LOCATION-BASED ADVERTISING IN CONTEXT

THE EFFECTS OF LOCATION-CONGRUENCY, GOAL RELEVANCE & MEDIUM TYPE

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Location-Based Advertising in Context

The effects of location-congruency, goal relevance & medium type

PROEFSCHRIFT

ter verkrijging van de graad van doctor aan de
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de rector magnificus prof.dr.ir. F.P.T. Baaijens,
voor een commissie aangewezen door het College
voor Promoties, in het openbaar te verdedigen op
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door

Arief Ernst Hühn

geboren te Nijmegen

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Het onderzoek of ontwerp dat in dit proefschrift wordt beschreven is uitgevoerd in overeenstemming met de TU/e Gedragscode Wetenschapsbeoefening.

Untuk Ejang Putri dan Ejang Kakung

Für Oma Koekkoek und Opa Hatsjie

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CHAPTER 1| INTRODUCTION AND OUTLINE

The precursor of advertising was likely to be the merchant that promoted the product or service by approaching consumers directly by means of simple face-to-face communication, nowadays known as one-to-one marketing or direct marketing. Although this form of promotion was not particularly suited for scale, it had one important advantage: the salesman was able to address the consumer in a very specific and personal way. This approach enabled the vendor to get a good impression of the consumer (e.g. name, age, gender, personal preferences, goal) and his or her context (e.g. time of day, weather, location etc.) through observation, questioning and past experiences. Subsequently that information is intuitively and intelligently used to tailor the commercial message to the individual consumer: "Hey John, good that you're in the neighborhood! We've got a special offer for you today, two chickens for the price of one! You always fancy some chicken soup during the cold days, don't you!"

However, with the introduction of advertising, the personal approach has generally made way for scalability. Instead of targeting individuals with high precision, it became largely a matter of large scale exposure. Ads via television, radio and print were able to reach mass audiences, but at the cost of increasingly overloading consumers with mostly irrelevant ads resulting in the tendency to avoid ads altogether (Rust & Varki, 1996; Zanot, 1984).

With the advent of the World Wide Web, practitioners and scholars expected that the interactive nature would push back ad avoidance. The possibility for two-way communication would namely enable advertisers to retrieve the consumer's needs and tailor ads accordingly (Rust & Varki, 1996). Unfortunately, this potential remains largely underutilized, which has resulted in the perseverance and even reinforcement of ad avoidance, particularly in the case of display ads (Li, Edwards & Lee, 2002; Drèze & Hussherr, 2003; Hollis, 2005; McCoy, Everard, Polak & Galletta, 2008). Click-through-rates for regular web display advertising in the last 5 years have barely progressed beyond 1 click per 1000 impressions[1]. Cho & Cheon (2004; 2012) blame the online ads for not taking into account the goals of the consumer. Along the same line of thought Li, Edwards & Lee (2002) state that *"pop-up ads relegate users to passive viewers of forced messages, similar to traditional advertising. When on-line, however, consumers are often goal directed and may believe the ads are even more intrusive than when they are viewed in other media"* (p.37). Thereby it seems that web advertising has not yet been completely successful in following up on Cho & Cheon's (2004)

[1] http://www.richmediagallery.com/tools/benchmarks

recommendation to *"[deliver] highly targeted, customized and context congruent advertising messages to decrease ad avoidance"* (p.94).

To complicate things even further, we have transitioned into the age of mobile computing with 3.4 billion smartphone subscriptions worldwide (Ericsson Mobility Report[2], Nov. 2015). The ubiquitous nature of these mobile devices practically means that messages can be received in all kinds of use contexts (Bauer et al., 2005). Moreover, mobile phones are personal and egocentric devices that are not tied to location but to persons (Katz & Byrne, 2013). Hence, on the one hand mobile enables the potential to reach consumers throughout their day regardless where they are. On the other hand, as opposed to more static media, these mobile messages need to consider a wider variety of contexts in order to become context-congruent. Fortunately, mobile devices also seem to be part of the solution as they are increasingly becoming more 'aware' of their context due to the integration of advanced actuators and sensors like high-resolution cameras, accelerometers, gyroscopes, compasses, light meters and indoor and outdoor communication technologies such as GPS, WLAN, WiMax, Bluetooth, RFID and NFC (Dhar & Varshney, 2011). Consequently, the interactive, ubiquitous, context-sensitive and the personal nature potentially enables applications to 'know' the user's context, which in turn creates the opportunity to tailor communication to these specific circumstances.

When talking about context, we follow the definition of Abowd, Dey, Brown, Davies, Smith & Steggles (1999): "Context is any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves" (p.3). Subsequently, many scholars have attempted to propose a taxonomy for the different types of context. However, most of these context meta-models can be narrowed down to the categories 'physical world',' individual', 'social, activity', 'technology' and 'change over time' as has been shown by the meta-analysis from Bauer (2012). Accordingly, context-congruency could then be defined as the extent to which the message takes into account these aspects.

Thereby it seems that mobile advertising tries to resemble some of the qualities of one-to-one communication of the early days, but without losing the potential of scale advertisers have become accustomed to. Tähtinen (2006) even goes as far as proposing to change the word mobile advertising since the term *advertising* originally does not accommodate for the interactive, context-sensitive and personalized nature

[2] http://www.ericsson.com/res/docs/2015/mobility-report/ericsson-mobility-report-nov-2015.pdf

of this medium. Generally advertising is defined as *"paid non-personal communication from an identified sponsor, using mass media to persuade or influence an audience"* (Richards & Curran, 2002, p.64). As a solution Tähtinen coins the term *m-adcom* which includes all the different forms of mobile commercial communication. Nevertheless, although we agree with the observation that the word advertising has become a bit confusing, we will still apply the term mobile advertising as it has become common good within academic literature. However, like most scholars, we will disregard the 'non-personal' element within the traditional definition of advertising as it seems to be dated due to the possibility to mass customize commercial messages (Richards & Curran, 2002).

A mobile advertising technique that aims to serve context-congruent commercial messages is Location Based Advertising (LBA). Bruner and Kumar (2002) define LBA as an advertising form where marketer-controlled information is specially tailored for the location where users access an advertising medium. According to them LBA could be perceived as a subset of Location Based Services (LBS), i.e. services that depend on and are enhanced by positional information of the mobile device. Put differently, LBA involves the application of LBS to enable content providers to offer the most consumer-focused local advertising at the right time and in the right place (Kuo, Chen, & Liang, 2009). Within the framework of Bauer et al. (2005) LBA specifically focuses on location (i.e. location-congruency), which falls under the category 'physical world'. Nevertheless, LBA should not necessarily be limited to location, but could also include other forms of context-congruency, e.g. goal congruency which then would fall under activity (chapter 4).

The technical operationalization of LBA largely depends on the objective of the campaign in question. At the moment, LBA is still largely applied to outdoor locations, which usually relies on GPS. However, there is also the possibility to realize LBA within indoor settings with higher precision using a wider collection of technologies such as Wi-Fi, RFID, NFC, iBeacons. Although Indoor LBA faced some implementation challenges in the past few years (Dhar & Varshney, 2011), marketers are finally catching up as 63% of marketers are planning to invest in Wi-Fi, 57% of marketers are planning to invest in GPS, 46% in NFC and 41% in beacons (The LBMA Global Location trends Report, 2016 [3]).

[3] http://thelbma.com/research/103/lbma-global-location-trends-report/

In terms of practical application, LBA has also gained considerable momentum in the last few years. xAd found in 2015 in an international survey[4] among 574 marketers from 11 countries that 80% used location targeting in their campaigns. Moreover, they found that targeting a specific audience, targeting consumers around businesses and sending location-relevant messages were the most prevalent reasons for marketers to deploy LBA. The future of Indoor LBA also seems rosy, with a projected revenue of $10 billion in 2020[5].

Despite the industry's increasing interest in LBA, there is relatively little scientific research regarding its effectiveness. Even though industry studies have shown that location-targeted display ads show click-through rates of 3% to 4%[6], it is not clear which aspects of LBA drive these effects. Most research deals with the technical realization of LBA whereas studies on consumer response are largely underrepresented. Within the subset of studies on consumer response, most attention is directed towards the general acceptance or willingness to receive LBA messages and less to the effect of LBA on consumers (for a thorough classification of LBA research go to chapter 4). Moreover, the most attention is directed towards content aspects of LBA, such as text versus multimedia (Xu, Oh & Teo, 2009), push advertisements versus pull advertisements and promotions versus advertising (Unni & Harmon, 2007).

Interestingly, the central aspect of LBA, adapting messages to the specific location of the user, i.e. location-congruency is largely absent from most effect studies. Even though at face value it seems obvious that mobile messages should be location-congruent it is scientifically still unclear if it is effective, let alone which psychological mechanisms underlie the effects. One exception is the study of Banerjee & Dholakia (2008) who investigated the effects of private versus public locations, work-related versus leisure related settings and advertising strategy (location independent versus location based). However, as with many LBA studies, the study from Banerjee & Dholakia used verbal scenarios to convey the situation in question which renders its ecological validity questionable. Other examples only appeared after or during our own studies. For instance, Fang, Yang, Li & Deng (2013) and Molitor et al. (2015) who both studied LBA's effectiveness using the database from real world companies that

[4] http://www.xad.com/press-releases/nearly-80-of-marketers-around-the-world-use-location-targeting-for-mobile-ad-campaigns/

[5] http://www.reuters.com/article/abi-research-idUSnBw126067a+100+BSW20150512

[6] http://www.businessinsider.com/mobile-location-based-ads-begin-to-work-2013-5?IR=T

used LBA. In both cases a correlation was found between positive consumer behavior (Click-Through-Rates in the case of Molitor et al., purchase behavior in the case of Fang et al.) and location-based advertising. Even though these are the first studies to investigate actual behavior as a result of LBA, it remains unclear which psychological mechanisms are responsible for this effect. Moreover, commercial data based on real world behavior lack the necessary experimental control making it difficult to take extraneous variables into account. In contrast, Lee, Kim & Sundar (2015) conducted an experiment in which they utilized virtual environments, similar to our studies (chapter 2, chapter 3, chapter 4, chapter 5), to investigate the effect of locational congruency (high versus low) on perceived intrusiveness in a more controlled setting. Similar to our findings location-congruency had a positive effect by lowering perceived intrusiveness. Still, our studies have a lot to add as we have investigated other mediators and used different reconstruction methods.

Furthermore, context-congruency is often associated with relevance (Edwards et al., 2002; Xu, Oh & Teo, 2009; Banerjee & Dholakia). Although indeed both concepts are intimately connected, according to Gidofalvi et al. (2008), location congruence and relevance are distinct constructs within LBA. Therefore, even though the location of a person could function as a proxy for their goals, intentions and interest, it should not be treated deterministically without any evidence. In fact, we can also imagine that location-based ads, despite not being congruent with the goals of the user, still have a positive effect by easing the cognitive demands. Hence, to uncover the relation between relevance, location-congruency and ad effectiveness in general we deem it necessary to also include goal relevance, i.e. the extent to which an advertisement is congruent with tasks and goals of the user. It gives us the opportunity to test the assumption that location congruence automatically triggers perceptions of relevance.

Another elemental theoretical question is to what extent the effects of LBA are unique to mobile. In other words, could it be that the advantages of location-congruency are independent from the type of medium and that the presumed positive effects could also take place within other media? After all, traditional media, such as stationary displays, can also offer location-based sales promotion. Unfortunately, the effectiveness of in-store location-based mobile advertising has never been compared with the effectiveness of point-of-sales in-store advertising (e.g., Cai, 2014; Hühn et al., 2012).

Hence, based on these considerations we are mainly interested in the possible influence of location congruency, goal congruency and media type on ad effectiveness. In order to hypothesize the impact of these predictors we mainly relied on the attitude-behavior model as formalized by Fishbein and Ajzen (1975). It provides us

with a conceptual understanding of how stimuli can ultimately lead to certain behavioral outcomes (e.g. purchase behavior, application use etc.). More specifically, the framework explains that upon exposure to a stimulus object (e.g. mobile advertisements) people associate certain attributes to the object in the form of cognitions. These in turn lead to an attitude, i.e. a global affective evaluation toward the stimulus-object located on a bipolar dimension (e.g. like – dislike, affect for or against). Subsequently, this attitude can potentially have an influence on behavioral intention (conation). Finally, intention can lead to a certain behavior.

The attitude-behavior model underlies well known theories such as the Theory of Reasoned Action (TRA; Fishbein & Ajzen, 1975) and Theory of Planned Behavior (TPB; Ajzen,1991) in which aspects such as subjective norm and perceived behavioral control are important determinants for behavioral intention and behavior. These theories in turn have laid the foundations of the Technology Acceptance Model (TAM; Davis, 1989) which looks at the precursors of technology use. Moreover, Fishbein and Ajzen's attitude-behavior model has frequently been used in the context of web ads (e.g. McCoy, Everard, Polak & Galletta, 2008) and mobile ads (e.g.Tsang, Ho & Liang, 2004; Xu, 2006; Morimoto & Chang, 2006; Xu, Oh & Teo, 2009; Unni & Harmon, 2007; Nysveen, Pedersen & Thorbjørnsen, 2005).

This model does not specifically address location- or context-congruency in itself. Instead it allows us to link our context-based predictors to cognitions with a contextual dimension which in turn ultimately either directly or indirectly (via attitude and/or intention) influence behavior. In this dissertation we have included three different cognitions: perceived ad intrusiveness (chapter 2, 3, 4, 6), perceived value (chapter 6) and perceived relevance (chapter 4, 6). On the one hand these constructs have proven to be relevant mediators for the effectiveness of advertisements (Heinonen & Strandvik, 2003). On the other hand, these variables are inherently contextual in nature, which makes them suitable contenders for mediating the presumed positive effect of context-congruent nature of LBA. Relevance, generally defined as "a criterion reflecting the effectiveness of exchange of information between people (or between people and objects potentially conveying information) in communicative relation, all within a context" (Saracevic, 1996, p. 5), shows that the evaluation of the relevance of an ad cannot be considered without context. Similarly, perceived ad intrusiveness which is defined as "a psychological reaction to ads that interfere with a consumer's ongoing cognitive processes" and "the degree to which advertisements in a media vehicle interrupt the flow of the editorial unit [and] all new environments in which ads appear" (Li, Edwards & Lee, 2002, p.39) also indicate its situational nature. Lastly, perceived value is defined as "*the customer's overall assessment of the utility of a*

product based on perceptions of what is received and what is given" (Zeithaml, Berry & Parasuraman, 1996) in which Pihlström (2008) differentiates between context- and content related value in which spatial and temporal aspects are determinative. Within the following chapters we will give a more detailed description for each of these constructs and will also describe how they relate to the predictors.

Consequently, based on these cognitions attitudes are formed. Initially (chapter 2 and 3) we looked at *attitude towards the app* based on the Technology-Acceptance-Model (Davis, 1989) since we were interested in the effects on the intention to use the application. However, later on we realized that attitude towards the ad would give us more precise results, as it limits itself mainly to the attributes associated with the advertisement instead of letting the user evaluate the whole application. Nevertheless, we believe that in this particular case both would probably have given us more or less the same results since the ads were the only functionality of our app, which means that the attitude towards the ad is somewhat reflected by the attitude towards the app. Along these same lines we defined the intention to buy the advertised product and intention to use the app. When it comes to behavioral measures we have only been able to take buying behavior into account with 2 studies (chapter 4 and 5).

Lastly, outside of the attitude-behavior model we have also included attention as an important mediator for ad effectiveness (chapter 5). Specifically, when it comes to investigating the mobile medium in comparison with traditional point-of-sales media, attracting attention could be an important distinctive quality. In addition to visual cues in the form of on-screen push notifications, sound and vibration can be used to enhance users' attention to the ad (Baumann et al., 2010; Miller, 2012).

In figure 1 we provide an overview of key concepts for ad effectiveness in LBA. This should not be seen as an a priori conceptual model as we have expanded our model as we went. We also would like to point out that in this overview we have not included the specific causal relations for clarity purposes. Instead we would like to refer readers to the Chapter for a full description of the relations being tested (please consult figure 2).

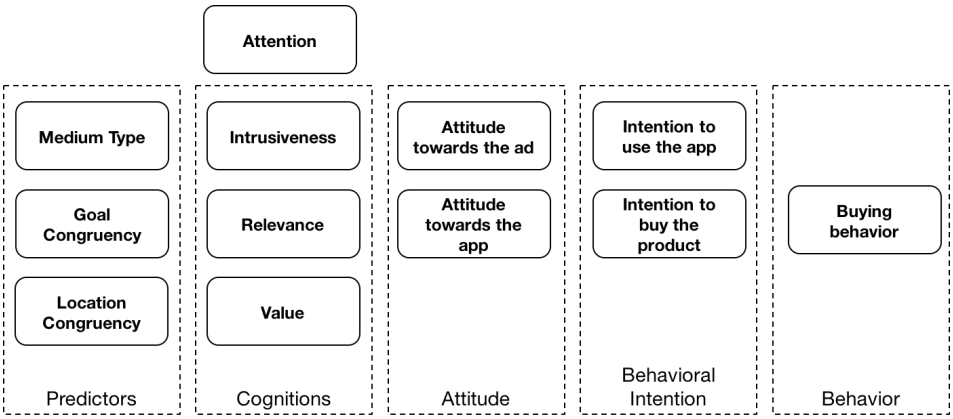

Figure 1. Overview key concepts for ad effectiveness in LBA

Apart from the theoretical knowledge gaps, the literature also points towards some methodological issues when it comes to LBA research and mobile advertising research in general. As discussed most studies have made use of verbal scenarios (e.g. Unni & Harmon, 2007; Xu et al., 2009; Banerjee & Dholakia, 2012; Čaić, Mahr, Aguirre, de Ruyter & Wetzels, 2012) begging the question to what extent these findings extend to real life situations. After all, verbal scenarios could lead to a different response due to the absence of a visceral contextual experience (Wehmeyer, 2007). Hence the importance of field studies as they enable us to "*not only study LBA in a real shopping context, but also to test the overall acceptability of the designed mobile service*" (Sun & May 2013). However, field studies have methodological challenges of their own. As discussed with the studies from Molitor et al. (2015) and Fang et al. (2013) field studies usually lack experimental control resulting in studies cluttered with extraneous variables due to the dynamic and unstable nature of real world situations (Kjeldskov, 2004; Kjeldskov & Skov, 2014; Bonnet, 2014; Hühn et al., 2012).

These shortcomings within lab and field studies stimulated researchers to look for new ways to reconstruct the use situation. One method that seems promising is the use of virtual environments. On the one hand it immerses participants in a dynamic and interactive context during their experience while on the other hand researchers gain a controllable, measurable and malleable research setting. According to Anderson (2012) the key advantages of virtual environments in retail research is that: *"realistic studies can be conducted without retailer support; products can be tested rapidly in their competitive context; and away from the eyes of competitors; the ability to collect behavioral measures of attention, engagement, navigation and choice as each individual moves through the store or shelf environment"*. Despite being promising

most previous evaluation research using virtual environments are usability studies. Moreover, the setups from these studies leave room for improvement in terms of display methods, navigation, and interactivity between the virtual environment and the mobile app.

RESEARCH OBJECTIVES, RESEARCH APPROACH AND CONTENTS OF THIS STUDY

As stated by the introduction there are both theoretically and methodologically driven objectives for this dissertation. Our theoretical objectives are represented by the following research questions:

- Does location-congruency increase the ad's effectiveness?
- In addition to location-congruency, does goal relevance increase the ad's effectiveness?
- To what extent does the medium type (mobile vs point-of-sale) play a role in the effectiveness of LBA?

Our methodological objectives are driven by the following research question:

- What are important insights when conducting research using virtual environments, video scenarios and field?

To address these research questions, we apply the triangulation framework of Human Computer Interaction (HCI) (Mackay and Fayard, 1997). Based on this framework research is conducted through the interchange between theory development, design and conducting observations. In figure 2 we illustrate how the framework is applied in this thesis. The figure can be read from left to right to see which theory has been investigated, which tool was developed, what observational method was applied and which measures were deployed. From top to bottom we can see the different studies that have been conducted.

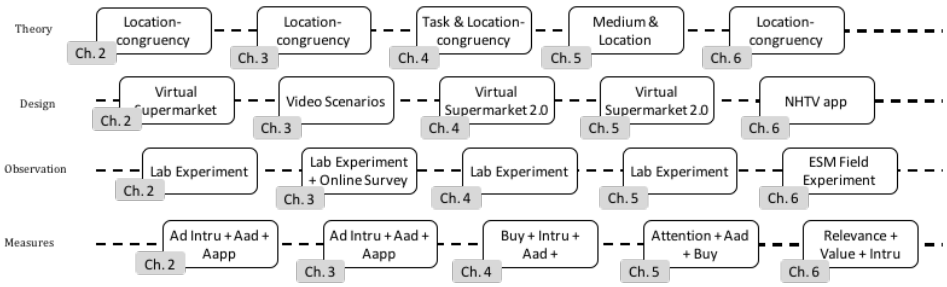

Figure 2. Triangulation framework; Ad Intru= Perceived Ad Intrusiveness, Aad = Attitude towards the ad, Aapp=Attitude towards the app, Buy= buying behavior

As reflected by the body of literature and the venues in which our work has been published, our investigation relied on a multidisciplinary approach. To support our theoretical groundwork with regards to the effectiveness of LBA we mainly made use of media psychology and communication science. However, when it came to the investigation of pervasive applications, data collection methods and reconstruction approaches we tapped into the field of Human-computer Interaction (HCI). With the expectation that computers will increasingly touch every aspect of human communication, it is our hope that this body of work contributes to bridging these different research fields.

CONTENTS OF THE THESIS

This dissertation follows a cumulative approach in which the chapters in this thesis are based on individual papers that have either been published, conditionally accepted for publication or submitted[7]. Before being included in this dissertation, all of the papers have undergone some slight changes based on new insights and/or expert feedback. For clarity purposes a short summary of the chapters is provided to give a brief description of their content, how they relate to the other chapters and which audience may be interested in its findings.

Chapter 2 covers two experiments in which we investigate the effects of location-congruency on perceived ad intrusiveness, attitude towards the mobile app and the intention to use the app. In addition, we elaborate on the use of a virtual environment to reconstruct the LBA use scenario, which also established an important basis for our

[7] The papers are listed and linked to each chapter under 'Published Work'

subsequent studies (see chapter 4 and 5). Usually user experience research on pervasive technologies faces considerable challenges regarding today's mobile context-sensitive applications: evaluative field studies lack control, whereas lab studies miss the interaction with a dynamic context. This dilemma has inspired researchers to use virtual environments to acquire control while offering the user a rich contextual experience. Although promising, these studies are mainly concerned with usability and the technical realization of their setup. Furthermore, previous setups leave room for improvement regarding the user's immersive experience. Hence, this chapter contributes to this line of research by presenting a user experience case study on mobile advertising with a novel CAVE-smartphone interface. Thereby this chapter is especially meant for scholars who are interested in utilizing virtual environments to conduct lab experiments. At the same time this chapter provides media and advertising scholars preliminary evidence in favor of location congruent advertising.

