evaluating going into stores and getting advice from salespersons. Thus, the solutions for AR applications might require adaptation to the differences in the current shopping behaviour in different countries.

More specifically, AR shopping services can be marketed along two lines of communication, the functionalist one and the hedonic one in countries similar to France and Finland. Additionally, a pan-European approach can be adopted by emphasizing self-visualization benefits of AR shopping services as there are users that are open to this in all four countries. Caution should be taken when entering more reluctant markets as we observed that Russia and Italy comprised distanced users. In operational terms, it would be proposed to postpone the dissemination in such countries until immersive/interactive features are sufficiently developed but also to try to sophisticate and combine AR services with tangible features (such as printed material).

In addition, AR isn't seen as a substitute to physical stores and human interaction. View 1, 2, and 6 show that AR has the potential of a complementary tool for shopping. It can be integrated into the physical store, blurring the divide between traditional and digital channels but also our way of perceiving reality. This paves the way for new innovations and research around augmentation technologies and the way we perceive reality. AR can also be integrated into online channels, adding a layer of information to what is available online. The details of how it can be integrated into these different consumer journeys and the complementarity between all available information sources on the path to purchase still need to be investigated in order to guide investments.

In the future, augmented reality, as a cognitive enhancement technology, can also be used in the workplace to connect to objects from anywhere, at any time, thus dematerializing organizations, and enabling remote decision-making. Further studies in different settings are required in order to understand perception of such technologies, how they can support people and what their impact on decision making, overall technology use and social interactions is.

From a more societal stance, a prolongation of the present study could investigate other augmentation technologies. While the ones studied here may appear relatively inoffensive, other are more invasive and are fusing the human body with technology, sometimes for health and safety reasons. Again these technologies are aimed at enhancing human experience, capabilities etc. How would the targeted users evaluate such technologies? This study contributes to understanding how people perceive AR, which may help understanding their perception of other technologies and patterns in accepting enhancement technologies.

We clearly need further research not only from the IS field but also from other disciplines.

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CONCLUSION

The present study provides qualitative insights into how potential users value augmented reality shopping services (product advertising, visualization, and virtual trial). To date, only a limited number of empirical and academic studies have been available. Features like playfulness, inspiration, creativity have been pointed towards potential drivers of user acceptance but beyond novelty and curiosity the functional dimension is crucial for daily integration in user habits. While mobile devices are highly disseminated and should ease the adoption of AR services, there is still very little knowledge on how to spread this technology and its commercial application. The present study provides qualitative empirical insights on how European users perceive AR shopping, and how shopping decision processes can be affected by the introduction of AR (use of AR to complement or even replace store visits). It also provides the ISR community with an example of how to conduct a comparative Q-method investigation, which has not yet been implemented in the field.

Based on our findings, theoretical, methodological and managerial implications are drawn. From a theoretical point of view, we support the idea that as far as technology perception, acceptance and use is concerned, both convergence and divergence hypotheses hold. This means that we can observe both uniform attitudes or perceptions across nations and specific nation-wise distinctions. The two co-exists. This co-existence has a methodological implication pertaining to the design of international research investigation and to data treatment. An additional and useful output of this study is that the perception of technologies entails a certain amount of homogeneity across Europe, provided that we deal with individual end-users[7]. This is also a significant consideration for future research dealing with individual end-users of IT.

The results obtained finally lead to managerial recommendations concerning the spreading of AR applications. For parts of the European population a common line can be adopted, mainly based on functional arguments and self-centred applications, whereas for some countries the use of AR should be further refined in order to fulfil more interactive expectations. In addition, the idea of combining AR more intimately with human interaction and contact as well as tangible goods provide an area of future development. Finally, we propose a non-hierarchical theoretical framework for studying AR, based on our findings that the hierarchy of influential variables differs from one viewpoint to another. Further research is definitely needed in order to analyse different contexts of use for AR applications.