Chapter 3 examines how two methods originating from the field of Human Computer Interaction (HCI) can help evaluate location-based advertisements. Specifically, we compare the use of virtual environments to simulate the user experience for advertisement recipients as reported in chapter 2 and a projective technique where feedback is solicited based on the use of video scenarios. We report two experiments, one using video scenarios (N=520), the other using virtual environments (N=53) (same study as in chapter 2), which both studied the effect of location-congruent ads have on perceived ad intrusiveness. This study is of particular interest to methodologists that are looking for solutions to study user experience in relation to context-sensitive information systems, in particular within the context of advertising.

Chapter 4 continues the research in chapter two, by adding an additional independent variable, namely goal congruency. The chapter investigates whether ads that are tailored to consumers' location are indeed more effective than ads that are not in the presence of either but also relevant to consumers' goals. Therefore, a 2 (location-congruency) X 2 (involvement) experimental design was employed. The data collection was done through the use of virtual environments, as has been developed in Chapter 2. This chapter will be of interest to media scholars that are looking into the interaction between contextual and intrinsic variables.

Chapter 5 aims to disentangle two constructs that underlie LBA, namely medium type (mobile vs point-of-sales) and location-congruency (vs location-incongruency) by showing that they differentially affect the efficacy of an ad. Like the studies presented in chapter 2 and 4 this study also makes use of a virtual supermarket. This chapter

should be valuable to scholars and practitioners who are interested in the efficacy of LBA compared to more traditional forms of advertising (point-of-sales).

Chapter 6 presents a field study investigating the effect of location congruent mobile ads on perceived intrusiveness, value and relevance, in contrast to the previous chapters where we deployed lab experiments using virtual environments and video scenarios. A mobile application for undergraduate students was developed, featuring regular campus news and information concerning class schedules. This application delivered daily ads for the University restaurant that were either location-congruent or location-incongruent. Utilizing the Experience Sampling Method (ESM) the app presented a short questionnaire to the participants for a period of four weeks, thereby measuring their perceived intrusiveness, relevance and the perceived value of these ads. This chapter is meant for researchers and practitioners who are interested which mediators are affected by location-congruency. In addition, it should also provide some methodological inspiration in how ESM can give insight in the user experience of LBA in the field.

Lastly, chapter 7 will provide a general reflection on the research results and methodological insights and concludes with a summary of all the findings from the different studies.

CHAPTER 2 | THE EFFECT OF LOCATION-CONGRUENCY ON THE INTRUSIVENESS OF LOCATION-BASED ADVERTISEMENTS

INTRODUCTION

The advent of new mobile devices like smartphones and tablets has contributed substantially to the momentum of the adoption of pervasive computing. Although these devices share many characteristics with their static counterpart, the desktop computer, their mobile nature enables applications to bring their functionalities into the user's dynamic context. Apart from location independence, applications also gain the ability to interact directly with the specific context of the user, due to context-sensitive technologies (e.g. camera, GPS, compass, accelerometer, etc.). Augmented reality and location-based services (or a combination of these) on a mobile device are popular examples that tie in closely with the ever-changing environment of the user and have attracted much attention from advertisers and marketing scholars (Dhar & Varshney, 2011). However, advertising research is limited when it comes to the evaluation of context-sensitive applications because of the lack of means to deal with the context-prone and dynamic research setting pervasive technology poses. Because of the lack of better alternatives advertising researchers mostly focused on simple forms of advertising (simple push SMS/MMS-advertising) and their methods generally relied on surveys with scenario descriptions (Banerjee & Dholakia, 2008; Bauer, Reichardt, Barnes & Neumann, 2005; Unni & Harmon, 2007; Wehmeyer, 2007; Xu, Oh, & Teo, 2009), thereby relying on imagined situations and lacking an embodied and altogether ecological valid experience, resulting in questionable results.

In contrast, to the field of human-computer interaction (HCI), mobility and context-sensitivity are already familiar challenges when it comes to the evaluation of pervasive applications. Until relatively recently mainly two types of studies were engaged to evaluate mobile applications: laboratory and field-test studies. Researchers have been divided about which method is more effective and efficient (Nielsen, Overgaard, Pedersen, Stage & Stenild, 2006). Main objections to field studies are concerned with the lack of control and the expensive and time-consuming endeavors associated with this type of research (Kjeldskov, Skov, Als & Høegh, 2004; Roto, Oulasvirta, Haikarainen, Lehmuskallio & Nyyssönen, 2004; Kjeldskov & Skov, 2014). In contrast, lab studies do not offer an immersive and interactive context for the user, thereby overlooking possible important influences that determine the everyday practice of these pervasive applications (Kjeldskov et al., 2004). Moreover, some mobile applications are currently difficult to deploy because the supporting technology (e.g. indoor positioning, RFID, etc.) is not yet in place (Barton & Vijayaraghavan, 2002).

These shortcomings have given rise to a new line of research where lab studies have been extended with the utilization of virtual environments (VEs) (Kjeldskov & Skov, 2014). This offers participants a dynamic and interactive context during their

experience while researchers gain a controllable and malleable research setting (Leichtenstern, André & Rehm, 2010). Although very promising, the aforementioned studies are mostly limited to usability studies. Moreover, the setups from these studies leave room for improvement in terms of display methods, navigation, and interactivity between the VE and the mobile app.

This paper builds on this line of work by introducing a working concept with a distinct combination of features: a mixed reality setup consisting of an interactive 360° CAVE (Cave Automated Virtual Environment) installation interacting with a location-based advertising application running on a smartphone (Khan, Nuijten & Deslé, 2011). To show the potential relevance of this approach we present a case study in which we conduct two experiments with this setup. These studies evaluate the user experience of a location-based advertising application within the context of a virtual supermarket. Based on literature and empirical data, it is our aim to tentatively answer the following explorative research question: *Can we generate meaningful research conclusions about the user experience of pervasive advertising apps in our mixed reality setup?* The answers and provided insights should help advertising and HCI researchers to conduct virtual reality aided evaluation studies of their own, thereby benefitting the design process of location based advertising applications and pervasive applications in general.

Before we discuss the specifics of our case study, we present the limitations in advertising research and review the different mobile evaluation methods in HCI.

BACKGROUND

Mobile Advertising Research

Since the advent of pervasive computing the advertising business has increasingly concerned itself with mobile technology as means to disseminate ads. As a consequence, mobile advertising has attracted the attention of advertising scholars to scrutinize its effectiveness. These studies investigated several mobile advertisement properties like for example text versus graphic (Xu et al., 2009), push versus pull (Unni & Harmon, 2007), permission based versus non-permission based (Barwise & Strong, 2002), situational context (Wehmeyer, 2007), location congruent versus location incongruent Banerjee & Dholakia, 2008) and their influence on subjective experience either based in cognition or attitude (e.g. ad irritation, ad intrusiveness and attitude towards the mobile ad, perceived usefulness). Subsequently Theory of Reasoned

Action (Fishbein & Ajzen, 1975), Theory of Planned Behavior (Azjen, 1991) and Technology Acceptance Model (Davis, 1989) offer a theoretical framework which links cognition and attitude to the behavioral intentions and behaviors that are of relevance to advertisers (e.g. intention to use a technology, intention to buy).

Results are usually obtained through surveys using scenario descriptions of use-context. Marketing studies using real encounters with mobile applications (e.g. (Kowatsch & Maass, 2010)) are on the other hand scarce. Although these scenario-based studies still yield interesting results regarding expectations people have, they are questionable since the participants have not interacted with the application itself, let alone within the use context (Wehmeyer, 2007; Xu et al., 2009).

This lack of data based on real contextual interaction signals the need for new approaches to study these phenomena. In this respect HCI methodology could be valuable to the field of mobile advertising research since it is already familiar with the challenges of evaluating mobile applications. Mobile advertising on the other hand serves as an appropriate vehicle to illustrate the potential of these evaluation methods within the field of HCI.

Mobile Application Evaluation: Field Versus Lab

Field studies are praised for taking the real life context into account. When it comes to studying the user experience of mobile context-sensitive apps, where a dynamic context is salient, field studies seem to be even more appropriate. However, methods examining phenomena in a real life context are time consuming, costly (Kjeldskov & Skov, 2014) and sometimes rely on third parties to acquire the necessary infrastructure (Wehmeyer, 2007). Moreover, some future concepts are hard to deploy in the real world, due to current technical constraints.

In addition to these practical issues, there are also some methodological challenges that trouble researchers. The mobile nature results in an unstable context with detrimental consequences for external validity. They report difficulties in terms of observation, manipulation and control of the use-context (Sun & May, 2013; Kjeldskov & Skov, 2014).

In contrast, lab studies are valued because of the control researchers have on the use context thereby excluding confounding variables and securing reproducibility (Kjeldskov & Skov, 2014). Certain evaluations are reasonably executable in lab settings when they only take the necessary environmental aspects into account. Lumsden, Kondratova & Durling (2007) for example evaluated the quality of three mobile speech

recognition systems where the environmental noise was artificially recreated with a 7.1 surround system.

Nonetheless there are drawbacks to laboratory studies, such as the lack of an ecologically valid and immersive context (Kjeldskov & Skov, 2014). Although real life environments can be recreated physically within lab studies to a certain extent, most mobile use contexts ask for an extensive and dynamic environment instead of a small sized living room or shop (e.g. Kowatsch & Maass, 2010)). In the case of evaluation of context-aware mobile systems the limitations of lab studies are even more prevalent since context not only serves as a backdrop, but also plays an active role in the use of the application (Abowd & Mynatt, 2000; Schellenbach, Krüger, Lövdén &Lindenberger, 2007). Moreover, Duh, Tan & Chen (2006) found more usability problems in the field than in the lab attributed to a different interaction style, cognitive load and a richer environment in the field.

These shortcomings on both field and lab studies, point out the need of an approach that provides on the one hand a controllable setting and on the other hand a rich context users can relate to and interact with while keeping costs, time and organizational effort as low as possible (Kjeldskov & Stage, 2004; Leichtenstern et al., 2010; Schellenbach et al., 2007; Kjeldskov & Skov, 2014).

Evaluation with Virtual Environments (VEs)

Inspired by the shortcomings of these traditional methods recent studies have tried to address these issues by using virtual environments (VEs). Ubiwise (Barton & Vijayaraghavan, 2002) is one of the first research efforts to evaluate pervasive applications with the assistance of a VE. Since that first attempt there have been several other prototypes presented with the same approach (Barton & Vijayaraghavan, 2002; Leichtenstern et al., 2010; O'Neill, Klepal, Lewis, O'Donnell, O'Sullivan & Pesch, 2005; Reynolds, Cahill & Senart, 2006; Schellenbach et al., 2007; Singh, Ha, Kuang, Olivier, Kray, Blythe & James, 2006; Snowdon & Kray, 2009; Kjeldskov, 2014).

Not only do VEs improve control (Leichtenstern et al., 2010; Snowdon & Kray, 2009), but they also give the researcher the possibility to test mobile concepts that are hard to deploy in the real world (Barton & Vijayaraghavan, 2002). Furthermore, advanced methods like psychophysiological measurements, video recording and behavioral tracking are easier to implement in VE than in the field because the researcher is given a stable research setting which simplifies the placement of measuring equipment. In the study by Schellenbach et al. (2007), VEs enabled them to

use a motion capture system to measure the effect of specific interactions with a mobile navigation system on the gait of participants. To set up such a motion capture system in the field or recreate the use-context (in their case study a museum) would be a daunting task.

When comparing the different setups reported in literature, we noted important similarities and differences. Most of these setups have in common that they use hybrid simulations, i.e. "*setups that rely on the integration and combination of the real and virtual world.*" This enables participants to directly interact with a physical mobile device (Leichtenstern et al., 2010), whereas full virtual simulations would have represented the device virtually, forcing its interaction to take place indirectly (e.g. via keyboard and mouse), which could disrupt the usage (Leichtenstern et al., 2010). In terms of differences we noted that some evaluation studies used desktop setups (e.g. (Barton & Vijayaraghavan, 2002; Leichtenstern et al., 2010) while others have moved to large-scale panoramic screens (Snowdon & Kray, 2009; Singh et al., 2006, Klompmaker, Stern, Reimann & Santelmann, 2007). Lin, Duh, Abi-Rached, Parker and Furness (2002) found that setups with a larger field of view (e.g. CAVEs as opposed to desktop) result in higher 'presence', i.e. the feeling of really being in the mediated environment. For simulation purposes, it would be desirable when participants really have the feeling that they are in the virtual environment as it would increase the ecological validity of the setup. Although not necessarily detrimental for their research goal, these screens displayed only environments using prerecorded photos or video lacking the possibility to navigate through the represented environment. In contrast, evaluations that relied on a navigable environment used 3D computer rendered environments (Barton & Vijayaraghavan, 2002; Leichtenstern et al., 2010; O'Neill et al., 2005; Schellenbach et al., 2007). Navigation style within these studies ranged from traditional input methods to more natural forms like treadmill based movement. The latter seems preferable since controls involving the mapping of body movement not only evoke higher presence (Slater, Steed, McCarthy & Marinelli, 1998) but also seem to result in a better representation of the cognitive state during the use of applications in the real world (Snowdon & Kray, 2009). In addition, audio, haptic and olfactory stimuli in a VE could also increase the sense of presence even further (Dinh, Walker, Song, Kobayashi & Hodges, 1999). Nonetheless the development of these test beds cannot only rely on theory but should also be validated in the field to strengthen its external validity. One validation study of particular interest for us is conducted by (Waterlander, Jiang, Steenhuis & Mhurchu, 2015) who investigated to what extent the buying behavior differed between a virtual and physical supermarket. The results show that for most products categories shopping behavior was similar, except for products

like fruits, vegetables and dairy. Furthermore, participants experienced medium to high presence even though it was conducted on a home computer.

Based on these comparisons we can reason that our CAVE-smartphone interface apparently extends earlier approaches by having a distinct combination of features: a 360° view CAVE, surround sound, navigation through full-body movement and the direct interaction between virtual location and the mobile application.

Furthermore, we have not yet encountered a study within VE aided evaluation focusing on the user experience of pervasive applications. Instead most studies have focused on usability evaluation and the technical realization of these test beds. Our case study gives some preliminary insights into how VEs can contribute to the user experience evaluation of mobile apps.

User experience and Ad Intrusiveness

User experience in HCI is a very broad concept and still undergoes semantic negotiations. Generally there are two approaches to user experience: reductionist and holistic (Karapanos, 2010). The reductionist approach chooses to identify distinct psychological constructs, while the holistic approach looks at experience as unique, highly depending on the specific situation and people. Since our case study is grounded in the motivation of advertisers, we are specifically interested in the way location-based applications can improve the user's experience of advertising. This involves a construct that takes into account the subjective experience of the user in relation to: 1) the medium (application), 2) the content of the medium (in our case advertising), and 3) the context. Moreover, the construct should be a good predictor for behavioral intention/behavior to be of use to advertisers. These requirements obviously place us within the reductionist approach.

The concept of perceived ad intrusiveness, which could be perceived as an component of the overall user experience, seems appropriate here; originally developed within the field of persuasive communication, it concerns itself with the experience people have when their cognitive processes are interrupted by an advertisement, which have proven to be good indicators for behavioral intentions (e.g. ad avoidance) (Li, Edwards & Lee, 2002; McCoy, Everard, Polak & Galletta, 2008). Intrusiveness regarding context is originally defined by Ha (1996) as 'the degree to which ads in a media vehicle interrupt the flow of an editorial unit'. Li et al. (2002) expands the concept by redefining "editorial unit" as "all new environments in which ads appear", thereby including advertising formats that not only interrupt media content but also other contexts, as is the case with mobile advertising. Since mobile

devices are ubiquitous due to their mobile nature, mobile ads can potentially interrupt the user anytime and anywhere (Bauer et al., 2005). In search of a countermeasure Edwards, Li & Lee (2002) found three ways of decreasing perceived ad intrusiveness: 1) by showing ads when cognitive efforts are low, 2) by showing relevant ads or 3) by providing value. On all three approaches LBA could contribute. However, our interest largely goes out to option 1 since it gives us the opportunity to investigate the direct cognitive effects of exposing users to location-congruent information. Concordantly, Edwards et al. (2002) state that context-congruency can lower the intrusiveness by reducing the divergent knowledge structures. Since LBA is a form of context-congruency we would expect that perceived ad intrusiveness would be lower when advertisements are congruent with their location as opposed to incongruent with their location. Hence, we formulated our first hypothesis as follows:

H1: Location-based advertisements will be perceived as less intrusive compared to location-incongruent ads.

METHOD

Before presenting the two experiments, we describe the general setup and procedure that both experiments shared.

General Setup

The experiments took place within a virtual supermarket simulated by a CAVE. A supermarket seemed to be the most suitable setting since mobile ads are more effective if they are aimed at low-priced and frequently bought products (Barwise & Strong, 2002). The VE (modelled in Maya and rendered in OGRE) is projected onto four rear- projection screens (each 3.6 meters wide by 2.6 meters high). The screens form a closed space, thereby offering the participant a 360° view of the environment. Participants can move in the virtual setting with the help of a head-tracking system based on four Wii-mote IR cameras. In contrast with head-mounted displays, the CAVE does not block out the physical world, which offers the opportunity to use physical objects and the representation of the participant's own physical body. In this particular case, it gave us the possibility to use an actual smartphone, with which participants were able to receive location-based ads. The tracking device (Figure 1, left) determines the participant's head position in the physical room, which is then used to control motion in the virtual supermarket. In essence, the participant acts as a

"human joystick": when the participant stands in the center of the CAVE the virtual camera stands still, whereas when the participant takes one step in a certain direction, the virtual camera moves accordingly, thus giving the illusion of movement within the virtual space. The participant is able to turn and step in every direction relative to the CAVE's center. The simulation is also sensitive to the magnitude of the participant's distance from the center of the physical room. This distance, determines the speed with which a participant walks within the environment. The simulation also corrects the first person view for the vertical axis. Thus, in the case in which one, for example, jumped or ducked the simulation corrected the perspective according to the vertical position of the participant's head. When it comes to shopping within the supermarket our simulation does not yet support interaction with virtual products. To simulate the act of selecting a product, participants were asked to make a grabbing gesture in the direction of the desired virtual product without actually attempting to interact with it directly (Figure 1, left). When the participant made this grabbing gesture, they received auditory feedback.

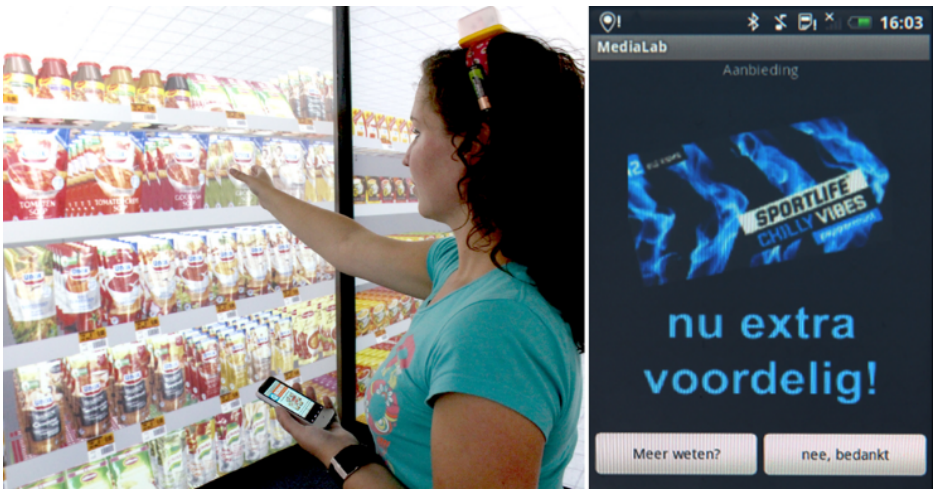

Figure 1. Left: Participant (wearing a headtracker and holding smartphone) makes a 'grabbing' gesture in the virtual supermarket Right: The chewing gum advertisement (study 1) after entering trigger area. With 'know more' & 'no, thanks' buttons the participant can pull more info.

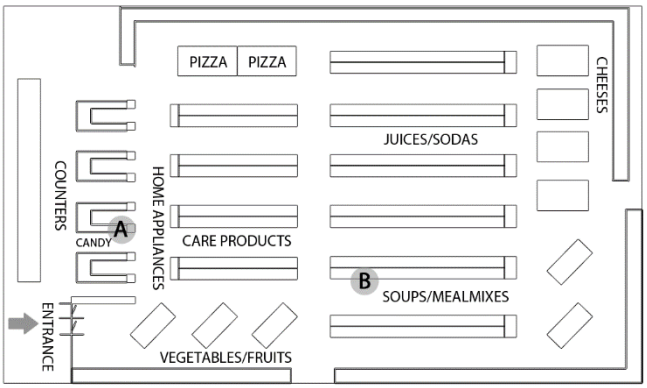

Figure 2. Floor plan of the virtual supermarket; location-congruent trigger area study 1 (A). Location incongruent area study 1 (B). Location (in)congruent area study 2 (B).

The interior of the supermarket (Figure 2), with regards to corporate style and spatial arrangement, was based on common denominators found in stores of popular Dutch supermarkets. The entire supermarket inventory was apparent and about one sixth of the shelves were filled with products at the time of the experiments. In the future it will be filled with a representative product set.

An Android application was developed, which connected the phone with the CAVE through Bluetooth. The application would play an audio message, vibrate and present the ad to participants. The application offered the option of receiving or rejecting more information about the product offer by using yes/no buttons. This ad was presented when the user was within a specific trigger area of the virtual supermarket.

General Procedure

During the briefing of both experiments we covered different topics: interacting with the smartphone and the CAVE, shopping instructions, notice for the slight risk of physical inconveniences (dizziness and nausea) due to disorientation in the CAVE, the length of the experiment (~30 minutes) and the confidentiality clause regarding the collected data. In addition, participants received tasks they had to complete during their virtual supermarket experience. These tasks involved doing shopping and varied slightly for each study to serve the specific research goal. After the briefing, participants were led to the CAVE where the head tracker was mounted and calibrated according to the specific height of the participant. Depending on the group the participant belonged to, the researcher had to start the corresponding supermarket

version (congruent or incongruent). After the experiment the participant was asked to fill out a questionnaire.

STUDY 1: PILOT

Our aim with our pilot study was to investigate the user's experienced intrusiveness when receiving a location-based ad. For clarity reasons we repeat our hypothesis:

H1.1: Location-based ads will be perceived as less intrusive compared to location-incongruent ads.

Experimental Design

A between-subjects design was used to test the hypothesis. Participants were randomly assigned to two conditions. Location-congruent: The ad with product X was presented when the user was on location A, in proximity of product X. Location-incongruent: The ad with product X was presented when the user was on location B, not in proximity of product X. Proximity was set to 0.5 meter distance to the product. Product X was chewing gum; location A was at the counter close to the chewing gum; location B was at the soup shelf instead (Figure 2). The ad advertised chewing gum (Figure 1, right).

Participants

The sample consisted of 12 participants of whom 8 witnessed the location-incongruent setup (4 male and 4 female; average age: 23) and 4 witnessed the location-congruent (2 male and 2 female; average age: 21). All of them were international university students. Moreover, they all owned a mobile phone and were familiar with smartphones equipped with a touch screen interface. For their effort participants received a 5€ gift coupon.

Tasks

The initial task was to navigate through the supermarket for a few minutes to get familiar with the controls and the interaction. Next, participants were asked to go to the main entrance of the supermarket to receive the second task: buying a pizza. While executing the second task participants were given a pre-scripted phone call

before reaching the pizza refrigerators. During this call the extra task of getting a soft drink and a soup package was given. After completing the task participants had to go to counter number 3. The shelves above the conveyor belt at that counter were filled with products including the advertised chewing gum. Depending on the condition a participant was assigned to, the chewing gum ad was triggered at one of two locations. The location-congruent condition triggered the ad within 0.5 meters of the chewing gum shelf (Figure 3, left) while the location-incongruent condition triggered the same ad within 0.5 meters of the soup shelf (Figure 3, right). The half-meter radius was determined by the researchers based on the observation that people usually enter this area when they want to look at products, whereas people that just walk by in the aisle do not trigger the ad.

Figure 3. Left: Participant from the context-congruent group receives a chewing gum mobile ad in front of the chewing gum shelf. Right: Participant from the context-incongruent group receives a chewing gum mobile ad in front of the soup shelf.

These tasks ensured that both groups visited their trigger area without giving away our research goal. In the case of the location-congruent group we did not need to ask participants to seek the chewing gum shelf, since they would visit it while checking out at counter 3. For the location-incongruent group the task to pick up soup ensured all participants within the incongruent group experienced similar conditions while receiving the mobile ad.

Measurement

Immediately after the virtual shopping experience, participants filled out a questionnaire that assessed their perceived ad intrusiveness of the received mobile ad. In order to take into account the complexity of an everyday commercial setting we also measured several control variables that have proven to affect the evaluation of

advertising and location-based advertising. Based on our literature study we included the following scales: product involvement (Verbeke & Vackier, 2004), privacy concerns (Barkhuus & Dey, 2003) and the attitude towards advertising in general (Muehling, Stoltman & Grossbart, 1990).

Results

The 12 respondents rated homogeneous with regards to the control variables, thereby excluding the possibility of these variables explaining the measured effect. The median scores on the ad intrusiveness scale for the congruent and incongruent group were respectively 3 and 5 (7 point scale). Since the data was not normally distributed we used the Mann Whitney U nonparametric test. Based on the results we can conclude that the median scores on the intrusiveness scale differed significantly ($z=-2.722$ $p=0.003$). It can be further concluded, although tentatively due to the small sample size, that mobile context-congruent ads lead to less ad intrusiveness than mobile ads which are not context-congruent.

Figure 4. 'Incongruent Group' shelf setup (left): all six shelves offer only meal mixes. 'Congruent Group' shelf setup (right): top three shelves offer soup, including the advertised soups (highlighted); bottom three shelves offer meal mixes

STUDY 2: LARGE SCALE

Our second study approaches the same research hypotheses as our pilot. For clarity reasons, we state once again:

H2.1: Location-based ads will be perceived as less intrusive compared to location-incongruent ads.

For this study we also extended our theoretical scope to the consequences of intrusiveness for behavioral intentions. Based on the attitude-behavior model of Fishbein and Ajzen (1975) we should expect that positive perceptions lead to a favorable attitude, which in turn has a positive influence on behavioral intentions. This theoretical framework has already been successfully applied to intrusiveness in the context of web ads (McCoy et al., 2008). Thus, we hypothesize:

H2.2: Lower level of perceived ad intrusiveness results in more favorable attitude toward the mobile advertising application

H2.3: Attitude towards the mobile advertising application is positively related to the intention to use the mobile advertising application

In the following section we present the motivations for the changes we introduced compared to our pilot (Study 1).

Experimental Design

For this study we again used a between-subjects design to test our hypotheses. Participants were randomly assigned to one of two conditions: 1) Location-congruent: the mobile ad with product x was presented when the user entered location B where product x, product group X and product group Y were available, 2) Location-incongruent: the mobile ad with product x was presented when the user entered location B where only product group Y was available (Figure 4). Contrary to study 1, we kept location constant and manipulated the products on the shelf to keep as many circumstantial factors constant as possible. Location B could be found approximately in the center of the supermarket and covered the space with again a radius of 0.5 meter from the manipulated shelf (Figure 2). For product x, a well-known Dutch soup product was used. Accordingly, the ad showed an offer with this specific soup product (Figure 5). Further, product group X consisted of soups and product group Y consisted of meal mixes.

Figure 5. The soup ad for study 2 (left) the participants received when they reached the trigger location. Subsequently, participants could pull more information about the offer by using 'yes' and 'no' buttons (middle, right).

Setup

Compared to the pilot study, we improved the realism of our scenario by creating a simple UI of the application using the supermarket's corporate style. Furthermore, participants had to start the application themselves in contrast to the pilot where the application was already started and was running in the background. In this way we wanted to convey the idea to the participant that this is an opt-in service within the environment of an application instead of a simple push message.

Participants

We recruited 70 participants through a marketing research company. From the 70 participants 15 participants received the ad outside the perimeter as a consequence of an unstable Bluetooth connection and 2 participants did not notice the ad. The remaining 53 participants (31 male, 22 female; age range 17-64 years, M= 28.57 years, SD=11.60) consisted of 26 who witnessed the location-incongruent setup (15 males and 11 females; M=28.96 years, SD=14.22) and 27 who witnessed the location-congruent (16 male and 11 female; M=28.19 years, SD=11.22). Moreover, they all owned a mobile phone and were familiar with smartphones equipped with a touch screen interface. For their effort participants received a 5€ coupon.

Tasks

Participants were given two tasks during the briefing: first, they freely navigated in the supermarket for a few minutes to get familiar with the controls and the interaction.

Second, they had to pick five different food products and then to go to the counter. The central location of our trigger area, the task of shopping five products and the limited product set of the virtual supermarket ensured that both groups visited the trigger area. In this way we did not have any specific instructions for participants to visit the manipulated shelf, thereby keeping our research goal concealed.

Measurement

After the virtual shopping experience, a questionnaire assessed the perceived intrusiveness (Cronbach's alpha=.841), based on the scale of Li et al. (2002), attitude toward the mobile application (single item) based on a scale of Bergkvist and Rossiter (2007) and measured their intention to use the application (Cronbach's alpha=.92) based on a scale of Kowatsch and Maass (2010). As was the case with our pilot study we also took into account relevant control variables: product involvement (Cronbach's alpha=.84) (Verbeke & Vackier, 2004), the attitude towards advertising in general (Cronbach's alpha=.84) (Muehling et al., 1990) and personal innovativeness (Cronbach's alpha=.85) (Agarwal & Prasad, 1997).

Results

The variable *intrusiveness* shows a statistically significant higher value with the incongruent-group (M=3.15, SD=0.90) than with the congruent-group (M=2.45, SD=1.07); (t(51)=-2.55, p<.05), thereby pointing in the direction expected by H2.1. The ANCOVA (see Table 1) confirms the significant effect of the congruent/incongruent condition when controlled for *product involvement* and *attitude toward advertising in general*. It also shows that the congruent/incongruent condition has the greatest effect (η^2=0,094). H2.1 is thereby supported by the data. Furthermore, we tested the remaining hypotheses by conducting a regression analysis. It showed that *intrusiveness* has a significant effect on the *attitude toward the app* (β=-0.173, p<.05) and is responsible for 14.1% of the variance, thereby supporting H2.2. *Attitude toward the app* has a positive influence on 'intention to use the application' (β=0.393, p<.001) when controlled for *innovativeness* (H2.3 supported). Together they explain 48.1% of the variance of *intention to use the application*.

Table 1. ANCOVA for 'intrusiveness'

Variable	*df*	*MS*	*F*	*partial η²*
Product involvement	1	1.621	1.826	.036
Attitude ad in general	1	4.369	4.921	.091*
Location-congruency	1	4.514	5.085	.094*
Error	49	.888		
Total	53			
Corrected Total	52			

GENERAL RESULTS AND LESSONS LEARNED

The results from both studies show us that location-congruency is a significant factor when it comes to lowering the intrusiveness people experience when using a mobile (advertising) application. Furthermore, users of a context-congruent application tend to form more positive attitudes toward the application and as a consequence are more likely to use it in the future.

In addition to the gathered quantitative data, these studies also provide insight into the specifics of conducting pervasive application evaluations using VEs. With regards to the setup, scenario and experimental design we had to be creative to deal with the challenges that this kind of research poses. Firstly, given the fact that the setup did not support any interaction with the virtual products, the participants were asked to make a 'grabbing' gesture towards the product of their choice. To give participants feedback on whether they were successful in their attempt, a 'wizard of Oz' procedure was implemented: as soon as the participant made the grabbing gesture the researcher manually played a confirmation sound. Since the CAVE installation formed a closed space, separating participants from the researcher, the use of video cameras was essential in observing the participant's actions within the CAVE.

When it comes to the experimental design, the concept of 'context-congruency' can be operationalized by manipulating one of the following factors: 1) by altering the product in the advertising application, 2) by altering the location where the ad is triggered (thereby obviously altering the context in which the ad is received) or 3) by replacing the advertised product in the shelf with a different product. In our pilot study (Study 1) we altered the trigger location thus manipulating the aforementioned factor 2. This resulted in the 'context-congruent' group receiving a chewing gum ad at the counter where chewing gum was displayed while the 'context incongruent' group

received the chewing gum ad at the soup shelf. Although altering the location seemed a rational choice, we realized that it compromises the requirement for experiments to keep circumstantial factors constant. Receiving an ad at the supermarket counter compared to receiving an ad at a supermarket aisle not only manipulates context-congruency but also possibly includes other situational factors that could unintentionally affect our dependent variable. Therefore, in our second study we decided to keep the location of the trigger area for both groups the same and to change the products that are within the vicinity of the trigger location instead. Because of the plasticity of our VE it was fairly easy to replace the congruent products (soup) with incongruent products (meal mixes). The third aforementioned factor we could manipulate, i.e. changing the product within the ad, was discarded as an alternative since it could affect the participant's product involvement towards the advertised product, which in turn influences their experienced intrusiveness (Wehmeyer, 2007).

When scrutinizing the effect of context-congruency, it is important for the research goal that participants reach the trigger area and notice the products. The importance lies in controlling any biases participants might experience in case their task description includes products in the ad's location-triggering area. Since the empty shelves were already common in the virtual supermarket, we were able to empty the opposing shelf to ensure that the participants would only notice the (in)congruent products while receiving the ad with their application. In addition, we placed the trigger area in a central location of the supermarket to increase its accessibility. This once again illustrates the benefits of the dynamic configuration of the VE in helping the researcher to adjust the setting to the needs of the study. Furthermore, participants can also be 'guided' towards the trigger area through the task scenario. In our first study we used the shopping list and counter to draw people towards their respective trigger areas. The second study had a different approach. During our pilot we experienced that the limited product set of the supermarket already 'forced' the participants to visit all the filled shelves, since there were not many other places of interest. Just by giving a generic task where participants had to shop for five products sufficiently increased the chance they reached the trigger area. This caused all participants to visit the trigger area.

CONCLUSION

This case study presented a setup with a CAVE-smartphone interface that was used to evaluate the user experience of a location-based advertising application. We

conducted two experiments that evaluated the perceived intrusiveness of location congruent versus location incongruent mobile ads. The results from both studies show a statistical significant difference between the two groups; participants receiving a location-congruent mobile ad perceived it as less intrusive compared to participants receiving a location-incongruent mobile ad, thus confirming our central hypothesis. Furthermore, our second study confirmed our other hypotheses: users of a context-congruent application tend to form more positive attitudes toward the application and as a consequence intend to use it in the future and intend to buy the advertised product. Thereby the results seem to support the underlying theory (Ajzen, 1991; Davis, 1989; Fishbein & Ajzen, 1975; Li et al., 2002) and contribute to the knowledge of persuasive communication by applying the construct of intrusiveness to pervasive advertising.

A more abstract, yet tentative methodological conclusion (see Limitations and Future Work section) is that such a setup enables mobile and pervasive computing researchers as well as advertisers/advertising scholars to conduct experimental studies to yield meaningful results regarding the user experience of mobile applications. Our literature study showed that such a setup has substantial advantages when compared to field and lab studies. When compared to field studies, such a setup can help researchers control and manipulate context parameters, enable the replication of studies and apply extensive measurement. When compared to lab studies, this setup can introduce malleable, immersive and interactive experiences with the envisioned context of use (Snowdon & Kray, 2009). As described earlier, we were able to manipulate location (study 1) and context (study 2) fairly easily when compared to the effort one would need in the field. In contrast, Nurmi, Salovaara, Bhattacharya, Pulkkinen & Kahl (2011) conducted a field study in a real supermarket and reported difficulties in modifying the environment due to restrictions from the supermarket. Compared to the existing literature our setup is a useful expansion as it offers a distinct combination of features like an interactive virtual environment (VE), 360° view, navigation controls with body movement and a virtual localizing system interacting with a physical smartphone. Nonetheless, its value needs to be verified by comparing this setup with other approaches.

Furthermore, based in our experience we provided guidelines for researchers planning to use such setups for evaluating context-aware pervasive computing applications.

Naturally, developing such an installation would initially require a considerable investment, but in the long run it would save time and money when it comes to performing user evaluations (Leichtenstern et al., 2010). Furthermore, since the

setting as well as the pervasive technology infrastructure takes place within the simulated environment, it does not rely on third parties for the operationalization.

LIMITATIONS AND FUTURE WORK

Although our results resonate with theory and expectations, they remain tentative due to certain limitations. Since we have not yet conducted a validation study, there is still uncertainty with regards to the external validity. We see two important factors that could have decreased the generalization of our results. In the first place we observe a potential tradeoff between the ecological validity and the internal validity. To strengthen the internal validity of our study we had to investigate the relationship between the user experience and context-congruency within a vacuum of some sort. Conducting the experiments within a VE helped us achieve that goal, due to high control and manipulability; we were able to customize the shelves and filter out confounding variables. However, these adjustments could have affected the outcome in such a way that the results cannot speak for the use context we wanted to investigate in the first place (i.e. real world supermarkets). This obviously has little to do with the use of VEs but more with the inherent properties of an experimental setup that investigates a specific causal relationship.

Secondly, we can speculate about the possibility that the limitations of our setup and simulation affected the ecological validity. The interaction with the VE, like the navigation style and manipulation of objects differed from physical reality. The absence of a complete product set is also a noteworthy difference. Furthermore, the presence of supporting equipment (head tracking system, beamers etc.) could have impaired the level of immersiveness. Validation studies that compare the results of a CAVE with a real life supermarket, could give some insight in to what extent the results are affected by these limitations. However, we must note that these shortcomings are not necessarily inherent to the principle of a virtual reconstruction of user experience, but are caused by our specific operationalization and by the limitations of current technology. As technology progresses certain aspects of the setup could be improved. In our case we are already in the process of extending our product set, improving the graphics and have already replaced the Wii-mote based head-tracking with the help of a Microsoft Kinect, thereby making the facilitating technology transparent to the user. Finally this issue raises the philosophical question whether such setups can become truly invisible and match field studies in realism. A pragmatic approach would be that the facilitating technology should be as unobtrusive as possible so that the participant

can focus better on the reconstructed user experience. Results from validation studies should guide us in this process of improvement.

In addition, the setup could also affect the outcome as a consequence of Hawthorne effects. Even though participants got the chance to get used to the setup, there is the risk that they behaved differently because the setup still reminded them they were taking part in an experiment.

Apart from the external validity we also see some room for improvement in terms of measurement. In our case we relied on questionnaires to gather our data. Even though the construct of intrusiveness is usually measured with self-report Likert scales, the delay between the stimulus and measurement could have affected the outcome. Since the use of the CAVE setup allows for elaborate measurements, direct measures like observations or psychophysiological measurements should be considered in the future.

CHAPTER 3 | THE EFFECT OF LOCATION CONGRUENCY ON INTRUSIVENESS - AN EXAMINATION THROUGH VIDEO-SCENARIOS AND VIRTUAL ENVIRONMENTS

INTRODUCTION

Marketers are increasingly considering mobile technology as a platform for advertising, recognizing its potential to deliver targeted advertisements by utilizing its ubiquitous, context-sensitive and personalized nature (Dhar & Varshney, 2011). Related research is concerned with how such new forms of advertising are received by the public. Up to this point, evaluation studies have mostly surveyed reactions of subjects to verbal or text scenarios (e.g. Banerjee & Dholakia, 2008; Bauer, Reichardt, Barnes, Neumann, 2005; Leichtenstern, André, Rehm, 2010; de Sá, Navalpakkam & Churchill, 2013; Sun & May, 2013; Wehmeyer, 2007; Xu, Oh & Teo, 2009). Such scenario-based surveys give an initial estimation of the participant's preconceptions but seem to be not well suited for retrieving the respondent's situated and embodied experience of mobile and location based advertisements. According to Schwarz (2007) attitude creation and human cognition relies heavily on the context and thereby should be respected by the research method.

This methodological challenge is quite familiar for the research field of Human-Computer Interaction (HCI), defined as "a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them" (Hewett, Baecker, Card, Carey, Gasen, Mantei & Verplank, 1992, p. 5). This field has traditionally emphasized the importance of context in shaping the user experience that results from using interactive technologies, and researchers evaluating different technologies and emerging experiences go into substantial lengths to expose research participants to the most realistic representations of user tasks and use context to obtain valid evaluation results. The convergence of the two fields suggests that advertising research aiming to investigate cognitive, affective, and behavioral consumer responses to mobile advertising can benefit greatly from using HCI research methods.

HCI evaluation methodology often has to strike a fine balance between the benefits and costs of testing in the field versus the laboratory. Where field studies tend to be compromising in terms of cost, feasibility, measurement and experimental control, lab studies typically lack in ecological validity failing to bring into the evaluation sufficiently rich and realistic representations of usage context (Kjeldskov & Skov, 2014). This is particularly problematic when the mobile application's functionality is highly context dependent as is the case with location-based advertising.

HCI researchers have developed numerous methods that attempt to strike a balance between requirements for cost, control and feasibility on the one hand and exposure to a realistic mobile usage context on the other. A relatively easy and cheap

way is to use VSs (or video prototypes), e.g., (Binder, 1999; Kowatsch & Maass, 2010). Hereby participants view how the mobile technology is used in a realistic context before they are asked to evaluate different aspects of usage and the imagined user experience. Another approach is to use hybrid simulations, which offer a virtual environment in which the mobile application can be used (Barton & Viayaraghavan, 2002; Leichtenstern et al., 2010; O'Neill, Klepal, Lewis, O'Donnell, O'Sullivan & Pesch, 2010; Reynolds, Cahill, Senart, 2006; Schellenbach, Krüger, Lövden & Lindenberger, 2007; Singh, Ha, Kuang, Olivier, Kray, Blythe & James, 2006; Snowdon & Kray, 2009). This latter approach has been applied in our previous study (Hühn, Khan, Lucero & Ketelaar, 2012) to evaluate a location-based mobile advertising application. Although these studies have shown promising results, methodological research to position and validate the use of VEs among other approaches is scarce.

Hence, this paper makes a first attempt to position the use of VSs and VEs in mobile advertising research by examining whether and how evaluation results may differ between the two methods, and discussing the advantages and disadvantages of each. This paper provides both HCI and advertising researchers with valuable insights on the strengths and weaknesses of these different lab approaches to recreate and evaluate context-sensitive mobile applications.

BACKGROUND

Location Based Advertising

When advertisements interfere with the consumer's goals and cognitive processes the risk of ad avoidance behavior increases (Cho & Cheon, 2004; Li, Edwards & Lee, 2002). One possible solution involves the use of context-congruent ads based on 'behavioral tracking' which adapt to the situation of the consumer (Cho & Cheon, 2004; Leppäniemi & Karjaluoto, 2005). A relatively young marketing method based on this principle is Location Based Advertising (LBA), a form of mobile advertising, where location-tracking technology (e.g., GPS) is utilized to send selected ads to the mobile communication device of the consumer.

For example, stores may use LBA to advertise only to passers-by approaching the shop window. LBA relies on the expectation that an ad that is relevant to the user's context, is considered as more relevant and less intrusive (Banerjee & Dholakia, 2008; Xu, 2006/2007).

Recent developments in communication technology have increased the possibilities considerably to make LBA an everyday practice (Dhar &Varshney, 2011). This is particularly the case since the introduction of smartphones equipped with powerful processors, a rich software platform, intuitive and multi-modal user interface, advanced sensors, high-speed internet and GPS. The user base of this new generation of phones is rapidly growing: in 2014 there are approximately 1,75 billion smartphone users worldwide (eMarketer Report, 2014). These developments increase the potential for advanced forms of mobile advertising beyond SMS (Short Message Service) and MMS (Multimedia Messaging Service) (Unni & Harmon, 2007), onto mobile applications with a high degree of interactivity, multimedia, connectivity and context-sensitivity.

Further progress is also expected in the field of positioning techniques. In contrast with GPS, new techniques based on WLAN, WiMax, Bluetooth, RFID and NFC give advertisers the possibility to track consumers with high precision in indoor settings (Dhar and Varshney, 2011; Liu et al., 2007). Even though indoor location tracking is gradually being introduced in the commercial sphere (e.g. iBeacon) there is still no widely available general purpose system which would play a role similar to that of GPS for outdoor-location tracking. Current experimentations involving indoor-positioning rely on custom systems making field studies considerably cumbersome to conduct.

The evaluation of mobile advertisements

Only relatively recently have advertising scholars scrutinized mobile advertising's effectiveness. Related studies have investigated several choices regarding mobile advertisements: the effectiveness of textual or graphical content (Xu et al., 2009); the application of animation, content relevance and/or user relevance (de Sa, 2013); the triggering of ads -'pushed' to the user or 'pulled' by them (Sun & May, 2013); the difference between permission based versus non-permission based (Barwise & Strong, 2002); the effectiveness of prompting based on the situational context (Wehmeyer, 2007); the location-congruency (Banerjee & Dholakia, 2008).