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APPENDIX A. Q-SORT INSTRUMENT

After viewing the three videos exemplifying augmented reality applications, please read the following statements concerning Augmented Reality :

1. Using AR with a webcam is too complicated. With a phone, it's OK.
2. I don't understand how it works, it's too complicated. I don't want to try.
3. AR is not surprising. I've already seen things like this before.
4. The wow-effect will not last long.
5. It doesn't make sense, it's absolutely useless.
6. It's better to go into shops than to live behind your screen and try things with AR.
7. I would use AR only as an exception, if I hadn't a second to spare to go into a shop.
8. It is not interesting in order to see real objects, but to visualize how some situations could evolve (our physical appearance, a location, an illness …).
9. It's good only to draw attention.
10. It's not for me, but for people who already know this technology very well.
11. Seeing an object through AR, it's good in a shop when you can neither see the object nor open the box.
12. Seeing products through AR saves time. It's quicker than searching for the products in a shop and trying them on.
13. It's playful and funny.
14. One needs to be able to touch a product.
15. When pre-visualizing a product through AR at home, one lacks the pleasure of going into a shop as well as the advice of the salesperson.
16. Using AR to visualize a product is stupid, because one cannot be sure it will look like this in reality.
17. AR is interesting for people who order on the Internet.
18. Seeing a product through AR is not enough to make me buy it.
19. It's good because it allows you to have pictures of yourself with the product you can share on the Internet.
20. It's interesting mainly to discover a product one did not know at all.
21. It's interesting because you can see yourself with the product on scale.
22. AR is good only when it actively involves us in the demonstration and the trying of the product.
23. AR can be good to first see a product and then go into a shop: it prepares the act of buying.
24. It's not necessary, I don't really need it.

Please sort the 24 statements according to your degree of agreement.

Place the number of the assertion in one of the following cases. For example if I totally agree with assertion # 19, I place it in case 7.

Please note that are a different number of agree/disagree cases, that is normal. So for case 7 (totally agree) I will put the two assertions that I most agree with.

Totally disagree			Don't agree or disagree			Totally agree
1	2	3	4	5	6	7

Please now answer a few complimentary questions:

1. Sex
2. Online shopping experience
3. Number of applications on your mobile
4. Brands following on social networks
5. Do you look at the websites of certain brands?
6. Do you want to add any comments?

APPENDIX B. FACTOR LOADINGS

QSORT	1	2	3	4	5	6
1 SFR1	0.6579X	0.3417	0.0683	0.2355	-0.3928	0.2470
2 SFR2	0.0767	0.2697	0.2608	-0.1865	0.1650	-0.6653X
3 SFR3	-0.0902	0.0092	0.1338	0.8750X	-0.1733	-0.1507
4 SFR4	0.7607X	-0.1817	0.1614	0.3615	0.0117	-0.0728
5 SIT1	0.5191	0.0241	-0.3956	0.5676X	-0.0349	0.2950
6 SIT2	0.0799	0.8960X	-0.2565	0.0729	0.0255	-0.1011
7 SRU1	0.3094	-0.0587	0.1002	0.7154X	0.0650	0.2797
8 SRU2	-0.0189	0.0187	0.9416X	0.0938	0.0958	0.0215
9 SRU3	-0.0322	0.8325X	0.3739	-0.1555	0.0344	-0.0398
10 SRU4	-0.0603	0.0620	0.1061	-0.0096	0.9600X	0.0188
11 SFI1	0.4716	-0.0571	-0.2401	0.6772X	0.2047	0.2626
12 SFI2	0.8473X	0.0899	-0.1286	-0.0464	-0.0071	0.0698
13 SFI3	0.1878	0.0487	0.1651	0.0118	0.1149	0.8475X
% expl.Var.	18	13	11	18	9	12

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APPENDIX C. SYNTHETIC Q-SORTS VISUALIZATION

2ND ORDER Q1

-3	-2	-1	0	1	2	3
2) I don't understand how it works, it's too complicated. I don't want to try.	5) It doesn't make sense, it's absolutely useless.	3) AR is not surprising. I've already seen things like this before.	8) It is not interesting in order to see real objects, but to visualize how some situations could evolve (our physical appearance, a location, an illness…).	1) Using AR with a webcam is too complicated. With a phone, it's OK.	11) Seeing an object through AR, it's good in a shop when you can neither see the object nor open the box.	4) The wow-effect will not last long.
12) Seeing products through AR saves time. It's quicker than searching for the products in a store and trying them on.	10) It's not for me, but for people who already know this technology very well.	7) I would use AR only as an exception, if I hadn't a second to spare to go into a store.	15) When pre-visualizing a product through AR at home, one lacks the pleasure of going into a store as well as the advice of the salesperson.	6) It's better to go into shops than to live behind your screen and try things with AR.	14) One needs to be able to touch a product.	23) AR can be good to first see a product and then go into a shop: it prepares the act of buying.
	19) It's good because it allows you to have pictures of yourself with the product you can share on the Internet.	9) It's good only to draw attention.	16) Using AR to visualize a product is stupid, because one can not be sure it will look like this in reality.	13) It's playful and funny.	18) Seeing a product through AR is not enough to make me buy it.	
		20) It's interesting mainly to discover a product one did not know at all.	21) It's interesting because you can see yourself with the product on scale.	17) AR is interesting for people who order on the Internet.		
			22) AR is good only when it actively involves us in the demonstration and the trying of the product.			
			24) It's not necessary, I don't really need it.			