Theoretical models such as the Theory of Reasoned Action (Fishbein & Ajzen, 1975), the Theory of Planned Behavior (Ajzen, 1991) and the Technology Acceptance Model (Davis, 1989) have often provided a theoretical framework that links cognition and attitude to the behavioral intentions and behaviors that are of relevance to advertisers (e.g. intention to use a technology, intention to buy).

Such investigations are almost invariably obtained through surveys that present different possibilities to research participants using narrative scenario descriptions of

use-context. There are very few studies that rely on real encounters with mobile applications in the intended context (e.g., see Kowatsch & Maass, 2010). Although these scenario-based studies yield useful results regarding expectations people might have from mobile advertising, they are not necessarily valid aids in predicting how users will react to mobile advertising and how they will experience it in real life. Participants in such studies do not interact with the application itself and do not use it within the intended use context (Wehmeyer, 2007; Xu et al., 2009). This limitation is even more problematic when the advertising concept is closely linked to this context, as is the case with location-based advertising. In conclusion, it appears necessary to enrich advertising research with methods for studying LBA that involve participants actually experiencing the ad and that are sensitive to the ad's intended context.

HCI methods for evaluating interactive applications and its user experience seem particularly fitting to address the abovementioned needs. Next, we review some of the methodological debate surrounding the evaluation of the user experience of mobile interactive applications.

Investigating mobile user experience: lab vs. field

Given their sensitivity to context field studies are suitable to evaluate the user experience of mobile context-sensitive apps. Nevertheless, testing in the field can be time consuming, costly (Kjeldskov & Skov, 2014) and may even depend on third parties for the necessary infrastructure (Wehmeyer, 2007). Furthermore, concepts of experimental mobile apps may be hard to test in the real world, due to technical, logistical and financial constraints of deployment (Barton & Vijayaraghavan, 2002; Cai, 2014).

In addition to these practical issues, there are also some methodological challenges when evaluating mobile apps. Kjeldskov and Stage (2004) argued that the mobile nature results in an unstable context with detrimental consequences. They reported difficulties in terms of observation, manipulation and control of the use-context. In line with this conclusion Roto et al. (2007) reported that investigating mobile phone use in the wild with a quasi- experiment "*is a laborious method and requires careful planning and vast technological resources*".

Instead, a great number of user studies are conducted within laboratory settings. A structured literature survey by Kjeldskov and Graham (2003) concluded that 71% of mobile evaluation studies they reviewed take place in laboratories. Since the technical barriers for field evaluations have largely been reduced in recent years, it is perhaps true that more field studies are currently used than 10

years ago. However, researchers often prefer laboratory studies because of the control researchers one can exert on the use-context -that helps exclude confounding variables and ensure reproducibility. Certain evaluations are reasonably executable in lab settings when they take environmental aspects into account selectively. For example, Lumsden (2007) evaluated the quality of three mobile speech recognition systems in the laboratory where environmental noise was artificially simulated with a 7.1 surround system.

The investigation of mobile user experience through Video Scenarios (VSs)

Another widely used HCI method for evaluating interactive applications involves VSs where the intended usage in a specific context can be visualized through a purpose made short clip. VSs of this sort are often used during early phases in the design of interactive applications where a design concept can be easily visualized with much less effort than it would take to implement it (Vertelney, 1989). This allows the designers to experience it and communicate it to stakeholders and more particularly target users of the application concerned. Videos offer several advantages for use in early design, including the ability to represent easily some concepts that are particularly hard to prototype, but are easy to produce in video with even including users in the process, enabling participatory design practices (Mackay & Fayard, 1999). Obtaining feedback from viewers is quite a common evaluation technique. For example, de Ruyter, Baha, Pijl and Markopoulos (2011) used video clips to evaluate the effects of blurring video in permanent video communications. Where field studies are elaborate and costly, VSs can enable the researcher to present the use scenario including the context in a relatively easy and cheap way. Although videos are predominantly used within HCI as a form of data collection for interaction design (Binder, 1999) and prototyping (e.g. de Sá, Antin, Shamma & Churchill, 2011) they can also be used for evaluation. Zwinderman, Leenheer, Shirzad, Chupriyanov, Veugen, Zhang & Markopoulos (2013) used video to evaluate design concepts with users and showed that despite the fact that video is seen and evaluated out of context, it is able to provide valid evaluations of a mobile interactive application.

Despite their popularity in HCI, VSs have to this date not yet been deployed yet in the domain of LBA. Especially when it comes to involving context-awareness, VSs could present serious challenges as "*videos are not a straightforward reproduction of embodied activity –in themselves video recordings 'flatten' the space of embodied interaction, they impose a perspective on unfolding action, and remove the embodied spatial and social context within which embodied interaction unfolds*"

(Donovan & Brereton, 2011). On the other hand, when evaluating technologies for the home, videos were found to be more effective than a home simulation laboratory in eliciting comments regarding different situations and contextual aspects of use (Bajracharya, Mamagkaki, Pozdnyakoya, Pereira, Zavialoya, de Zeeuw & Markopoulos, 2013).

In this paper, we show how video can be used to survey reactions of potential LBA users, and compare it experimentally to a different way of conveying to users the nature of LBA that relies on virtual environments.

The investigation of mobile user experience through VEs

In addition to the aforementioned shortcomings of lab studies, such as the lack of a realistic and immersive context (Kjeldskov & Stage, 2003) in the case of evaluation of context-aware mobile systems the limitations of lab studies are even more prevalent since context not only serves as a backdrop, but also plays an active role in the use of the application (Abowd, Mynatt, 2000; Schellenbach et al., 2007). Although one can physically recreate, to a certain extent, real life environments in the lab, most mobile use contexts that constitute an extensive and dynamic environment are very different to a small sized living room or a shop window, i.e. the contexts which can be easily imitated via simulation laboratories (e.g. Kowatsch & Maass, 2010). Moreover, Duh, Tan and Chen (2006) found more usability problems in the field than in the lab. They attributed those to different interaction styles, cognitive load, and a richer environment in the field.

These shortcomings on both field and lab studies, highlight the need of an approach that provides on the one hand a controllable setting and on the other hand a rich context users can relate to and interact with, while keeping costs, time and organizational effort as low as possible (Kjeldskov & Stage, 2004; Leichtenstein et al., 2010; Schellenbach, 2007).

There are recent studies that try to address these issues with the use of virtual environments (VEs). Ubiwise (Barton & Vijayaraghavan, 2002) is one of the first research efforts to evaluate pervasive applications with the assistance of a VE. Since that first attempt there have been several other prototypes presented with a similar approach (Leichtenstern et al., 2010; O'Neill et al., 2005; Reynolds, Cahill & Senart, 2006; Schellenbach et al., 2007;Singh et al., 2006 Snowdon et al., 2009). VEs improve control and observation over field studies (Leichtenstern et al., 2010; Snowdon & Kray, 2009), and they allow testing mobile concepts that are hard to deploy in the real world (Barton & Vijayaraghavan, 2002). Advanced methods like psychophysiological

measurements, video recording and behavioral tracking are easier to implement since VEs support a stable setting. For example, Schellenbach et al. (2007) used a motion capture system to measure the effect of specific interactions of a mobile navigation system on the participants' gait, which they used in a VE. Such a study would have been very difficult in a real life setting.

When comparing the different setups reported in literature, we noted important similarities and differences. A common characteristic is that they use hybrid simulations, i.e. a setup that relies on "the integration and combination of the real and virtual world" (Leichtenstern et al., 2010). In this way, participants can directly interact with a physical mobile device; whereas full virtual simulations would represent the device virtually, forcing its interaction to take place indirectly (e.g., via keyboard and mouse) and that could disrupt usage (Leichtenstern et al., 2010). In terms of differences, some studies use desktop setups (e.g. Barton & Vijayaraghavan, 2002; Leichtenstern et al., 2010) while others use large-scale panoramic screens (Snowdon & Kray, 2009; Singh et al., 2006; Klompmaker, Stern, Reimann & Santelmann,2007) that enhance the feeling of being in the mediated environment, i.e. presence (Lin et al., 2002; Snowdon & Kray, 2009). Although not necessarily detrimental for the respective research goals of these studies, they used prerecorded photos or video thereby lacking the possibility for participants to freely navigate in the virtual environment.

In contrast, more sophisticated evaluations that rely on a navigable environment use 3D computer rendered environments (Barton & Vijayaraghavan, 2002; Leichtenstern et al., 2010; O'Neill et al., 2005; Schellenbach et al., 2007). The navigation style in these studies ranges from traditional input methods to more natural interaction forms like treadmill based movement control. The latter seems preferable since controls involving the mapping of body movement not only evoke higher presence (Slater, McCarthy & Marinelli, 1998) but also seem to result in a better representation of the cognitive state during the use of applications in the real world (Snowdon & Kray, 2009). Additionally, audio, haptic and olfactory stimuli in a VE could potentially increase the sense of presence even further (Dinh, Walker, Song, Kobayashi, 1999). Nonetheless the development of these test-beds cannot only rely on theory but should also be validated in the field to strengthen its external validity (Sutcliffe, de Bruijn, Gault, Fernando & Tan, 2005; Klompmaker et al., 2007; Schellenbach et al., 2007; Snowdon & Kray, 2009).

OUR COMPARISON OF TWO STUDIES

To expand the existing toolset of researchers interested in the evaluation of mobile apps we want to position the use of two relevant reconstruction methods, namely VSs and VEs. Hence, we compare our previous study (Hühn et al., 2012) with a new study in which we investigate the same scenario using VSs. When comparing these we are specifically interested in the way location-based applications can improve the user's experience of advertising. To execute this comparison, we chose ad intrusiveness as our benchmark since it takes the subjective experience of the user into account in relation to 1) the medium (mobile device); 2) the content of the medium (advertisement) and 3) the context (Li, Edwards & Lee, 2002). Furthermore, we chose ad intrusiveness since in past studies it has been demonstrated that it is an important influence on behavioral intention and actual behavior, which is important to advertisers.

Perceived ad intrusiveness

Intrusiveness has proven to be a relevant indicator for feelings of ad irritation and ad avoidance in traditional media (Ha, 1996) and on the web (Li et al. 2002, Edwards et al., 2002, McCoy et al., 2008). With regard to the mobile platform intrusiveness has already been investigated by Wehmeyer (2007) and Unni and Harmon (2007). However, when it comes to LBA, perceived ad intrusiveness is under-explored, even though the concept is theoretically suited for the investigation of context-congruent ads. Instead most studies have concentrated on the concept of irritation and its effects on attitude and behavioral intentions (Tsang et al., 2004, Xu et al., 2009) but at the same time provide little understanding of how these feelings of irritation arise. Li et al. (2002) emphasize that intrusiveness differs conceptually from irritation. Irritation finds itself in the domain of affective evaluation, whereas intrusiveness occurs at a precursory stage, as a result of the discrepancy between the advertisement and the cognitive processes of the consumer.

In addition to the cognitive dimension, intrusiveness also contains a contextual dimension (Morimoto & Chang, 2006), which makes it an attractive concept for studying the efficacy of context-congruent advertising forms such as LBA. Ha (1996, p. 77) emphasizes the importance of context by defining intrusiveness "as the degree to which advertisements in a media vehicle interfere with the editorial unit". In this case editorial unit refers to the media content where the advertisement appears in. Subsequently, Li et al. (2002, p.39) expands the definition by replacing 'editorial unit'

with ”every possible environment in which ads might appear.” Moreover, they claim that as communication technology progresses, ads increasingly appear at unexpected moments and in non-traditional contexts. As a consequence of this new medium-neutral definition, intrusiveness is well suited for the investigation of mobile advertising and LBA in particular. Where the old definition mainly applied to forms of advertising in television, radio, newspaper and web, which interrupted the media content, the new definition encompasses the ubiquitous nature of mobile ads. Mobile devices, because of their ubiquitous quality, can also potentially disturb the user at times when he or she pays attention to the physical environment rather than the medium itself (Bauer et al., 2005; Wehmeyer, 2007). However, this disturbance, i.e. perceived intrusiveness can be decreased by relating the content of the advertisement to the context in which it is displayed, as exemplified by Edwards et al. (2002), albeit in the context of web-ads. Their rationale was that context-incongruent ads activate divergent knowledge structures and create added processing demands whereas context-congruent ads are seen as positive social influences and thus do not compromise the consumer’s autonomy (, p. 86). In other words, ads that are related to the context of the user ask for less cognitive effort than context-incongruent ads which consequently lead to less negative cognitions. Similarly, LBA should lower the processing demands by relating ads to the location of the user, resulting in less perceived ad intrusiveness. Hence, our hypothesis is as follows:

H1: Location-congruent ads will be perceived as less intrusive compared to location-incongruent ads.

Intrusiveness, attitude and behavioral intentions

Smartphone owners are in the first place technology users but secondly also a potential target group for ads (Xu et al., 2009). To substantiate our hypotheses, we relied on the Theory of Reasoned Action (TRA) of Fishbein and Ajzen (1975), Theory of Planned Behavior (TPB) of Ajzen (1991) and Technology Acceptance Model (TAM) of Davis (1989). The theories of Fishbein and Ajzen suggest that perceptions/beliefs lead to a global (affective) evaluation, or attitude (Liska, 1984). We therefore assume that the negative perception of “perceived ad intrusiveness” affects the overall evaluation of the LBA application negatively. The relationship between intrusiveness and the affective evaluation (attitude) has been confirmed in the case of mail advertising (Morimoto & Chang, 2006) and web ads (McCoy, 2008). This study tries to find a similar relationship in the case of LBA. Thus we propose the following hypotheses:

H2: Lower level of perceived ad intrusiveness results in a more favorable attitude toward the mobile advertising application.

H3: The attitude towards the mobile advertising application is positively related to the intention to use the mobile advertising application.

STUDY 1: EVALUATION WITH VIRTUAL ENVIRONMENTS[8]

Method

For this study we adopted a between-subjects design. Participants were randomly assigned to one of two conditions: 1) Location-congruent: the mobile ad with product x was presented when the user entered location B where product x, product group X and product group Y were available, 2) Location-incongruent: the mobile ad with product x was presented when the user entered location B where only product group Y was available (Figure 1). We kept location constant and manipulated the products on the shelf to keep as many circumstantial factors constant as possible. Location B could be found approximately in the center of the virtual supermarket and covered the space with a radius of 0.5 meter from the manipulated shelf. For product x, a well-known soup product was used. Accordingly, the ad showed an offer with this specific soup product (Figure 3). Further, product group X consisted of soups and product group Y consisted of meal mixes.

Figure 1. Left: incongruent shelf, advertised product is replaced by meal-mixes; right: congruent shelf, advertised product (soups) is present (highlighted in green).

[8] This study has been published in Hühn, Khan, Lucero and Ketelaar (2012).

Setup

The experiments took place within a virtual supermarket simulated by a CAVE (see figure 2a and 2b). A supermarket seemed to be the most suitable setting since mobile ads are more effective if they are aimed at low-priced and frequently bought products (Barwise & Strong, 2002). The VE (modelled in Maya and rendered in OGRE) was projected onto four rear-projection screens (each 3.6 meters wide by 2.6 meters high). The screens form a closed space, thereby offering the participant a 360° view of the environment. Participants could move in the virtual setting with the help of a head-tracking system based on four Wii-mote IR cameras.

In contrast with head-mounted displays, the CAVE does not block out the physical world, which offers the opportunity to use physical objects and the representation of the participant's own physical body. In this particular case, it gave us the possibility to use an actual smartphone, with which participants were able to receive location-based ads. The tracking device (Figure 1, right) determines the participant's head position in the physical room, which is then used to control motion in the virtual supermarket. In essence, the participant acts as a "human joystick": when the participant stands in the center of the CAVE the virtual camera stands still, whereas when the participant takes one step in a certain direction, the virtual camera moves accordingly, thus giving the illusion of movement within the virtual space. The participant is able to turn and step in every direction relative to the CAVE's center. The simulation is also sensitive to the magnitude of the participant's distance from the center of the physical room. This distance, determines the speed with which a participant walks within the environment. The simulation also corrects the first person view for the vertical axis. Thus, in the case in which one, for example, would jump or duck the simulation corrected the perspective according to the vertical position of the participant's head. When it comes to shopping within the supermarket our system does not yet direct manipulation of virtual products. To simulate the act of selecting a product, participants were asked to make a grabbing gesture, without actually attempting to interact with the virtual product (Figure 2b). When the participant made this grabbing gesture, they received auditory feedback.

Figure 2a. CAVE setup overview; Figure 2b. Participant with phone 'grabs' product

We created a simple user interface for the application using the supermarket's corporate style. Furthermore, participants had to start the application themselves. In this way we wanted to convey the idea to the participant that this is an opt-in service within the environment of an application instead of a simple push message.

Figure 3. The soup ad (left) the participants received when they reached the trigger location. Subsequently, participants could pull more information about the offer by using 'yes' and 'no' buttons (bottom right).

General Procedure

During the briefing we covered different topics: interacting with the smartphone and the CAVE, shopping instructions, the slight risk of physical inconveniences (dizziness and nausea) due to disorientation in the CAVE, the length of the experiment (~30 minutes) and the confidentiality clause regarding the collected data. In addition, participants received tasks they had to complete during their virtual supermarket experience. After the briefing, participants were led to the CAVE where the head tracker was mounted and calibrated according to the specific height of the participant. Depending on the group the participant belonged to, the researcher had to start the

corresponding supermarket version (congruent or incongruent). After the tasks were completed the participant was asked to fill out a questionnaire.

Sample

Seventy participants were recruited through a marketing research company. 17 participants had to be excluded as a consequence of 15 participants receiving the ad outside the perimeter due to an unstable Bluetooth connection and 2 participants not noticing the ad. The 53 participants that remained (31 male, 22 female; 17-64 years, M= 28.57 years, SD=11.60) consisted of 26 who were exposed to the location-incongruent setup (15 males and 11 females; M=28.96 years, SD=14.22) and 27 who were exposed to the location-congruent (16 male and 11 female; M=28.19 years, SD=11.22). Moreover, participants were only selected if they owned a mobile phone and were familiar with smartphones equipped with a touch screen interface. For their effort participants received a five euro gift coupon.

Results

All participants in the congruent condition noticed that they received the ad in front of the soup. In the incongruent condition 65.4 % of the participants noticed correctly that they received the ad in front of the meal mixes whereas the remaining participants (34.6%) were not able to remember specifically the location. However, none of the participants in the incongruent condition mentioned that they received the ad in the proximity of soup products.

The variable *intrusiveness* shows a statistically significant higher value with the incongruent-group (*M*=3.15, *SD*=0.90) than with the congruent-group (*M*=2.45, *SD*=1.07); (t(51, *N*=53)=-2.546, p<.05), thereby pointing in the direction expected by H1. The ANCOVA (see Table 1) confirms the significant effect of the variable *congruence* when controlled for *product involvement* and *attitude toward advertising in general*. It also shows that congruence has the greatest effect (η^2=0,094). H1 is thereby supported by the data. *Intrusiveness* in turn has a significant effect on the *attitude toward the app* (β =-0.173, p<.05) and is responsible for 14.1% of the variance, thereby supporting H2. *Attitude toward the app* has a positive influence on 'intention to use the application' (β =0.393, p<.001) when controlled for *innovativeness* (H3 supported). Together they explain 48.1% of the variance of *intention to use the application*.

Table 1: Mean scores per condition per variable (fit: location-congruent, misfit: location-incongruent)

Variable	Condition	M	SD	p
Perceived ad intrusiveness	Fit N=27	2.45	1.07	p<0.05
	Misfit N=26	3.15	0.90	
attitude towards application	Fit N=27	5.74	1.02	p>0.05
	Misfi N=26	5.26	1.31	
product involvement	Fit N=27	4.12	1.34	p>0.05
	Misfit N=26	3.71	1.28	
attitude ad in general	Fit N=27	4.96	1.18	p>0.05
	Misfit N=26	4.79	0.94	
innovativeness	Fit N=27	4.90	1.38	p>0.05
	Misfit N=26	4.61	1.11	
Total	N=53			

STUDY 2: EVALUATION WITH VIDEO-SCENARIOS

Hypotheses

The same hypotheses were tested as in study 1. However instead of reconstructing the scenario in a CAVE participants were asked to watch a video.

Design & setup

A between-subjects design (congruent vs. incongruent) was used. Through an online questionnaire a congruent or incongruent video scenario was presented to participants. Participants in the congruent condition watched a video where the ad with product X (soup) was presented on a mobile phone when the consumer was on location A, in proximity of product X. This clip was shot in the CAVE with the same shelf lay-out as in our VE study. Respondents in the incongruent condition watched the same video with the only difference that the ad with product X was presented on a mobile phone when the consumer was on location B (meal mixes), not in the vicinity of product X. The perceived proximity was set to about 0.5 meter distance to the product.

Sample

We recruited 520 participants 17 years or older, in the possession of a smartphone. The participants received 160 points in a reward system at the market research company which helped with recruiting.

Procedure

Participants were invited through a market research company to participate. Through a link in the e-mail participants entered the survey. At the beginning of the survey people were thanked for their participation and received a short briefing with regard to the research topic and the expected time to complete the survey. To provide participants with a clear idea of the content of the application, both groups read a scenario about either the congruent- or the incongruent condition. Then participants had to provide some demographic info and control questions (sex, age, education, and smartphone possession). Participants younger than 17 were excluded from participation. After completion they were shown the movie clip. After that respondents were randomly assigned to one of the two groups and were exposed to the respective video (congruent or incongruent). The system registered if the movie was played. Respondents who have not played the video were suspended from the research. After the video participants had to fill out the rest of the questionnaire.

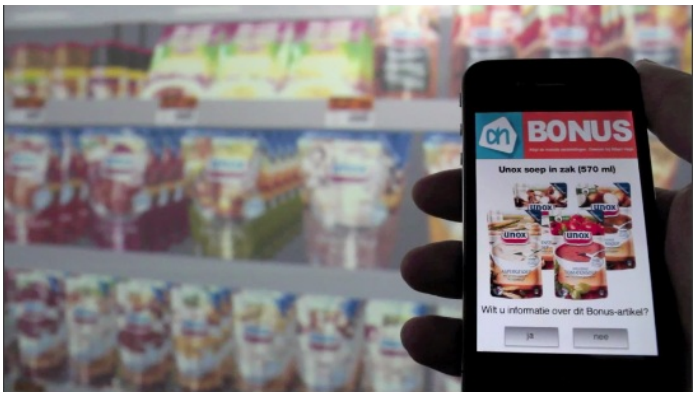

Figure 4. Frame from the (context-congruent) VS

Measurement Instrument

The same scales (perceived ad intrusiveness, attitude towards the app and intention to use the app) were used as in study 1.

Results

Of the 520 participants, 260 answered questions about the congruent condition and 260 about the incongruent condition. The sample consisted of 53% female participants. The age varied between 19 and 66 years old, the average age was 43,2 (SD=13,37). No differences existed between the congruent and incongruent groups concerning age ($t(518, N=520)=.464$, $p>.05$), gender ($\chi^2(1,N=520)=.124$, $p>.05$, and education ($\chi^2(1,N=520) = 8.458$, $p>.05$).

A manipulation check showed that in the incongruent group only a relatively low amount of participants (48,8%) recognized that they received the soup ad in front of the mealmixes shelf. In contrast, in the congruent group, a considerable larger amount of people correctly answered this question (78,8%). More remarkable is the considerable amount of participants (44,6%) who assumed they received the soup ad in front of the soup shelf while they had in fact received it in front of the mealmixes.

Table 2: contingency table location congruent/incongruent X ad received

	When the ad was displayed, the person was close to…					
	Sodas	Pizzas	Soups	Mealmixes	Don't know	Total
Congruent	2	0	205	32	21	260
Incongruent	0	4	116	127	13	260
Total	2	4	321	159	34	520

No difference was found between the congruent and the incongruent condition for perceived intrusiveness (see table 3). However, linear regression shows that a lower level of perceived ad intrusiveness results in a more favorable attitude toward the mobile advertising application ($\beta=-.687$, $p<.01$), thus confirming H2. Furthermore, confirming H3, the attitude towards the mobile advertising application is positively related to the intention to use the mobile advertising application ($\beta=.667$, $p<.01$).

Table 3: Mean scores per condition per variable

	Condition	M	SD	P
Intrusiveness	Fit	5,057	1,323	P>.05
	Misfit	5,059	1,152	
Attitude towards App	Fit	3,380	1,642	P>.05
	Misfit	3,275	1,562	
Attitude ad in general	Fit	4,002	1,379	P>.05
	Misfit	4,015	1,377	
Product involvement	Fit	3,691	1,147	P>.05
	Misfit	3,468	1,271	
Intention to buy	Fit	3,323	1,464	P>.05
	Misfit	3,373	1,461	
Intention to use	Fit	2,937	1,971	P>.05
	Misfit	2,852	1,895	
Innovativeness	Fit	3,935	1,423	P>.05
	Misfit	3,972	1,435	

Note: column 1= variable, column 2 = scenario condition, column 3 = mean score per condition, column 4 = standard deviation per condition, column 5 = p-value independent t-test

As mentioned earlier, we noticed that only a part of the participants were aware of the context in which they received the ad. Based on this outcome we once again compared the congruent and incongruent group, however this time we excluded the participants that did not answer the manipulation check question correctly, resulting in 205 participants in the congruent group and 127 participants in the incongruent group. The analysis shows that once again there is no significant difference in perceived ad intrusiveness between the location congruent (M=5.10 , SD=1.32) and location incongruent group (M=5.07, SD=1.15); (t(330, N=332)=.152, p>.05).

Meta-analysis

Based on the results from both studies we have observed that the VE study confirmed H1 whereas the VS study has not been able to find a significant difference between the congruent and incongruent condition. In addition, in order to determine if the mean scores of both the congruent and incongruent conditions of the VSs differ significantly from the conditions from the VE study we conducted a one-way ANOVA with a Tukey's post hoc test. The results show that the congruent condition has a significantly higher intrusiveness score than the VE study. Also the incongruent condition from the video scenario shows a significantly higher intrusiveness score.

Table 4: Post hoc Tukey's test comparison of intrusiveness between CAVE and VSs

(I) Condition	(J) Condition	Mean Diff (I-J)	SD
Congruent VS	Congruent VE	2.61*	.25
Incongruent VS	Incongruent VE	1.91*	.26

* P<0.05

DISCUSSION & CONCLUSION

This paper aims to position two context-reconstruction approaches, commonly found in HCI, for LBA research (and mobile advertising research in general), namely VEs and VSs. Hence, we conducted a meta-analysis by comparing results from a VE based LBA study with a study investigating the same use scenario but recreated through VSs. The results from our VE study were in alignment with our hypotheses, i.e. location-congruent ads are evaluated as significantly less intrusive than location-incongruent mobile ads which in turn elicits a positive attitude towards the app. As mentioned earlier, the theoretical explanation is that advertisements that are context-incongruent, interfere with the recipient's cognitive processes and thereby elicits higher levels of intrusiveness (Li et al., 2002). In contrast, the VS study did not yield any differences on the outcome measures between both conditions.

In search of an explanation of why the VS study failed to reject the null hypothesis the manipulation check could offer some meaningful insights. As shown by the results, the VS study showed that a large part of the participants was not able to correctly recognize the context in which the ad was received. More specifically, within the incongruent condition almost half of the participants incorrectly assumed that they received the soup ad in front of the soup condition. A possible explanation seems to be that implicit expectations tend to play an intervening role, in two possible ways: 1) the participant expects to receive a location-based ad and already assumes it upfront, thereby not explicitly noticing the incongruent products in the shelf, or 2) the participant does not remember the shelf in front of which the ad was received and post hoc fills in the gap with his or her expectation.

In contrast the VE study showed that all the participants in the congruent condition remembered they received a location-congruent ad. Even though the incongruent

group contained some participants that could not specifically remember the context, none of them confused it with the congruent condition.

In sum, these findings suggest that the use of VS elicits less contextual awareness. As stated by Donovan and Brereton (2011) "videos are not a straightforward reproduction of embodied activity –in themselves video recordings 'flatten' the space of embodied interaction, they impose a perspective on unfolding action, and remove the embodied spatial and social context within which embodied interaction unfolds". Subsequently this could have hindered our manipulation of perceived context-(in)congruency which in turn could explain the absence of a significant difference between the groups within the VSs based study.

Furthermore, the meta-analysis also showed that the VE study resulted in significantly more positive evaluations than the VS study for both the congruent and incongruent condition. These findings could be explained by the study of Braunhofer et al. (2011) in which 26 participants were randomly assigned to experience one of two systems: a music system that recommended music based on a certain point-of-interest (POI) versus a system that did not take into account the location of the user when recommending music. Among other results, the researchers found that while immersed in the surrounding of a certain POI's context both groups yielded significantly higher preference of the music track when compared to the web interface, i.e. when detached from the context of use. The parallel between the study of Braunhofer et al., (2011) and our study seems to be that media content (may it be music or an advertisement) is evaluated more positively when it is consumed within the actual context. Alternatively, the consistent differences we found could also have originated from the way these video scenarios in our particular instance have been produced (see limitations & future work) instead of an inherent difference between VEs and VSs.

LIMITATIONS & FUTURE WORK

Although our results are in line with our expectations, they remain tentative due to certain limitations. Conducting the experiments within a VE enhanced internal validity by means of high control and manipulability; we were able to customize the shelves and filter out confounding factors that can be found in the real world and can influence the perceived intrusiveness of the ad. This obviously has little to do with the use of VEs but more with the inherent properties of an experimental setup that investigates a specific causal relationship. We can speculate about the possibility that the limitations of our setup and simulation affected the ecological validity. The

interaction with the VE, like the navigation style and manipulation of objects differed from physical reality. Furthermore, the relatively small product set in the virtual supermarket is also a noteworthy difference with a real world situation.

In addition, the setup could also affect the outcome as a consequence of reactivity. Even though participants got the chance to get used to the setup, there is the risk that they behaved differently because the setup still reminded them they were taking part in an experiment. Apart from the external validity we also see some room for improvement in terms of measurement. In our case we relied on questionnaires to gather our data. Even though the construct of intrusiveness is usually measured with self-report Likert scales, the delay between the stimulus and measurement could have affected the outcome. Since the use of the VE setup allows for elaborate measurements, direct measures like observations or psychophysiological measurements should be considered in the future.

There are also some important remarks to be made when it comes to our use of VSs. In our case we chose to film the footage inside the CAVE to keep as many aspects (shelves, products, lighting etc.) similar for the purpose of even comparison. However, one could speculate to what extent the use of real video images would have led to a more realistic looking scenario. Furthermore, it is also important to consider how the footage should be filmed. For instance, how much time should be spent on key moments in the video (e.g. receiving the ad, showing the shelves in the background) is important to consider as it determines the ability for people to take in information. It is also important to think about camera perspective. Even though a first person perspective allows for more presence (the feeling of being in the mediated environment; Slater, Spanlang, Sanchez-Vives & Blanke, 2010) it provides less oversight than with a third person perspective. As mentioned earlier, these choices can affect the evaluation.

To further substantiate our claims with regard to the possible lack of contextual awareness in VS, we suggest that future studies control for contextual awareness, e.g. by asking questions about details in the environment. We believe that a major added value of a setup such as the VE-setup we present in this paper, is in simulating scenarios which are currently extremely difficult to conduct in the field. For example, precise indoor location position is currently feasible, nevertheless at present there is no universal standard, such as GPS for outdoor positioning, to facilitate indoor, location-based advertisements. But one can also think of numerous future scenarios to be conducted in such a setup.

CHAPTER 4 | INVESTIGATING THE EFFECTS OF LOCATION-BASED ADVERTISING IN THE SUPERMARKET: DOES GOAL RELEVANCE TRUMP LOCATION CONGRUENCE?

INTRODUCTION

For a number of years, advertisers have been able to tailor online ads to consumers' location, most commonly using IP addresses or WiFi location. Recently, however, the increasing availability of location tracking technologies, such as GPS-enabled mobile phones, has enabled companies to shift from 'standard geo-targeting', most commonly utilized in desktop or traditional marketing, to 'geo-precise targeting', used in mobile marketing (xAD 2012, April 1). These efforts use more specific longitude and latitude data to tailor messages to the consumer's exact location (Banerjee and Dholakia 2012). Such 'Location-Based Advertising' (LBA) has been conceptualized as marketer-controlled information customized to the exact location where users access advertising media (Bruner and Kumar 2007; Unni and Harmon 2007). Recently, a number of professional publications have argued that LBA is one of the big promises of mobile advertising. It has been reported that LBA can increase click-through rates of mobile advertising by a factor of 2.5 (1.0% versus 0.4%) (Tode 2013, Feb 6). Moreover, a report by *VerveMobile* (2014) stated that recipients of LBA were 2.7 times more likely to visit the advertised store than people who did not receive LBA. An article in *Mobile Marketer* (Tode 2013, Feb 1) quotes Howie Schwartz, CEO of *Human Demand*, as saying "[LBA] is something that desktops can't do – it can't do location at that level." And "[It] is probably the biggest thing that is going to push mobile advertising this year." No wonder, then, that companies offering LBA-related products and services have seen big rises in advertisers' demand (Tode 2013, Feb 1; xAD 2012, April 1). A next possible step is a shift to hyper-local 'indoor' LBA, which can target consumers inside malls or even on specific spots inside stores, using Bluetooth-based applications like Apple's iBeacon (Tode 2013, Nov 20).

In spite of the general enthusiasm among advertising and marketing professionals, only a few scientific studies have investigated whether LBA can be an effective tool to influence consumers' attitudes and behaviors (Banerjee and Dholakia 2012). Given this paucity of data on LBA's effectiveness, the present study sets out to investigate whether ads that are tailored to consumers' location are indeed more effective than ads that are not.

Besides from learning how effective LBA is, it is pivotal to know under which circumstances LBA is effective. One professional publication has suggested that advertisers need to get both context and relevance right in order for mobile advertising to work (Johnson 2013, Feb 22). That is, it is not enough to send consumers messages about products that are available nearby; rather, it is imperative that these products are relevant to consumers at the same time. Although this seems very plausible, there is no scientific research to support this claim. In the present study, we

therefore set out to investigate the effects of LBA under conditions of high and low relevance. Our study is the first study to investigate the combined influence of location-based messages and relevance. It employed a virtual reality setting to create a simulation of a real-life shopping experience. This allowed us to achieve relatively high ecological validity and also gave us the opportunity to assess purchase behavior. Our study thus constitutes a considerable step forward in the field of LBA research, where most studies rely on scenario-study methodology (e.g., Banerjee and Dholakia 2012; Unni and Harmon 2007; Xu Oh and Teo 2009).

Location-Congruent Advertising and Goal relevance

It has been proposed that the impact of traditional advertising is declining because consumers navigate their media-environment more actively than in the past. Rather than passive recipients of, for instance, television content, consumers use media to fulfill their goals (LaRose Mastro and Eastin 2001). These can consist of being entertained or searching for specific information, among other things (Cho and Cheon 2012). The important thing here, however, is that advertising often impedes the fulfillment of these goals, for instance when consumers are distracted from their entertainment or when pop-up advertising impedes on consumers' search for information. In some cases, consumers may adjust their goals to include advertising. In most cases, however, the result will be advertising avoidance (Cho and Cheon 2004; Kim and Sundar 2010; Li, Edwards and Lee 2002). A solution for this is to deliver advertising content which is highly relevant to consumers' salient goals, i.e. high goal relevance. When advertisers succeed in doing so, ads are more likely to be noticed, appreciated and have a greater chance of being effective (Edwards Li and Lee 2002; Van Doorn and Hoekstra 2013; Wehmeyer 2007; D. J. J. Xu 2006).

The relevance of the advertised product in the eyes of the consumer has been an important issue in the advertising literature for a long time. In the Elaboration Likelihood Model (ELM; Cacioppo and Petty 1984), for instance, it is acknowledged that different kinds of appeals can be effective for different audiences. For example, an early study by Petty and Cacioppo (1983) showed that consumers exposed to an ad paid more attention to the ad when it concerned a product that was available in their neighbourhood (high relevance) than when it concerned a product that was not (low relevance).

To increase perceived relevance, Cho and Cheon (2012) have suggested that advertisers deliver ‘highly targeted, customized, and context-congruent advertising messages’ (p.94), as this increases the likelihood that ads actually help consumers to

fulfil their goal, rather than stand in the way. Such targeted messages can be created through consumer profiling, systematic behavioral tracking or other types of 'e-customization' (Ansari and Mela 2003).

It is often assumed that LBA increases perceived relevance by enabling advertisers to advertise for products that are physically nearby, thus creating the chance to use the information in the ad immediately. For instance, one professional publication (Tode, 2013, Feb 6) states that adding location information in mobile advertising "brings real value to users by helping them find products and services where and when they want them." Scientific publications likewise assume that LBA can be effective due to the possibility to 'offer the most customer-focused local advertising' to consumers (Lee 2010, page 709; see also Kuo et al., 2009). The assumption seems to be that location congruence automatically triggers perceptions of relevance. However, there is no empirical research on this. This is problematic because, as Gidofalvi et al. (2008) have pointed out, location congruence and relevance are distinct constructs. After all, it is unlikely that knowing where a consumer is will always be sufficient to know what the consumer is up to. In the present paper, we therefore make a distinction between location congruence and relevance. According to Gidofalvi et al. (2008), LBA should not only be tailored to consumers' location, but also to their interests, in order to create involving advertising content (Li et al. 2002). Adopting this reasoning, we expected that goal relevance is not the inevitable result of location congruence but rather an important additional predictor of advertising effectiveness. More specifically, we expected that goal relevance and location congruence interact to produce effects on advertising effectiveness, as content needs to be both goal-relevant and location-congruent to be most effective. The present study is the first study to investigate this.

Previous Research on LBA

As mentioned above, there is very little scientific evidence for the effectiveness of LBA. As of July 8 2014, a search on Web of Science using the search string ((location-based OR "location based") AND (advertising OR marketing OR promotion)) yielded 127 results. A similar search using the search string ("geo-targeting" OR "geo targeting") found no results. The majority of the 127 results dealt with programming or engineering issues and only a limited number dealt with consumer reactions to LBA. As can be seen in Table 1, which shows 19 studies that investigated consumer reactions towards LBA, most studies have focused on consumer acceptance of the technology, usually operationalized as a general willingness to receive location-based messages.

Among other things, these studies have shown that credibility, entertainment, interactivity (Lin Huang Chang and Jheng 2013), perceived relevance (H. H. Lee and Hill, 2013) and opportunities for social interaction (Roback and Wakefield, 2013) have a positive effect on consumers' acceptance of LBA. Also, consumer acceptance has been found to be influenced by age, education level (Chong, 2013) and personality traits (Junglas Johnson and Spitzmuller 2008). There is a dearth of research, however, on consumer impact.

Table 1. Previous research on consumer reactions to LBA

Source	Focus of the Study	Design
Banerjee and Dholakia 2012	Consumer impact	Experimental study
Chen and Chang 2013	Consumer acceptance	Survey
Chong 2013	Consumer acceptance	Survey
Dhar and Varshney 2011	Conceptualization and description of LBA	Literature review
Fang et al. 2013	Consumer impact	Analysis of company archival data
Gallego, Woerndl, and Huecas 2013	Consumer acceptance	Survey
Gidofalvi et al. 2008	Capacity of the LBA channel	Simulation study
Hühn et al. 2012	Consumer impact	Experimental study
Junglas, Johnson, and Spitzmuller 2008	Consumer acceptance	Survey
Lee and Hill 2013	Consumer acceptance	Survey
Lee, Yeung, and Yu 2012	Consumer impact	Interviews with consumers
Lin et al. 2013	Consumer acceptance	Survey
Okazaki and Barwise 2011	Consumer acceptance	Literature review
Richard and Meuli 2013	Consumer acceptance	Survey
Roback and Wakefield 2013	Consumer acceptance	Survey

Tussyadiah 2012	Consumer impact	Focus group study
Unni and Harmon 2007	Consumer impact	Experimental study
Xu, Oh, and Teo 2009	Consumer impact	Experimental study
Zhou 2013	Consumer acceptance	Survey

Two studies aimed to gauge the effectiveness of LBA using qualitative methods (Lee Yeung and Yu 2012; Tussyadiah 2012). Tussyadiah (2012), for instance, had consumers discuss their possible reactions to LBA in focus group interviews. Her conclusions were that the effects of LBA are dependent on relevance and connectivity. While such an approach is certainly worthwhile and allows for a broad exploration of consumer experience, one can argue that it does not provide a sufficiently ecologically valid research context to derive accurate predictions of consumers' reactions to LBA. Talking about hypothetical location-congruent messages, after all, is vastly different from receiving LBA in real life (Hühn et al. 2012).

Xu and colleagues (2009) employed an experimental design to investigate the relative effectiveness of text versus multimedia messages in LBA. They hypothesized that multimedia messages would be perceived as more engaging and informative than text messages as they can provide more vivid information about the product. At the same time, Xu et al. note that multimedia messages impose a higher cognitive load on recipients and may therefore lead to more irritation. The results of their study yielded support for both hypotheses. Banerjee and Dholakia (2012) investigated the effects of location-congruent ads for men versus women, in private versus public places, and in work versus leisure contexts. Unni and Harmon (2007) investigated the effects of pull versus push messages and of message content (brand advertising versus promotional). None of these studies, however, employed a no-LBA control group and could therefore make a reliable prediction as to the effect of location-congruent versus location-incongruent advertising. Moreover, all three studies used a verbal scenario procedure, asking consumers to imagine receiving a location-congruent ad. As with the qualitative studies mentioned above, one can wonder whether such a procedure results in a reliable prediction of what consumers would do if they actually received a location-congruent ad in real life.

It has been noted that advertising researchers have struggled with the evaluation of interactive and context-sensitive applications like LBA because of their lack of means to create an ecologically valid research setting (Hühn et al. 2012). In the field of

human-computer interaction (HCI), however, this has been a familiar challenge for some time, giving rise to a new line of research where lab studies have been extended with virtual environments (Hühn et al. 2012). This offers participants a dynamic and interactive context during their experience while researchers retain a controllable and malleable experimental setting (Leichtenstern André and Rehm 2010).

In an attempt to investigate the effects of LBA, Hühn and colleagues (2012) employed research tools derived from the field of HCI. They conducted an experiment in a lab setting, using a simulated shopping location created by means of virtual reality. This virtual environment created the interactivity that is necessary for a relatively ecologically valid consumer experience. Participants entered a 'virtual supermarket' with the task to select five product of their own choice. They were provided with a smartphone with a preinstalled shopping application which enabled them to receive either location-congruent or location-incongruent ads. Their results suggest that location-congruent ads are perceived as less intrusive than location-incongruent ads, and that this lower perceived intrusiveness leads to more positive attitudes towards the ad. However, although the location-congruent ads were more relevant to participants in terms of proximity to the advertised product, it is unclear how relevant the product was to participants' goals and interests in this study. In addition, as intention to purchase the product and actual buying behavior were not assessed, it is hard to say if LBA will indeed lead to increased sales on the basis of this study.

Quite a different approach was used by Fang and colleagues (2013), who provided a quantitative estimate of LBA's effectiveness using company archival data. This study used data on daily movie ticket sales via mobile phone applications and found that consumers' chances of ordering tickets spiked significantly after receiving location-congruent messages, both immediately and cumulatively over the next 9 days. However, the role of goal relevance remained underexplored in this study. The data showed an effect on the purchase behavior of subscribers to the mobile movie-ticket service and it can be assumed that the offer was relevant to all or most of them. The study therefore does not provide us with an estimate of the effects of LBA under conditions of low relevance, nor does it quantify the effect of relevance on the effectiveness of LBA. More generally, while Fang and colleagues' study is the first one to investigate actual buying behavior as a result of LBA, studies of company archival data cannot be expected to offer the experimental control necessary to investigate moderators of LBA impact.

In all, we can conclude that only two previous studies investigated the effects of LBA in an ecologically valid context. One study used virtual reality to simulate a real-life shopping experience (Hühn et al. 2012), while the other one investigated real-life

purchase decisions which were gleaned from company archival data (Fang et al. 2013). No study investigated the combination of location congruence and relevance. The present study aimed to fill this gap in the literature.

As in Hühn et al.'s (2012) study, we used a virtual simulation of a real-world shopping experience. In this virtual research environment, we manipulated both location congruence and goal relevance and assessed effects on persuasion. We assessed purchase behavior, perceived ad intrusiveness, and ad attitude as our outcome measures. As noted above, purchase behavior is rarely assessed in LBA studies, even though it is often regarded as the ultimate criterion of advertising's effectiveness (Schultz et al. 1993). However, in the present study, the simulation of a real-life shopping experience that we employed allowed us to observe participants' product choice and thus use purchase behavior as a persuasive outcome measure. Advertising intrusiveness, as Vespe (1997) has already noted, is a common complaint of consumers when advertising practices interrupt the fulfillment of their goals. Intrusiveness can be seen as a perception that occurs when consumers' cognitive processes are interrupted (Li et al., 2002). Intrusiveness can have negative consequences such as irritation and ad avoidance (Cho and Cheon, 2004) and is therefore a relevant outcome measure. Finally, attitude towards the ad was assessed as this variable is usually seen as an important outcome of advertising practices (MacKenzie et al. 1986).