2ND ORDER Q2

-3	-2	-1	0	1	2	3
5) It doesn't make sense, it's absolutely useless.	19) It's good because it allows you to have pictures of yourself with the product you can share on the Internet.	1) Using AR with a webcam is too complicated. With a phone, it's OK.	2) I don't understand how it works, it's too complicated. I don't want to try.	7) I would use AR only as an exception, if I hadn't a second to spare to go into a store.	15) When pre-visualizing a product through AR at home, one lacks the pleasure of going into a store as well as the advice of the salesperson.	6) It's better to go into shops than to live behind your screen and try things with AR.
20) It's interesting mainly to discover a product one did not know at all.	21) It's interesting because you can see yourself with the product on scale.	4) The wow-effect will not last long.	3) AR is not surprising. I've already seen things like this before.	11) Seeing an object through AR, it's good in a shop when you can neither see the object nor open the box.	18) Seeing a product through AR is not enough to make me buy it.	8) It is not interesting in order to see real objects, but to visualize how some situations could evolve (our physical appearance, a location, an illness…).
	24) It's not necessary, I don't really need it.	17) AR is interesting for people who order on the Internet.	9) It's good only to draw attention.	13) It's playful and funny.	22) AR is good only when it actively involves us in the demonstration and the trying	
		23) AR can be good to first see a product and then go into a shop: it prepares the act of buying.	10) It's not for me, but for people who already know this technology very well.	14) One needs to be able to touch a product.		
			12) Seeing products through AR saves time. It's quicker than searching for the products in a store and trying them on.			
			16) Using AR to visualize a product is stupid, because one cannot be sure it will look like this in reality.			

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2ND ORDER Q3

-3	-2	-1	0	1	2	3
3) AR is not surprising. I've already seen things like this before.	1) Using AR with a webcam is too complicated. With a phone, it's OK.	8) It is not interesting in order to see real objects, but to visualize how some situations could evolve (our physical appearance, a location, an illness…).	5) It doesn't make sense, it's absolutely useless.	4) The wow-effect will not last long.	6) It's better to go into shops than to live behind your screen and try things with AR.	2) I don't understand how it works, it's too complicated. I don't want to try.
7) I would use AR only as an exception, if I hadn't a second to spare to go into a store.	9) It's good only to draw attention.	13) It's playful and funny.	11) Seeing an object through AR, it's good in a shop when you can neither see the object nor open the box.	15) When pre-visualizing a product through AR at home, one lacks the pleasure of going into a store as well as the advice of the salesperson.	10) It's not for me, but for people who already know this technology very well.	20) It's interesting mainly to discover a product one did not know at all.
	17) AR is interesting for people who order on the Internet.	16) Using AR to visualize a product is stupid, because one cannot be sure it will look like it in reality.	14) One needs to be able to touch a product.	23) AR can be good to first see a product and then go into a shop: it prepares the act of buying.	12) Seeing products through AR saves time. It's quicker than searching for the products in a store and trying them on.	
		19) It's good because it allows you to have pictures of yourself with the product you can share on the Internet	18) Seeing a product through AR is not enough to make me buy it.	24) It's not necessary, I don't really need it.		
			21) It's interesting because you can see yourself with the product on scale.			
			22) AR is good only when it actively involves us in the demonstration and the trying of the product.			