Hypotheses

We expected ads that were high in goal relevance to be more persuasive than ads that were low in goal relevance (Edwards Li and Lee 2002; Van Doorn and Hoekstra 2013; Wehmeyer 2007; Xu 2006), hence resulting in increased purchase behavior. As the alignment of messages with consumer goal pursuit is the most important predictor of (low) perceived intrusiveness and an important predictor of ad attitude (Li et al. 2002), we also expected that highly goal relevant messages would result in decreased perceptions of intrusiveness and more positive ad attitudes as compared to messages low in goal relevance. Our first set of hypotheses therefore was:

Hypothesis 1a: Ads high in goal relevance will result in more purchase behavior than ads low in goal relevance.

Hypothesis 1b: Ads high in goal relevance will result in decreased perceptions of intrusiveness as compared with ads low in goal relevance.

Hypothesis 1c: Ads high in goal relevance will result in more positive ad attitudes as compared with ads low in goal relevance.

Our second set of hypotheses concerned the interaction between goal relevance and location congruence. As we have discussed above, location congruent messages will be more likely to be perceived as relevant for consumers than location incongruent messages, but only if consumers have an actual interest in the advertised product. In line with previous theorizing (Gidofalvi et al., 2008), we therefore expected that location-congruent advertising would be especially likely to be in line with consumers' goals, and hence more likely to result in increased purchase behavior, decreased perceptions of intrusiveness and more positive ad attitudes, under conditions of high goal relevance. Therefore, our second set of hypotheses was:

Hypothesis 2a: Location congruence will lead to higher levels of purchase behavior, but only under conditions of high goal relevance.

Hypothesis 2b: Location congruence will lead to lower levels of intrusiveness, but only under conditions of high goal relevance.

Hypothesis 2c: Location congruence will lead to higher levels of ad attitude, but only under conditions of high goal relevance.

METHOD

Design and Manipulations

In order to investigate the influence of both location congruence and goal relevance we employed a 2 (location congruent vs. location incongruent) x 2 (high goal relevance vs. low goal relevance) between-subjects design. All participants received a short grocery list with the instruction to purchase the listed products in a Virtual Supermarket (VSM). They were told to do their groceries in the VSM with the use of a mobile shopping app that was preinstalled on a HTC Legend smartphone. By taking a photograph of a product with the smartphone, participants could add the product to a virtual shopping basket in the mobile app. Participants were told that they should proceed to the check-out after having placed all products in the grocery list in their virtual shopping basket. During this virtual shopping experience, participants received one ad on their mobile device, which was used to create our experimental manipulations. In fact, the ad contained the same offer for all participants, i.e., a

discount offer for a specific brand of tomato soup. The virtual space contained a 'trigger area' in the form of a circle (not visible to participants) with a radius of 0.5 meter. Entering this trigger area immediately triggered the ad. Importantly, the ad was triggered on the same (virtual) location in the VSM for all participants. However, the VSM itself was manipulated such that for half of the participants, the shelf that was closest to the ad's trigger area contained the tomato soup in question, making the ad location-congruent. For the other half of the participants, the shelf contained instant meal mixes, and the packed tomato soup could only be purchased on another location, making the ad location-incongruent. To make sure that participants would relate the mobile ad to their immediate shopping environment, a banner was placed over the shelf which also contained a promotional offer for the shelved product. That is, the banner stated an offer for the packed tomato soup on the shelves in the location-congruent condition, but contained an offer for the shelved meal mixes in the location-incongruent condition (see Figure 1). One could argue that this introduces a confound to the design, as the conditions now differed in 1) the products that were shelved close to the ad's trigger area, and 2) the promotional banner that was placed over the shelves. However, the placement of the banner was deemed necessary because trial runs indicated that some participants, especially elderly participants, did not relate the mobile ad to their immediate surroundings. The banner thus functioned to increase awareness of the products shelved next to the trigger area.

a

b

Figure 1a. Location-incongruent shelf with the meal-mix ad b. Location-congruent shelf with the soup ad

We chose to manipulate the location of the advertised product rather than the location of the trigger area. The reason for this was the fact that varying the location of the trigger area would mean that participants would receive the ads in different locations, introducing the possibility that their reactions to the ad may be influenced by the myriad of factors that differ between the different locations (e.g., distance into the supermarket, progress with the shopping list, shelved products in the vicinity of the trigger area, etc.).

Goal relevance was manipulated by changing the products on the grocery list. In the high-relevance condition, the shopping list included soup, making the ad highly relevant, whereas in the low-relevance condition, the shopping list included soft drinks instead of soup, making the ad not relevant. As participants were asked to imagine that they were on a 'budget' of €10 to purchase these articles, they would have been likely to be motivated to consider price and therefore interested to receive ads for price-promotions. Participants were randomly assigned to the four resulting conditions using a computerized random number generator. Table 2 provides a schematic overview of the operationalizations. Another way to manipulate goal relevance is to offer participants different ads in the different conditions. Thus, participants could have received only one shopping list (e.g., all lists containing soup), but the product that was advertised in the ad could have been manipulated (e.g., soup ads in the high-relevance condition and soft drinks in the low-relevance condition). A downside of this, however, would be that the content of the ad (soup versus soft drinks) would differ systematically between the conditions. Thus, possible differences between the high- and low-relevance conditions may be ascribed to participants reacting differently to soup versus soft drinks due to personal preferences. For this reason, we chose to keep the ad constant and manipulate the VSM and the shopping list as manipulations of location and goal relevance.

Table 2. Schematic overview of operationalizations

	High Goal Relevance	Low Goal Relevance
Location congruent	Unox soup ad in front of soup shelf + shopping list with soup	Unox soup ad in front of soup shelf + shopping list with soft drinks (instead of soup)
Location incongruent	Unox Soup ad in front of meal mixes shelf + shopping list with soup	Unox Soup ad in front of meal mixes shelf + shopping list with soft drinks (instead of soup)

Participants

The study included a total of 139 participants, who were recruited through a market-research company. Of all participants, 65 (46.8%) were women, 60 participants (43.2%) had finished tertiary education, and the mean age was *M*(SD) = 38.9(15.0). The results of a χ^2 analysis showed that the four conditions did not differ significantly in terms of gender, $\chi^2(3) = 1.94$, $p = .59$, or education, $\chi^2(3) = 6.40$, $p = .09$. The results of a one-way ANOVA showed that the four conditions did not differ significantly in age, $F(3, 135) = 0.63$, $p = .60$.

Procedure

Upon arrival in the laboratory, participants were seated and given an explanation of the research procedure. Participants were explained how they could navigate the VSM by moving forward, backward and sideways (see below). They were warned of potential dizziness/nausea and were told that they should interrupt/stop the experiment at any time if they wished.

Participants were given an HTC Legend smartphone and were instructed to keep this phone in their hands during the entire experiment. They were told that they could operate the phone with their fingers, using the touch sensitive screen. Participants were notified that the log files of the virtual supermarket and the phone would be saved as part of the data collection, so that their route through the virtual

supermarket would be recorded, as well as the offers that they received and the products that they bought. In addition, they were told that a questionnaire would be administered after their experience in the virtual supermarket. All participants agreed with this and signed informed consent forms.

After these instructions, the participants were asked to complete a three-minute practice run in a nearly empty supermarket, with the aim of mastering navigation and use of the phone. This practice run entailed navigating a short route through the VSM, purchasing one product by making a photo of the product with the phone, and reporting at the (virtual) counter for the check out.

After the practice run, participants were asked whether they had any additional questions or concerns. If this was not the case, participants started their grocery shopping task. They were told to imagine that they were shopping for a friend, who needed ingredients for dinner, but could not do his own groceries because he had to take his brother to the hospital at the last minute. This was done to make sure that personal preferences did not interfere with the manipulation of goal relevance. They were told to imagine that their friend had given them a grocery list, which included fruit, instant meal mix, rice and soup in the high-relevance condition, and fruit, instant meal mix, rice and soft drink in the low-relevance condition. A scan of supermarket prices in the Netherlands' main supermarket chains revealed that these products could be purchased for anywhere between €7 and €10. However, prices were not revealed in the VSM, neither on the shelves nor through the smartphone, and it is reasonable to belief that the €10 budget served as a gentle nudge for participants to be open to price promotions. After their experience in the virtual VSM, participants were taken to another room, where they were seated and could fill in the questionnaire.

Virtual Supermarket

The VSM (modeled and rendered in Unity) was projected onto four rear-projection screens (each 3.6 meters wide and 2.6 meters high). The screens formed a closed space, called the CAVE, with a square floor surface of approximately 13 m^2, offering participants a 360° view of the environment. Participants were instructed to stand in the exact center of the floor surface, which was designated by a cross on the floor. Participants could move in the VSM with the help of a head-tracking system based on the Microsoft Kinect. This system determines the participant's head's position in the CAVE, which is then used to control motion in the VSM. When the participant stands in the center of the CAVE the virtual camera stands still, but when the participant takes one step forward, the projections on the screens change to give the participant the

impression of moving forward. As long as the participant remains standing one step from the center of the CAVE, he/she will keep 'moving'. The speed with which this happens is dependent on the distance between the participant and the middle of the CAVE: a larger distance (a bigger step forward) results in faster virtual movement. The participant is able to turn and step in every direction relative to the CAVE's center; he/she can move sideways and backward, and to the left and right, by taking a step to the side and to the back, and turning to face left/right. The simulation did not correct the first person view for the vertical axis, for instance correcting the perspective when participants ducked or jumped, as this was not deemed necessary for the experimental task at hand. In contrast to often-used head-mounted virtual displays, the VSM did not block out the physical world, offering us the opportunity to include physical objects, in particular the mobile smartphone, in the experimental procedure.

For the present study, a supermarket environment was created based on the corporate style and spatial arrangement in the supermarkets of the Netherland's largest supermarket chain (see Figure 1). All shelves were filled with products, although some products were stacked at multiple shelves and the inventory, relative to a real-world supermarket, was not complete. As in most Dutch supermarkets, participants first encountered the fruit and vegetable section. The trigger area of the mobile ad was placed at the end of this section. Right behind the trigger area, a shelf facing the entrance of the supermarket was used to display the advertised product in the location-congruent condition and the non-advertised instant meal mixes in the location-incongruent condition.

An Android application was developed, which connected the phone with the CAVE through Wifi. The moment that the participants entered the trigger area of the virtual supermarket, this application would play a notification sound, vibrate and present the ad to participants. The application could also be used to purchase products (see above). Participants were instructed to access this list and delete photographs if they had made a mistake or if they had changed their mind about purchasing a product. By deleting the photograph, the product was removed from the virtual shopping basket.

Questionnaire

Manipulation checks

We used two self-constructed instruments to assess perceived goal relevance and perceived location congruence as manipulation checks. Three items assessed goal relevance by asking participants to indicate their agreement with the statements 'The mobile ad fitted my goals well', 'The mobile ad was not relevant to my task' and 'The

mobile ad fitted what I was doing' each on a 7-point scale (1 = *strongly disagree*; 7 = *strongly agree*). We reversed the second item to create an average goal relevance scale (α = .89; M = 4.31; SD = 1.96). One item assessed perceived location congruence by asking participants to indicate their agreement with the statement 'The mobile ad was suitable to my specific location' (M = 4.50; SD = 1.69).

Perceived ad intrusiveness was measured using 7 items from previous research by Li et al. (2002). For instance, one item asked participants to indicate the extent to which they found the mobile ad distracting (1 = *strongly disagree*; 7 = *strongly agree*; α = .87; M = 3.07; SD = 1.18).

Ad attitude was assessed with a self-constructed scale of 12 items using a 7-point scale. These items asked participants to indicate the extent to which they found the ad important, meaningful, useful, valuable, believable, negative, fun, bad, no fun, unbelievable, good and positive (1 = *strongly disagree*; 7 = *strongly agree*). A factor analysis revealed the existence of two factors, with all factors loading on the first factor, which accounted for 36.2% of variance, except for the items negative, bad, no fun and unbelievable, which loaded on the second factor, accounting for 33.5% of variance. Based on these results, we dropped these four items from the scale. The resulting scale had a high internal consistency (α = .91; M = 4.31; SD = 1.19).

Purchase behavior

As detailed above, participants could add products to their virtual shopping basket by making a photo of the desired products with the phone. After adding all desired products to the shopping basket, participants could report at the (virtual) counter for the check out. Participants were instructed to access the shopping basket and delete photographs if they had made a mistake or if they had changed their mind about purchasing a product. By deleting the photograph, the product was removed from the shopping basket. After participants completed the questionnaire, the virtual shopping basket was inspected by the experimenters to record whether the advertised product was purchased or not.

Analyses

We investigated the effects of location congruence (LC), goal relevance (GR), and the interaction between LC and GR on our manipulation checks perceived location congruence and perceived goal relevance with ANOVAs. As purchase behavior constituted a dichotomous variable, and ANOVAs require dependent variables on an

interval or ratio scale, we used χ^2analyses to investigate the effects of LC and GR on purchase behavior. Effects on intrusiveness and ad attitude were investigated in a series of ANOVAs.

RESULTS

Manipulation Checks

We first investigated whether Location Congruence (LC), Goal Relevance (GR) and the interaction between LC and GR had significant effects on our manipulation checks: perceived location congruence and perceived goal relevance. In the ANOVA, GR had a significant effect on perceived goal relevance, $F(1, 128) = 178.91$, $p < .000$, $\eta_p^2 = .58$, while LC did not, $F(1, 128) = 0.93$, $p = .34$, $\eta_p^2 = .01$. An investigation of the means revealed that participants in the high-relevance condition perceived the ad as more relevant (M = 5.82) than participants in the low-relevance condition (M = 2.85). The interaction between LC and GR did not have a significant effect on perceived goal relevance, $F(1, 128) = 3.07$, $p = .08$, $\eta_p^2 = .02$. With regards to perceived location congruence, the results of the ANOVA showed that LC had a significant effect on perceived location congruence, $F(1, 125) = 5.50$, $p = .02$, $\eta_p^2 = .04$, with participants in the location-congruent condition perceiving the ad as more location-congruent (M = 4.85) than participants in the location-incongruent condition (M = 4.16). There was no significant effect of GR, $F(1, 125) = 0.75$, $p = .39$, $\eta_p^2 = .01$. The interaction between LC and GR did not have a significant effect on perceived location congruence, $F(1, 125) = 0.69$, $p = .41$, $\eta_p^2 = .01$.

Persuasive Outcome Measures

With regards to purchase behavior, Table 3 shows that only one participant in the low-relevance condition bought the advertised product. There was no significant main effect of LC, $\chi^2(1) = 1.56$, $p = .21$. There was an effect of GR, however, as the majority of participants (79.7%) in the high-relevance condition bought the advertised product, and only a very small minority in the low-relevance condition (1.4%), $\chi^2(1) = 88.52$, $p < .001$. This supports Hypothesis 1a. In addition, within the high-relevance condition, the likelihood of purchasing the product was greater for the location-congruent participants (90.9%) than for the location-incongruent participants (69.4%), $\chi^2(1) =$

4.91, p = .03. There was no significant effect of LC in the low-relevance condition, $\chi^2(1)$ = 1.01, p = .31. Hypothesis 2a was thus supported.

Table 3. Proportions of buyers and non-buyers in the four conditions

	High Goal Relevance		Low Goal Relevance	
Behavior	Location Congruent	Location Incongruent	Location Congruent	Location Incongruent
Did buy the advertised product	30	25	1	0
Did not buy the advertised product	3	11	34	35

With regards to intrusiveness, our results revealed that there was no main effect of LC, $F(1, 124) = 0.93$, p = .34, η_p^2 = .01. However, participants in the high goal relevance condition perceived the ad as less intrusive than participants in the low goal relevance condition ($M_{High\text{-}relevance}$ = 2.76; $M_{Low\text{-}relevance}$ = 3.38; $F(1, 124) = 9.29$, $p < .01$, η_p^2 = .07, supporting Hypothesis 1b. There was no significant interaction between LC and GR on I, $F(1, 124) = 0.52$, p = .47, η_p^2 = .004, leading us to reject Hypothesis 2b.

For ad attitude, significant main effects of both LC, $F(1, 126) = 4.44$, p = .04, η_p^2 = .03, and GR, $F(1, 126) = 36.46$, $p < .001$, η_p^2 = .22, were found. However, inspection of the means revealed that the significant effect of LC was in the opposite direction from what could have been expected: attitudes towards the ad were more negative in the location-congruent condition (M = 4.12) than in the location-incongruent condition (M = 4.51). For GR, inspection of the means showed more positive attitudes in the high-relevance (M = 4.86) than in the low-relevance condition (M = 3.79), supporting Hypothesis 1c. These main effects were qualified by a significant interaction between LC and GR on I, $F(1, 126) = 10.44$, $p < .01$, η_p^2 = .08. Further inspection of this interaction effect revealed that, contrary to our expectations, there was no effect of LC in the high-relevance condition ($M_{Location\text{-}congruent}$= 4.96; $M_{Location\text{-}incongruent}$ = 4.76; p = .46). Instead, in the low-relevance condition, participants had more negative attitudes towards the ad when it had been location-congruent than when it had been location-incongruent ($M_{Location\text{-}congruent}$ = 3.32; $M_{Location\text{-}incongruent}$ = 4.27; $p < .001$) (see Table 4 and figure 2). Thus, although the interaction was significant, the simple effects showed a different pattern than was expected. Hypothesis 2c was rejected.

Table 4. Means, SDs in the four conditions for intrusiveness and ad attitude, and F-values for the differences

	High Goal Relevance				Low Goal Relevance						
	Location Congruent		Location Incongruent		Location Congruent		Location Incongruent		ANOVA Results		
	M	SD	M	SD	M	SD	M	SD	LC	GC	LC x GC
Intrusive	2.79	1.18	2.73	1.05	3.55	1.22	3.21	1.12	0.95	9.33*	0.52
Aad	4.96	1.02	4.76	1.10	3.32	0.79	4.27	1.11	4.54*	34.51*	10.44*

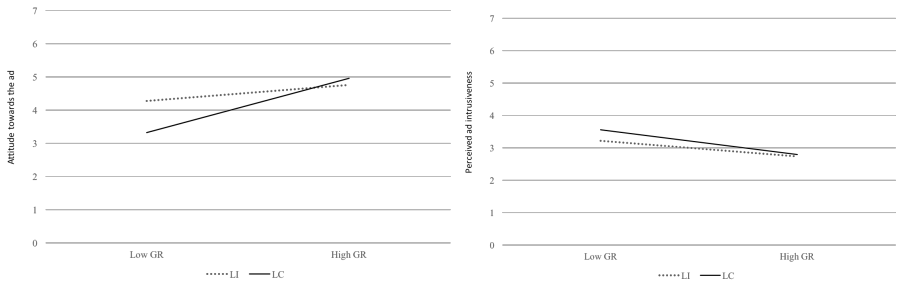

Figure 2a.(left) Interaction goal congruence X location congruence on attitude towards the ad
Figure 2b. (right) Interaction goal congruence x location congruence on perceived ad intrusiveness

DISCUSSION

The present study investigated the combined influence of goal relevance and location congruence on purchase behavior, perceived intrusiveness and ad attitude. We hypothesized that goal relevance would predict purchase behavior, ad intrusiveness, and ad attitude (Hypotheses 1a, 1b, and 1c). These expectations were borne out, as purchase behavior was higher, ad intrusiveness was lower, and ad attitude was more positive in the high-relevance condition as compared to the low-relevance condition. In addition, we expected that location congruence would result in increased purchase behavior, lower levels of ad intrusiveness, and more positive ad attitudes, but only for consumers for whom the ad was highly goal relevant. This expectation was borne out for purchase behavior, supporting Hypothesis 2a: the location-congruent ad resulted in more purchases than the location-incongruent ad, but only when the advertised product was highly relevant for participants because they had the goal to purchase it.

For ad intrusiveness and ad attitude, this effect was not found, however. In fact, the results for ad attitude revealed quite a different pattern. Contrary to Hypothesis 2c, location congruence resulted in more negative ad attitudes when the advertised product was of low relevance to participants. Perhaps the explanation for this result lies in the disruption to consumers' activities that results from the message. The combination of an irrelevant mobile message and a shelf filled with the undesired advertised product may be more disruptive to consumers' activities than the mobile message alone. That is, a mobile message alone may be easier to discard or ignore than a message that is combined with information in the real world. If that is the case, location congruence could be a double-edged sword and advertisers should consider the advertised products' relevance very carefully before employing LBA. However, we did not find evidence that location-congruent messages were particularly likely to result in perceived intrusiveness under conditions of low relevance, something that we would expect if the disruption hypothesis were true. More research is needed to investigate whether location-congruent messages can backfire when the advertising content is perceived as irrelevant.

Another explanation of the unexpected interaction between goal relevance and location congruence arises from our use of a banner to direct participants' attention to the advertised product in the location-congruent condition. The combination of a banner and a mobile ad, while perhaps not especially noteworthy in the high-relevance condition, may have been perceived as useless in the low-relevance condition, resulting in more negative attitudes. Or the mobile ad may have been considered to add little information to the banner. If that is the case, advertisers should perhaps not be too afraid that location-congruent messages backfire, although they should still take care not to overexpose consumers with irrelevant information.

Besides from the negative effect of location congruence on ad attitude in the low-relevance condition, it is also noteworthy that location congruence did not result in more positive ad attitudes for participants in the high-relevance condition. This is in contrast with a previous study that found location-congruent advertising to result in more positive consumer reactions (Hühn et al. 2012). However, a crucial difference between the present study and that previous study is the fact that in the previous study, participants were not given a shopping list, and had no opportunity to make (virtual) purchases. Instead, participants roamed their virtual shopping environment freely, during which they received a mobile ad, after which attitudes towards the ad and mobile application were assessed. Thus, participants may not have been likely to evaluate the ad on the dimension of goal relevance, as both ads did not have direct bearing on their activities. Instead, they may have solely evaluated the ad and

application based on location congruence. In the present study, however, the ad may have been predominantly judged on goal relevance rather than location congruence. In other words, with the shopping list on their minds, participants may have used goal relevance as the main consideration to determine the value of the ad in both the location-congruent and –incongruent conditions. Consistent with this, goal relevance was found to significantly affect purchase behavior and ad attitude, but there were no main effects of location congruence. To investigate the role of consumer goals further, future studies could randomize participants over three conditions: high-relevance, low-relevance and free shopping. This could also have the practical benefit of determining whether different LBA messages are needed for shopping-list shopping versus leisurely browsing.

In all, the present study provides insights into the effects of location-congruent advertising for high- and low-relevance consumers. Below, we will expand on the theoretical and managerial implications of our results.