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2ND ORDER Q4

-3	-2	-1	0	1	2	3
5) It doesn't make sense, it's absolutely useless.	2) I don't understand how it works, it's too complicated. I don't want to try.	1) Using AR with a webcam is too complicated.With a phone, it's OK.	3) AR is not surprising. I've already seen things like this before.	4) The wow-effect will not last long.	19) It's good because it allows you to have pictures of yourself with the product you can share on the Internet.	11) Seeing an object through AR, it's good in a shop when you can neither see the ob object nor open the box.
16) Using AR to visualize a product is stupid, because one cannot be sure it will look like it in reality.	9) It's good only to draw attention.	8) It is not interesting in order to see real objects, but to visualize how some situations could evolve (our physical appearance, a location, an illness…).	6) It's better to go into shops than to live behind your screen and try things with AR.	7) I would use AR only as an exception, if I hadn't a second to spare to go into a store.	20) It's interesting mainly to discover a product one did not know at all.	23) AR can be good to first see a product and then go into a shop: it prepares the act of buying.
	18) Seeing a product through AR is not enough to make me buy it.	10) It's not for me, but for people who already know this technology very well.	12) Seeing products through AR saves time. It's quicker than searching for the products in a store and trying them on.	13) It's playful and funny.	21) It's interesting because you can see yourself with the product on scale.	
		22) AR is good only when it actively involves us in the demonstration and the trying of the product.	14) One needs to be able to touch a product.	15) When pre-visualizing a product through AR at home, one lacks the pleasure of going into a store as well as the advice of the salesperson.		
		24) It's not necessary, I don't really need it.	17) AR is interesting for people who order on the Internet.			

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2ND ORDER Q5

-3	-2	-1	0	1	2	3
14) One needs to be able to touch a product.	15) When pre-visualizing a product through AR at home, one lacks the pleasure of going into a store as well as the advice of the salesperson.	6) It's better to go into shops than to live behind your screen and try things with AR.	3) AR is not surprising. I've already seen things like this before.	1) Using AR with a webcam is too complicated. With a phone, it's OK.	8) It is not interesting in order to see real objects, but to visualize how some situations could evolve (our physical appearance, a location, an illness…).	22) AR is good only when it actively involves us in the demonstration and the trying of the product.
21) It's interesting because you can see yourself with the product on scale.	17) AR is interesting for people who order on the Internet.	7) I would use AR only as an exception, if I hadn't a second to spare to go into a store.	4) The wow-effect will not last long.	2) I don't understand how it works, it's too complicated. I don't want to try.	11) Seeing an object through AR, it's good in a shop when you can neither see the object nor open the box.	24) It's not necessary, I don't really need it.
	19) It's good because it allows you to have pictures of yourself with the product you can share on the Internet.	16) Using AR to visualize a product is stupid, because one cannot be sure it will look like it in reality.	5) It doesn't make sense, it's absolutely useless.	13) It's playful and funny.	12) Seeing products through AR saves time. It's quicker than searching for the products in a store and trying them on.	
		18) Seeing a product through AR is not enough to make me buy it.	9) It's good only to draw attention.	23) AR can be good to first see a product and then go into a shop: it prepares the act of buying.		
			10) It's not for me, but for people who already know this technology very well.			
			20) It's interesting mainly to discover a product one did not know at all.			

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2ND ORDER Q6

-3	-2	-1	0	1	2	3
1) Using AR with a webcam is too complicated. With a phone, it's OK.	7) I would use AR only as an exception, if I hadn't a second to spare to go into a store.	6) It's better to go into shops than to live behind your screen and try things with AR.	2) I don't understand how it works, it's too complicated. I don't want to try.	3) AR is not surprising. I've already seen things like this before.	13) It's playful and funny.	17) AR is interesting for people who order on the Internet.
16) Using AR to visualize a product is stupid, because one cannot be sure it will look like it in reality.	10) It's not for me, but for people who already know this technology very well.	9) It's good only to draw attention.	4) The wow-effect will not last long.	12) Seeing products through AR saves time. It's quicker than searching for the products in a store and trying them on.	18) Seeing a product through AR is not enough to make me buy it.	21) It's interesting because you can see yourself with the product on scale.
	15) When pre-visualizing a product through AR at home, one lacks the pleasure of going into a store as well as the advice of the salesperson.	11) Seeing an object through AR, it's good in a shop when you can neither see the object nor open the box.	5) It doesn't make sense, it's absolutely useless.	23) AR can be good to first see a product and then go into a shop: it prepares the act of buying.	22) AR is good only when it actively involves us in the demonstration and the trying of the product.	
		19) It's good because it allows you to have pictures of yourself with the product you can share on the Internet.	8) It is not interesting in order to see real objects, but to visualize how some situations could evolve (our physical appearance, a location, an illness…).			
			14) One needs to be able to touch a product.			
			20) It's interesting mainly to discover a product one did not know at all.			
			24) It's not necessary, I don't really need it.			

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