Theoretical implications

On a theoretical level our results draw attention to the distinction between location congruence and relevance. It is sometimes suggested that location-congruence will be highly relevant to consumers, because the advertised product is available nearby (Kuo et al. 2009; Lee 2010). Our results cast doubt on that, as there were no positive effects of LBA in the low-relevance condition. In addition, location congruence did not result in increased levels of perceived relevance as assessed for our goal-relevance manipulation check. It seems the LBA literature would benefit from a more fine-grained model of relevance in advertising. One model that could be used to formulate hypotheses about LBA-related processes is the Relevance-Accessibility Model (RAM; Baker and Lutz 2000). The RAM predicts that an advertising message is most likely to influence purchase behavior when it is both relevant and accessible at a time when purchase is possible. This reasoning suggests that the LBA literature could benefit from focusing on accessibility rather than on relevance as the major advantage of LBA: by conveying messages at a location where the consumer might buy the product, rather than at a location where there is no opportunity to buy the product, LBA can dramatically increase the accessibility of the message in consumers' minds at the time of the purchase. It is unclear, however, whether LBA can increase relevance, as this is predominantly dependent on consumers' interests and goals. Perhaps the RAM, or other theoretical models on the relevance of advertising, can be used to disentangle

the roles of relevance and accessibility in LBA, as well as guide future research into the factors that make an advertising message effective.

Managerial implications

The positive effect of LBA on purchase behavior in the high-relevance condition is in line with previous research reporting significant effects for LBA (Fang et al. 2013; Hühn et al. 2012). It suggests that, under the right circumstances, LBA 'brings real value to users by helping them find products and services where and when they want them' (Tode 2013, Feb 6). But in addition to studies reporting a positive general effect of LBA, the present results suggest that it is only profitable for advertisers to send 'local' messages when they can personalize these messages to increase relevance. In advertising practice, this could be done by using data on demographics or purchase history to tailor product offers to consumers' needs (Johnson 2013, Feb 22; Tode 2013, Feb 6). Alternatively, companies could give consumers the opportunity to customize their own product (Miceli Raimondo and Farace 2013) or to coproduce some aspect of the communication process (Bacile Ye and Swilley 2014). A report from *Mobile Marketer* stated that 24% of location-based campaigns already used a combination of 'third party data' and 'place-based targeting' (Tode 2013, Feb 6). Perhaps this practice explains the large effects sometimes claimed in professional publications with regards to the effectiveness of LBA (Tode 2013, Feb 6). At any rate, the present results support the notion that LBA needs to be combined with highly relevant advertising content (Johnson 2013, Feb 22).

This conclusion is underlined by findings from another recent study, which showed that highly involved consumers reported more positive attitudes towards LBA than low-involvement consumers (Lee, Kim, and Sundar, 2015). As the present study, that study also showed involvement (i.e., goal relevance) to be the strongest predictor of ad attitudes, far stronger than location congruence. As such, it seems that personal relevance trumps goal congruence. Thus, a second recommendation for advertisers is that, given the choice between tailoring to consumers' goals and tailoring to consumers' location, advertisers should surely focus on consumers' goals first.

This may also be true for other forms of LBA. There are gradations within geo-targeting, with the fairly common LBA based on cell tower or WiFi-location on one end of the extreme, and the fine-grained use of consumers' exact location, for instance with the help of Bluetooth, on the other end. The location-congruent messages that we used in the present study are most similar to the latter, fine-grained, type of LBA. LBA based on cell tower or WiFi location is more common, however, partially because

its broader scope offers the opportunity to reach more consumers (Tode 2013, Feb 1). Future studies should investigate the role of relevance and location congruence for less precise types of LBA. For now, the results of the present study suggest that location-based messages need to be highly relevant for consumers in order to be effective.

Strengths and limitations

A number of strengths and limitations of the present study should be noted. A notable strength is our use of the virtual supermarket. The virtual supermarket provided participants with a realistic shopping experience, while providing us with the experimental control to manipulate the location of the products.

One notable limitation is the use of participants' shopping list as a manipulation of goal relevance. This manipulation was part of a scenario in which participants were asked to do groceries for a friend, which may have limited participants' involvement in the procedure. Asking participants to use the virtual supermarket to do their own groceries, for instance by using their virtual purchases as actual orders in an online delivery service, could be the next step in creating an even more realistic shopping experience. Ultimately, however, field experiments are necessary, not only to study LBA in a real shopping context, but also to test the overall acceptability of the designed mobile service (Sun and May 2013). Another limitation of the shopping list procedure may have been that it was 'too effective' as a manipulation of goal relevance, in the sense that it left participants at the two extremes of the goal relevance continuum. That is, whereas in real life products can be slightly less or slightly more desirable than other products because of factors like brand, packaging, perceived quality, etcetera, the advertised products in our experiment were not desirable at all (because they weren't on respondents' shopping list), or highly desirable (because they were). Thus, one could argue that our experiment does not reveal the effects of goal relevance at moderate levels of goal relevance. Future studies could employ more subtle manipulations of goal relevance, or could try to measure goal relevance on a scale that allows for more subtle differences. As the first study to investigate the combination of goal relevance and location congruence, however, the present results are nevertheless informative.

CONCLUSIONS

The results of the present study draw attention to the distinction between location congruence and personal relevance. Whereas it is sometimes suggested that location-congruence will always increase relevance, our results suggest that these two concepts have distinct effects. Future research should attempt to disentangle the effects of location congruence and personal relevance further. As for recommendations for practice, the present results suggest that LBA can be of great value to advertisers, provided they succeed in creating content that is relevant to consumers. If there is a choice between creating personally relevant ads on the one hand or employing location-based ads, advertisers should surely focus on personal relevance, as it seems to have a stronger effect on relevant outcome measures than location congruence. In addition, location congruence may result in negative perceptions when the advertising content is irrelevant, although this latter effect should be investigated further in future research. The results underline the pivotal role of goal relevance, as this factor not only moderated the effect of location congruence on behavior, but also had strong main effects on behavior and perceptions of the ad.

CHAPTER 5 | DISENTANGLING LOCATION BASED ADVERTISING: THE EFFECTS OF LOCATION-CONGRUENCY AND MEDIUM TYPE ON CONSUMERS' AD ATTENTION AND BRAND CHOICE

INTRODUCTION

Imagine that you are doing your daily shopping in your local supermarket, and your smartphone starts vibrating at the moment you pass the shelf with different brands of soup which are comparably attractive to you. Taking a closer look at your phone, you notice that you have received an ad for a brand of tomato soup that is on the shelf in front of you. Tomato soup happens to be on your shopping list, and you decide to buy the advertised brand, persuaded by the ad you received on your mobile phone. But would your choice have been the same if the ad had been presented on an in-store display (i.e., point-of-sales advertising) above the shelf you were looking at, rather than on your personal mobile device? And would you still have chosen the advertised brand if you had not received the ad on your mobile phone in the soup aisle, but in a different location in the supermarket? In other words, can the potential effectiveness of a location-based advertisement be attributed to medium type, location-congruency, or both? In the present paper we aim to disentangle these two constructs, which are thought to underlie the effectiveness of location-based advertising. Specifically, we will test the different effects of medium type and location-congruency on consumers' ad attention and brand choice, as well as the interaction between these two constructs.

It is commonly believed that the increased functionality offered by smartphones provides significant potential for the development of mobile marketing and retailing (Holmes, Byrne, & Rowley, 2014). In 2013, global investment in mobile advertising was approximately $16.7 billion, and it is expected to exceed $62.8 billion by 2017 (Yakov, Stephen, & Sarvary, 2014). The example above illustrates an upcoming mobile marketing technique, location-based advertising (LBA). LBA can be conceptualized as marketer-controlled information tailored to the location where consumers encounter their products (Brunner & Kumar, 2007; Unni and Harmon 2007). Advertisers use location-tracking technology (e.g., GPS, Bluetooth, and Wifi) to send these context-congruent ads to the consumer's mobile communication device. LBA is believed to offer retailers great benefits because consumers can be reached with sales promotions that are customized to their specific location (Cai, 2014). Receiving tailored, personalized advertisements on their smartphones may lure consumers into a store they are passing, or may persuade them to consider an advertised product when they are already in a store.

Even though research on LBA is still limited, a few studies have been conducted. Unni and Harmon (2007) studied the impact of message content and push/pull messages on perceived privacy concerns about location tracking, perceived benefits, value, and intentions. Banerjee and Dholakia (2008) studied advertisements received

within different contexts (private vs. public, leisure vs. work) and the differences between male and female consumers in their perceptions of usefulness of the ad, store evaluations, and willingness to respond to the offer. Xu, Oh, and Teo (2009) investigated the effects of LBA multimedia advertisements versus LBA text-based advertisements on attitude, intention to use the LBA application, and purchase intention. Finally, Hühn et al. (2012) focused on the location-congruent aspect of LBA by comparing the perceived ad intrusiveness of location-congruent and location-incongruent ads.

Nonetheless, these previous studies have not taken into account that LBA consists of two underlying constructs that could be responsible for its effectiveness: mobile (vs. point-of-sales) advertising and location-congruency (vs. location incongruency). Theoretically, we do not know whether the medium (smartphone) or location-congruency accounts for the effects on consumer responses that have been found in previous LBA research. Traditional media, such as stationary displays, can also offer location-based sales promotions. In the past research, however, the effectiveness of in-store location-based mobile advertising has never been compared with the effectiveness of point-of-sales in-store advertising (e.g., Cai, 2014; Hühn et al., 2012). It might be the case that mobile ads are superior to stationary ads in drawing consumers' attention.

Therefore, the present study aims to disentangle the two constructs that are thought to underlie the effects of LBA. Specifically, we will determine to what extent *location-based mobile advertising* (LBMA) has an added value in in-store retail settings compared to *location-based point-of-sales advertising* (LBPA), when it comes to consumers' ad attention and brand choice. Additionally, we compare the efficacy of mobile vs. stationary advertising in location-incongruent settings. From now on, we will distinguish between LBMA and LBPA, as distinct aspects of the general concept LBA.

The present study does not only contribute to the existing LBA knowledge from a theoretical, but also from a methodological perspective. Previous effect studies on LBA have predominantly used verbal scenarios to investigate the effects of LBA (e.g., Banerjee & Dholakia, 2008, 2012; Unni & Harmon 2007; Xu, Oh, and Teo 2009), which has significantly limited the ecological validity of their findings. Instead, we will use the highly controllable virtual supermarket (VSM) setting previously used by Hühn et al. (2012), which offers participants an immersive and interactive context, and enables researchers to measure the actual brand choice. Below, we will first discuss how medium type and location-congruency may differentially affect consumers' attention and brand choice.

MOBILE VS. POINT-OF-SALES ADVERTISING

Unni and Harmon (2007) claim that the merits of LBA lie in the fact that consumers can be targeted with location-congruent ads on their personal (mobile) devices. In their view, the mobility and personal nature of the mobile device distinguish mobile marketing from more traditional and immobile advertising such as in-store displays. One of the advantages of mobile ads compared to point-of-sales ads is that mobile ads may be superior in drawing consumers' attention. In addition to visual cues in the form of on-screen push notifications, sound and vibration can be used to enhance users' attention to the ad (Baumann et al., 2010; Miller, 2012).

However, whereas sound and vibration may give mobile advertising an advantage over point-of-sales advertising, we do not expect mobile ads to result in increased ad attention in location-congruent situations for two reasons. First, when consumers are already standing in front of the shelf that contains the desired product on their shopping list, it seems unlikely that they will overlook a point-of-sales display ad in their direct visual field. Second, in a location-congruent situation, an advertisement on a mobile phone and a stationary display ad are equally goal relevant (cf. Baker &Lutz, 2000). Corroborating this argument, Gallagher, Parsons, and Foster (2001) found that consumers' attention for advertisements was not affected by the medium through which they were exposed to an ad (whether in print or on a website). Therefore, we do not expect a difference in attention between mobile and point-of-sales ads in location-congruent settings.

In location-incongruent situations, however, mobile ads might draw more attention than display ads. The aforementioned additional cues of sound and vibration that characterize mobile advertising do come into effect here. In addition, the interruptive nature of receiving a mobile ad could increase ad attention, since people tend to remember details of interrupted tasks better than tasks that are not interrupted, the so-called 'Zeigarnik effect' (Liu, 2008). We, therefore, expect that mobile ads will draw attention better than display ads in location-incongruent situations. No studies to date have compared LBA using different media.

In sum, the advantages of LBA may not derive from medium type, but rather from the congruency between the ad and the location of the advertised product. However, when there is no congruency between ad and product location, medium type may have an influence, and a mobile ad may have an advantage over a display ad in drawing consumers' attention. In other words, LBA is effective when the mobile

advertisement or display is close to the product because it is close to the product (not because it is mobile), whereas when the mobile advertisement is not close to the product it may have an advantage, because it is mobile. We thus expect the effect of medium type on ad attention to be moderated by location-congruency. Specifically, we have formulated the following hypothesis:

H1: Consumers will be more likely to devote attention to mobile ads than point-of-sales ads, but only in location-incongruent situations.

LOCATION-CONGRUENCY

The rationale behind tailoring persuasive messages to consumers' individual needs and interests, such as their location, is that it increases the perceived personal relevance of the message, and in turn increases consumers' motivation to pay attention to and elaborate on the persuasive information, thus making them susceptible to persuasion (Buijzen, Van Reijmersdal & Owen 2010; Dijkstra &De Vries, 1999; Tam & Ho, 2006). Advertisements received in location-congruent settings should 'deliver the right message to the right people at the right time' (Cho & Cheon, 2004), such as offering an advertisement for soup when consumers are in a supermarket where that brand of soup can be purchased. Location-congruent advertising messages are assumed to be consistent with consumers' present goals or tasks. Being at the same location as the target product at the moment of exposure to an ad should thus facilitate the efficacy of the ad.

Another reason why location-congruent advertisements may be more effective than those offered in location-incongruent settings is that most retail products are low-involvement products (Hoyer, 1984). According to the relevance-accessibility model (Baker & Lutz, 2000), people are likely to engage in an *indifferent* decision-making process for low-involvement products. According to the authors, when people respond indifferently to an ad, they tend to respond to the first product they 'like' and that meets their requirements. Baker and Lutz (2000) further argue that an indifferent decision-making process makes easily applicable product benefits such as location convenience more important. Considering that most products bought in a supermarket can be seen as low-involvement products, processes of indifferent decision-making and consumers' susceptibility to location convenience should enforce the effects of location-congruent ads. We, therefore, suggest that advertisements received in a location-congruent setting will be more effective than advertisements received in a location-incongruent setting.

In addition to positively affecting consumers' brand choice, we expect location-congruent ads to attract more attention from consumers than location-incongruent. It has been demonstrated that goal-relevant cues draw more attention than cues that are not relevant to reaching a goal (Carpenter, 1988). Previous research has shown that context congruency can improve attention to an ad (Zanjani, Diamond & Chan, 2011). According to these scholars, when an ad is semantically or conceptually related to the context, this context can serve as a cognitive prime, which in turn improves attention to that particular ad. For instance, a magazine article with the same topic as an ad may prime the content of the ad, increasing attention to the ad. Based on this knowledge, we will test the following hypotheses:

H2a: Consumers are more likely to devote attention to location-congruent ads than to location-incongruent ads.

H2b: Consumers who are confronted with a location-congruent ad will be more likely to choose the advertised brand than consumers who are confronted with a location-incongruent ad.

Previous research has repeatedly shown that consumers' attention to an ad is positively related to their intention to buy the advertised brand (Goodrich, 2011; Gronhaug, Kvitastein & Gronmo 1991; Haley and Baldinger, 1991). Based on these findings, and in line with the hierarchy of effects model (Engel, Kollat, and Blackwell, 1978), we posit that ad attention mediates the effect of location-congruency on brand choice:

H2c: Consumers' attention to an ad positively affects their choice for the advertised brand in location-incongruent conditions.

All hypotheses are represented in a research model in Figure 1. We tested these hypotheses by conducting an experiment in a VSM setting in a large room with four walls of video projection (cf. Hühn et al., 2012). In the supermarket, participants were presented with an advertisement for a specific product brand, either on their mobile phone or on a stationary display, in a location in which the advertised product was or was not directly available. We examined the effects of location-congruency and medium type on participants' ad attention and brand choice.

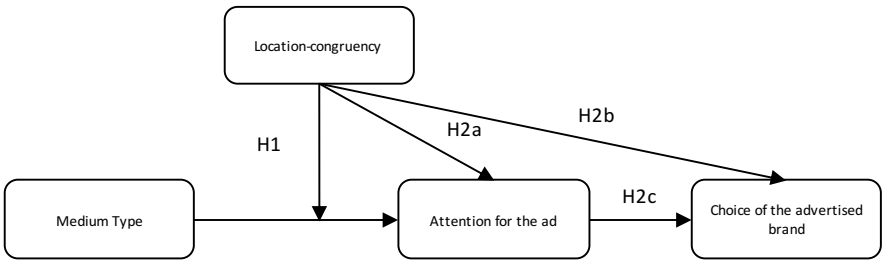

Figure 1. Moderated mediation model for the effects of Location-Congruency and Medium Type on Attention for the ad and Choice of the Advertised Brand.

METHOD

Participants and design

The Dutch marketing research agency CG-studies recruited 120 Dutch consumers, who participated for financial compensation. The sample is highly representative for the Dutch population with respect to sex and age (M_{age} = 39.40; 57.6% female), household composition, and employment. Participants were assigned to one of the four conditions of a 2 (medium type: mobile vs. point-of-sales display) × 2 (location congruency: congruent vs. incongruent) between-subjects design, with brand choice and ad attention as dependent variables. One participant was excluded from the analyses because he failed to finish the experiment independently and successfully.

Procedure

Upon arrival at the laboratory, participants were seated and received an explanation of the research procedure. They were told that they would engage in a grocery-shopping task in a VSM. After reading and signing a consent form, participants entered the computer-assisted virtual environment (CAVE), where the experiment leader provided instructions on how to navigate and pick up products in the VSM. Participants were warned of potential dizziness or nausea, and were told that they could interrupt or stop the experiment at any time.

Virtual supermarket (VSM)

The VSM was projected onto four rear projection screens (each 3.6 m wide and 2.6 m high). The screens formed a closed space, called the CAVE, with a square floor surface of approximately 13 m^2, offering participants a 360° view of the environment. For the present study, a supermarket environment was created based on the corporate style and spatial arrangement in the supermarkets of the Netherland's largest supermarket chain. All shelves were filled with products.

Participants were instructed to stand in the exact center of the floor surface of the CAVE, indicated by a cross on the floor. Participants could move in the VSM with the help of a head-tracking system based on Microsoft's Kinect. This system determines the position of the participant's head in the CAVE, which is then used to control motion in the VSM. When participants stand in the center of the CAVE, the virtual camera stands still, but when they take a step forward, the projections on the screens change to give participants the impression of moving forward. As long as participants remain standing one step from the center of the CAVE, they keep 'moving.' Moving speed is determined by the participant's distance from the middle of the CAVE: the larger the distance (a bigger step forward), the faster the virtual movement. Participants were able to turn and step in every direction relative to the CAVE's center; they could move sideways and backward, and to the left and right by taking a step to the side and to the back, and turning to face left or right. The simulation did not adjust the vertical axis, for instance, correcting the perspective when participants ducked or jumped, as this was not deemed necessary for the experimental task at hand. In contrast to often-used head-mounted virtual displays, the VSM did not block out the physical world, offering us the opportunity to use physical objects, in particular the smartphone.

Each participant received an HTC Legend Smartphone and instructions to keep this phone in their hands during the entire experiment. An Android application was developed, which connected the phone with the CAVE through Wi-Fi. The grocery list that participants were to use during the experiment was programmed into the application. Participants could operate the phone with their fingers, using the touch screen. The application was used to 'purchase' products: by pointing to a specific product and pressing the 'buy' button, the selected product was placed in the 'shopping basket.' Participants were instructed to delete products if they had made a mistake or if they had changed their mind about purchasing a product. Additionally, they were notified that the log files of the VSM and the phone were saved as part of the data collection, which means that their route through the VSM was recorded, as well as potential offers received on their mobile device. In addition, they were

informed that a questionnaire would be administered after their experience in the virtual supermarket.

After a practice run, participants were asked whether they had any additional questions or concerns. If this was not the case, they received the grocery-shopping task. According to Zanjani, Diamond, and Chan (2011), ads are more interesting to task-oriented viewers when the ads provide information related to their task. Therefore, each participant received a grocery list containing four products (cola, toilet paper, chocolate sprinkles, and a bag of crisps; brands not specified), among which was the target product that would be advertised (chocolate sprinkles). This target product is a popular Dutch sandwich topping often consumed for breakfast or lunch. Participants were instructed to imagine that they were shopping for a friend, who was unable to go shopping because he had to take his brother to the hospital at the last minute. In order to make the sales promotion in the upcoming advertisement more salient, participants were instructed to spend about €10 on the total purchase of the four items on the list.

During the experiment, participants were free to walk around in the VSM and follow their own route, picking up all the products that were on their shopping list. As in most Dutch supermarkets, participants first encountered the fruit and vegetable section. At the end of this section, at the front of an aisle, a trigger area was programmed in which participants were presented with an advertisement. To make sure that all participants entered the ad's trigger area, several empty cases were placed around it, so that participants had to cross the area in order to reach other parts of the supermarket. At the same time, this allowed us to keep the trigger area small enough to make sure that participants noticed the shelf that was positioned in front of the aisle, where the advertised product was displayed.

Medium type

The advertisement was either presented on participants' smartphone, or on a stationary display above the product shelf that was positioned at the front of the aisle. In all conditions, the advertisement promoted a 25% discount of a specific brand of chocolate sprinkles which reduced the original price from €1.85 to €1.37 (13.7% of the available budget of €10). The advertised brand was De Ruijter chocolate sprinkles, and there were competing brands of the same product category available in the VSM around the same price (Albert Heijn, €1.49; Venz, €1.55; Fair trade, €1.92).

In the mobile conditions, at the moment that participants entered the trigger area of the VSM, the smartphone application played an audio notification, vibrated, and

presented the ad to participants. For the mobile conditions, the display did not present the advertisement, but presented the Albert Heijn supermarket logo (AH) instead.

Location congruency

Location congruency was manipulated by presenting the advertised product at a location that was either congruent or incongruent to where participants received the advertisement. As explained above, the advertisement was always presented to participants at a fixed location in the supermarket at the front of an aisle. Location-congruent conditions the advertised product (De Ruijter chocolate sprinkles) and three competitive brands from the same product category (Venz, Albert Heijn, and Fair trade) were presented on the product shelf at the front of this aisle. In location-incongruent conditions, this product shelf contained products from a different product category (electronics), and the advertised product was located elsewhere in the supermarket.

When participants had collected all the products that were on their shopping list, they were instructed to go to the checkout counter to complete the virtual shopping task. The experiment leader subsequently accompanied participants to another room where they filled out a questionnaire that measured participants' brand attention and their demographic characteristics.

Dependent variables

Brand choice

Our main dependent measure was whether participants had added the advertised brand (De Ruijter chocolate sprinkles) to their virtual shopping basket. In total, 45.4% of the participants bought the advertised product and 52.1% bought a competing brand of the same product category. The remaining participants chose not to buy chocolate sprinkles at all.

Ad attention

In our study, it was not possible to measure consumers' attention to advertisements in a direct way. Therefore, in line with Desmet and Traynor (2010), we consider ad recognition as a proxy for ad attention (cf. Desmet and Traynor 2010). We measured participants' recognition of the advertised product brand (De Ruijter chocolate sprinkles), as well as the specific 25% discount sales promotion (cf. de Sa, Navalpakkam, and Churchill 2013). Participants were presented with 16 pictures that showed one of the four chocolate sprinkle brands (De Ruijter, Venz, Albert Heijn, or Fair trade), combined with one of the four different sales offers (25% discount, second product for half price, two products for 2€, or 0.50 € discount).

Participants were asked to point out the advertisement that they had seen during the experiment. We measured ad recognition by assigning scores on a four-point scale: In total, 46.2% of the participants recognized the correct advertisement (De Ruijter: 25% discount), which was statistically represented by a score of 3. When participants correctly recognized the advertised brand but not the correct sales promotion, or correctly recognized the sales promotion but not the correct brand (26.9%), they were assigned a score of 2. The 7.6% of participants that neither correctly recognized the advertised brand nor the specific sales promotion were assigned a score of 1. Another 19.3% indicated that they did not see any of the ads at all and were assigned a score of 0.

Covariates

Experience with smartphone use

The amount of smartphone use was measured by asking participants how much time per day they spend on their smartphone, on average (fewer than 5 minutes, 5 minutes, 10 minutes, 15 minutes, 30 minutes, 45 minutes, 1 hour, 1.5 hours, 2 hours, 2.5 hours, 3 hours, 3.5 hours, 4 hours, 5 hours or longer).

Brand attitude

'Participants' attitude toward the advertised brand (De Ruijter chocolate sprinkles) was measured with a single-item question on a seven-point scale: 'What is your appreciation of <brand>.'

RESULTS

Ad attention

To test our hypotheses, we first conducted an ANCOVA with ad recognition as a function of medium type and location-congruency. In order to rule out possible confounds, we included age, sex, experience with the use of smartphones, and brand attitude as covariates in this and all subsequent analyses. The ANCOVA revealed a significant main effect of medium type: consumers in the mobile-ad condition were better able to recognize the ad (M = 2.30, SD = 0.89) than those in the display-ad condition (M = 1.71, SD = 1.27): $F(1, 99) = 6.93$, $\eta_p^2 = .06$, $p = .011$. As expected, this effect was moderated by location-congruency: $F(1, 99) = 5.41$, $\eta_p^2 = .05$, $p = .022$. Supporting Hypothesis 1, in location-incongruent situations, mobile ads were better recognized (M = 2.36, SD = 0.20) than display ads (M = 1.35, SD = 0.21); $F(1, 99) = 6.55$, $\eta_p^2 = .06$, $p = .012$. In location-congruent settings, there was no difference between the recognition of mobile (M = 2.14, SD = 0.21) and display ads (M = 2.09, SD = 0.19): $F(1, 99) = 0.59$, $\eta_p^2 = .006$, $p = .455$. The main effect of location-congruency did not reach statistical significance, nor did any of the covariates, all p's > .05.

Brand choice

To test Hypotheses 2b and 2c, we conducted a logistic regression analysis with choice for the advertised brand as dependent variable, and medium type, location-congruency, and ad recognition as predictors. Age, sex, experience with the use of smartphones, and brand attitude were included as covariates. In line with Hypothesis 2b, the analysis revealed that consumers who were exposed to location-congruent ads were more likely to choose the advertised brand (72.2%) than those who were exposed to location-incongruent ads (27.8%), $B = 1.67$, Wald(1, 100) = 11.49, $p = .001$, odds ratio = 5.30. Moreover, supporting Hypothesis 2c, ad recognition positively affected consumers' choice for the advertised product brand, $B = 0.98$, Wald(1, 100) = 13.10, $p < .001$, odds ratio = 2.67. Specifically, consumers who were better able to recognize the ad were more likely to buy the advertised product. Neither the main effect of medium type nor any of the interactions or covariates was significant, all p's > .05.

Moderated mediation analysis

To test our proposed model, that the advantages of LBA rely on location-congruency, and that advantages of a mobile medium only take effect in case of location-incongruent advertising, we conducted a moderated mediation analysis, using Hayes' (2012) PROCESS SPSS macro with 5000 bootstrap resamples. Medium type had a positive effect on ad recognition (B = 2.08, p = .002), indicating that consumers recognized mobile ads better than display ads. Ad recognition was also positively affected by location-congruency (B = 1.76, p = .009). Consumers recognized location-congruent ads better than location-incongruent ads (Hypothesis 2a). Moreover, the interaction of medium type and location-congruency significantly affected consumers' ad recognition (B = −0.97, p = .022).

Testing the paths to consumers' choice of the advertised brand revealed that ad recognition (B = 0.97, p < .001) and location-congruency (B = 3.94, p = .022) positively affected consumers' choice of the advertised brand. Confirming the effects of moderated mediation, medium type had a conditional indirect effect on consumers' choice of the advertised brand with a conditional indirect effect = 1.09, boot SE = 0.53, 95% bias-corrected bootstrap confidence interval [0.31, 2.15]). The results show that the indirect effect is not zero within a 95% confidence interval (CI does not include 0) we can conclude that medium type positively affects ad recognition, which in turn had a positive effect on consumers' choice for the advertised brand, but only when the ad was shown in a location-incongruent situation (H1). In location-congruent situations, the indirect effect of medium type vanished with a conditional indirect effect = 0.14, boot SE = 0.36, 95% bias-corrected bootstrap confidence interval [−0.60, 0.84] (since the confidence interval includes zero).

DISCUSSION

The present study aimed to disentangle the two constructs underlying the effectiveness of LBA. The main conclusion of our study is that effects of location congruence seem to overrule the influence of medium type. Independent of the medium through which the ad was presented (mobile or stationary display), consumers exposed to a location-congruent ad were more likely to choose the advertised brand than consumers exposed to a location-incongruent ad. However, in location-incongruent situations, a mobile ad appeared to be more effective than a point-of-sales ad, by directing consumers' attention to the advertisement. The present results confirm that ad attention positively affects brand choice when the ad is

presented at a different location than the advertised product. Compared to point-of-sales advertising, the merits of mobile advertising thus seem to lie in the fact that consumers are more likely to pay attention to an advertisement that is received in a location-incongruent situation. In other words, the closer the sensual personalization of the ad, the better the chance of attention.

With this study, we were able to establish that the advantages of (location-based) mobile advertising, compared to more traditional point-of-sales ads, do not lie in location-congruent situations. In line with Baker and Lutz's (2000) arguments and Gallagher, Parsons, and Foster's (2001) empirical research, we found that consumers' attention was not affected by the medium in location-congruent settings. However, corroborating the so-called 'Zeigarnik effect,' namely that people tend to remember interrupted tasks better than tasks that are not interrupted (Liu, 2008), we found that consumers' attention was better for mobile than for point-of-sales ads in incongruent locations. Again, future research should test the plausibility of this explanation.

A limitation is that in the present experiment it was technically not possible to measure consumers' attention for advertisements in a more direct way, without disturbing consumers and impairing ecological validity. For that reason, we considered ad recognition as a proxy of attention, which was measured after the virtual shopping task was completed. However, whereas our analyses confirm that ad recognition mediates the effect of medium type on brand choice in location-incongruent conditions, we cannot rule out that our measure of ad recognition was influenced by participants' brand choice. Although this limits the interpretability of the mediation effect, studies in the domain of television advertising have demonstrated that either ad or brand recognition functions as strong predictor of consumers' brand choice (e.g., Nedungadi, 1990). Future research in a VSM setting should consider an unobstrusive and more direct measurement of attention, such as eye-tracking technology instead of ad recognition.

This is the first study that disentangles the two constructs that underlie the effects of LBA: medium type and location-congruency. We find support for the argument that location-congruency increases perceived personal relevance of the message (Buijzen, Van Reijmersdal, and Owen 2010; Cho and Cheon 2004; Dijkstra & De Vries 1999; Tam & Ho 2006), facilitating choice and attention for the advertised brand. In the present experiment, the product that was advertised (chocolate sprinkles) was one of the items on participants' shopping lists. Although the advertisement is assumed to have influenced participants' brand choice, the purchase of the product itself was pre-planned. For future research, it would be interesting to explore whether the advantage of location-congruent ads over location-incongruent ones also holds for

more impulse product purchases, and whether it may stimulate consumers differently to buy a certain item that they were not planning to purchase in advance. Since many grocery items are assumed to be bought on impulse (Beatty and Ferrell, 1998), it would be highly relevant to study these effects. Furthermore, future research could extend the concept of location-congruency to indoor vs. outdoor advertising. Lastly, this study manipulated location-congruency for consumers who had already entered a store, and it would be useful to test the advantage of mobile vs. display advertising for consumers passing a store in which the advertised brand is offered.

In addition to theoretical advancements, our study has high ecologic validity because we measured actual purchase decisions of participants in a highly controllable VSM, one that closely resembled a real supermarket setting. For future research, it would be interesting to replicate our findings with a larger, even more representative sample.

It is important for retailers to know whether the enthusiasm about the possibilities of using smartphones in a retail setting is justified, and whether it is fruitful to invest in location-based mobile advertising. Although the present results show that the effects of medium type are overruled by location-congruency, mobile phones seem to have the advantage over displays in drawing attention to an ad. Furthermore, as opposed to stationary in-store media, personal mobile devices offer a dynamic platform to tailor commercial information to the individual consumer in other ways than location-congruency. When serving ads, mobile devices can take into account one's personal profile, shopping history, social context, shopping basket content, and time spent in the supermarket, whereas stationary media remain the same regardless of one's situation. However, while LBMA does provide greater connectivity and personalization opportunities, prior permission to contact the consumer is likely to be critical for the future success of mobile advertising.

CHAPTER 6 | THE INFLUENCE OF LOCATION BASED ADVERTISING ON PERCEIVED AD INTRUSIVENESS, RELEVANCE AND VALUE: A FIELD STUDY

INTRODUCTION

The wide-spread adoption of mobile devices with continuous, real-time location tracking technology has opened up the possibility for marketers to serve online ads that are tailored to the consumers' location, a technique also known as Location Based Advertising (LBA). While traditional advertising runs the risk of not sufficiently taking into account the goals and context of the user, usually leading to irritation and ad avoidance (Li, Edwards & Lee, 2002; Cho & Cheon, 2004), LBA offers the opportunity to tailor ads more specifically to the consumers' situation by taking into account the consumers' physical location. Although the development of LBA still finds itself in an early stage, technology- and businesswise (Dhar & Varshney, 2011), professional publications already report that LBA increases click-through rates (Tode, 2013, Feb 6) and generate traffic (Verve Mobile, 2014). The expectation that current outdoor location tracking technologies such as GPS and GSM Cell-ID will be complemented with methods that improve accuracy and enable indoors location-tracking (e.g. Bluetooth, RFID, WiMax and sensor technology) could make LBA even more attractive for marketers (Dhar & Varshney, 2011).

Even though LBA has received both professional and academic interest, research on the effectiveness of LBA is still in its infancy. As Hühn et al. (2012) and Van 't Riet et al. (2015) have shown, the majority of the LBA related studies are concerned with the technical realization. From the studies that look into consumer reactions, most deal with the general willingness of consumers to receive location-based ads. It is only in the last few years that researchers have increasingly looked into the effects of LBA by means of an experimental setup (e.g. Banerjee & Dholakia, 2012; Hühn et al., 2012; Unni & Harmon, 2007; Xu, Oh & Teo, 2009; Lee et al., 2015; Čaić, Mahr, Aguirre, de Ruyter & Wetzels, 2012; Ketelaar et al., 2015 Van 't Riet et al., 2015).

These impact studies have investigated different aspects of LBA such as location type, situational context, gender (Banerjee & Dholakia, 2012), multimedia vs. text-based ads (Xu, Oh & Teo, 2009) and push vs. pull (Unni & Harmon, 2007). But when it comes to the effectiveness of LBA itself, it is location-congruency defined as the extent to which messages (e.g. ads, notifications etc.) are tailored to the consumer's location, which deserves attention. It is only recently that location-congruency has been included in impact studies. Hühn et al. (2012) and Lee et al. (2015) investigated whether tailoring ads to the consumer's location has a positive influence on beliefs, attitude and behavior. In both instances location-congruency was found to have a positive impact, which seem to suggest that LBA is effective as an advertising technique.

Conclusions from these past impact studies remain tentative due to the questionable ecological validity of their experimental setups. Most LBA studies to date have either used verbal scenarios to convey the situation in question (e.g. Unni & Harmon, 2007; Xu et al., 2009; Banerjee & Dholakia, 2012; Čaić, Mahr, Aguirre, de Ruyter & Wetzels, 2012), or recreated scenarios in the lab within virtual environments (Hühn et al., 2012; Lee et al., 2015; Ketelaar et al., 2015; Van 't Riet et al., 2015). In these approaches the question remains to what extent these findings extend to real life situations since the absence of an actual experience in context, in a scenario-based study, might possibly lead to participants to evaluate situations differently than in an actual response in-the-field (Wehmeyer, 2007).

The dearth of field studies regarding location-based ads could partly be attributed to the technical challenges of data collection which is time-consuming and costly (Kjeldskov, 2004). Furthermore, field studies are also afflicted by methodological challenges. Given the dynamic and unstable nature of real world situations, field studies usually lack experimental control resulting in studies cluttered with extraneous variables (Kjeldskov, 2004; Kjeldskov & Skov, 2014; Bonnet, 2014; Hühn et al., 2012). Nonetheless, field studies are important as explained by Sun and May (2013), "*not only to study LBA in a real shopping context, but also to test the overall acceptability of the designed mobile service*" (Sun and May 2013).

To our knowledge, there have been a few LBA field studies that specifically investigate location. For example the study from Aalto et al. (2004) who conducted a field trial to evaluate their prototype location-based advertising system. However, their research was largely qualitative in nature and did not investigate the effects of location-congruency on ad effectiveness since no comparison was made between location-congruent and location-incongruent conditions. Moreover, the participants answered the questionnaires ex situ, long after they have been exposed, thereby increasing the likelihood of memory bias. Another example is the study of Molitor, Reichhart, Spann, & Ghose (2015). In this instance the researchers conducted an experiment on a fully operational LBA platform which was already used by real consumers. Interestingly, they found a continuous negative influence of geographical distance on ad response rates (measured through click-through rates). In addition, they also found that ranking ad lists based on distance (random vs. distance-based ranking) and displaying distance information (display distance info vs. no distance info) have a positive influence on response rates. However, since only behavioral outcomes (click-through rates) were measured, as with many of the other LBA field studies (Varnali et al., 2012; Spiekermann, 2011; Ghose et al., 2013; Luo et al., 2014), it remains unclear how geographical distance influenced the perception of the ad,

thereby leaving open the question of what is the psychological mechanism behind LBA effectiveness.

Hence, our objective for this study is to determine in situ if location-congruent mobile ads have a positive effect on the user perception of mobile ads. To meet this demand for in situ real world data we conducted a within-subjects field quasi-experiment using the Experience Sampling Method (ESM), a quasi-naturalistic method that involves signalling questions at informants repeatedly throughout the sampling period (Hektner, Schmidt, & Csikszentmihaly, 2007). In our particular case we made use of context-triggered sampling which enabled us to trigger an ESM questionnaire based on location and ad exposure. Consequently we were able to retrieve ad evaluations that are based on immediate experience rather than reconstructions from memory as is the case with prior studies that relied on ex situ post-questionnaires (Consolvo et al., 2007). To our knowledge this is the first study that implemented context-aware sampling ESM in an existing LBA application for the purpose of the evaluation of ad perception. With this paper we hope to contribute to the understanding of LBA effectiveness while at the same time providing methodological and practical insights regarding the execution of ESM assisted mobile advertising research in the field.

BACKGROUND

Mobile Marketing & Location Based Advertising

With 2.5 billion smartphone users worldwide (eMarketer, 2014) and the growing readiness amongst consumers to engage with mobile marketing (Persaud & Azhar, 2012) the smartphone has quickly become an interesting advertising vehicle for advertisers. In addition, the level of sophistication with which mobile users can be approached has also improved. Thanks to the continuing advances in sensor technologies (accelerometers, gyroscopes, etc.) and localization technologies (e.g. GPS [Global Positioning System], WPS [Wifi-based Positioning System] and cellular positioning) mobile phones have become increasingly context-aware (Dhar & Varshney, 2011).

The presence of context-aware features enables the possibility for marketer-controlled information customized to recipients' geographic positions (Bruner II & Kumar, 2007), a form of advertising that we refer to as Location Based Advertising

(LBA). However, as with every medium, certain conditions should be met before engaging with consumers through the mobile channel.

Foremost, LBA should be permission-based at all times; Barwise and Strong (2002) show that unpermitted mobile ads can lead to irritation, avoidance and negative brand perceptions. In addition, Unni and Harmon (2007) find that there is a relatively greater willingness to accept permitted mobile advertising amongst younger consumers than amongst older age groups. Furthermore, LBA may trigger consumer concerns about privacy and assurance of users' privacy and security is therefore of great importance (Cheung, 2014; Unni & Harmon, 2007).

In terms of the LBA message characteristics previous research shows that multimedia messages as opposed to text messages lead to more favorable attitudes and behavioral intentions, albeit with an increased risk of irritation, (Xu, Oh & Teo, 2009). In addition, Unni and Harmon (2007) show that push messages are perceived as less preferable than pull. This means that users prefer to receive ads on explicit request instead of receiving them on the advertiser's initiative.

Several studies have pointed out that situational aspects are an important influence on how mobile ads are perceived. For instance, Banerjee and Dholakia (2012) show that people within public settings and while doing leisure-related activities find advertising more useful than in private settings and during work-related activities. More specifically, Hühn et al. (2012) and Lee et al. (2015) have shown that location-congruent ads are perceived as less intrusive. These findings seem especially interesting since location-congruency is inherent to LBA. However, there has been relatively little in situ experimental research on the topic.

Our previous studies (chapter 2, 3) have already looked at the relation between location-congruency and perceived ad intrusiveness as well as relevance (chapter 4). Interestingly, we found some unexpected results between chapter 2 and 3 and chapter 4: 1) the effect of location-congruency on perceived intrusiveness in chapter 2 and 3 could not be reproduced in chapter 4 and 2) there was no relation between location-congruency and perceived relevance (manipulation check). One tentative explanation could be that the task prohibited a causal effect from location-congruency on perceived relevance; after all the goal was fixed and could not easily be changed thereby obstructing any possible relation between location-congruency and relevance. Hence, during this chapter we look at these mediators jointly, but this time in the field without the restriction of having a task. Conveniently Heinonen and Strandvik (2003) provide a framework in which LBA can be related to relevance and perceived ad intrusiveness. Borrowing from service quality models the authors theorize that

consumer responsiveness towards mobile ads is primarily based on a function of relevance, acceptance/disturbance and overall value, which in turn are influenced by respectively content and contextual factors. Below we will focus on these individual dependent factors to see how they relate to location-congruency. Based on these insights we will formulate hypotheses. The outcome should provide answers to which perceptions can be influenced by location-congruency.

Perceived ad intrusiveness & location-congruency

In Heinonen & Strandvik's framework (2003) 'disturbance' is operationalized through the theory of perceived ad intrusiveness by Li, Edwards and Lee (2002) where it is defined as the 'psychological reaction to ads that interfere with a consumer's ongoing cognitive processes' (Li et al., 2002, p. 39). Intrusiveness has been associated with irritation and ad avoidance in traditional media (Ha, 1996; van Doorn & Hoekstra, 2013) and on the web (Li et al., 2002; McCoy et al., 2008) and mobile (Wehmeyer, 2007; Lee et al., 2015).

Heinonen and Strandvik (2003) mainly associate contextual characteristics of the ad (when, where and how) with the elicitation of disturbance. More specifically, Ha (1996) defines intrusiveness as the measure in which ads disrupt the flow of the media message. This definition was extended with context being not only the media message in which the ad was communicated, but also as every possible environment where an ad could be (Li et al., 2002). With the ad Implicitly, it builds on the notion that context (media context and/or physical context) plays an important role in our ongoing cognitive processes; hence stimuli (e.g. ads) that do not take into account the situation of the receiver run the risk of being perceived as a disturbing force.

The rationale with LBA with regards to perceived ad intrusiveness could be that the use of location-congruency could lower the interference with the cognitive processes by taking into account the context in which these processes take place. Similarly, we expect that locations that the user will visit in the short term will also be part of the ongoing cognitive processes due to planning and anticipation; thereby ads that are related to these locations, which we will name location-(semi)congruent ads, will cause less interference.

Hühn et al. (2012) and Lee, Kim and Sundar (2015) provide some empirical support for this line of reasoning since they found a negative effect of location-congruency on perceived ad intrusiveness. However, the results were collected through the use of virtual environments, which is still an interruption of a mediated context (perceived ad intrusiveness in the traditional definition of Ha, 1996) instead of the physical context.

Hence, our study tests a similar relationship but in a real world setting with the following hypothesis:

H1: Location-(semi)congruent advertising is perceived as less intrusive than location-incongruent advertising.

Perceived relevance & location-congruency

The relevance of the ad is strongly related to ad involvement and is based on inherent needs, values, and interests (Zaichkowsky, 1994). Based on Heinonen and Strandvik's responsiveness framework (2003) it is assumed that the relevance of an ad is mainly affected by the ad content. However, based on Construal Level Theory (CLT) there are also reasons to believe that context can have an influence on involvement and relevance. Construal Level Theory explains that we tend to think about objects more concretely (low construal level) when they are psychologically close, whereas objects that are psychologically far away are represented more abstractly (high construal level; Trope & Liberman, 2010). Generally, psychological distance can be affected through social, temporal, spatial and/or hypothetical (the extent to which an object is definite and real) distance.

When it comes to spatial distance and persuasion Fujita, Eyal, Chaiken, Trope and Liberman (2008) and Kim, Rao, and Lee (2009) found that messages that were associated with a nearby source were more persuasive. Similarly, Luo et al (2014) in search of an explanation for the results of their field study also found with their survey a negative relation between psychological spatial distance and ad involvement. Luo et al. (2014) speculate that lower level construals tend to generate more involvement which in turn leads to higher relevance. Katz & Byrne (2013) propose a slightly different take by hypothesizing that concrete ads (e.g. price information) with relatively small spatial distance are more easily processed which consequently increases the effectiveness of the ad (Kim et al., 2009).

Lastly, based on CLT we could also reason that ads that associate themselves with locations that are going to be visited by the receiver in the near future will be less distant hypothetically, spatially and temporally than ads that are related to locations that are not going to be visited in the near term. The resulting decrease in psychological distance should then also lead to an increase in perceived relevance. Based on these arguments we would like to propose the following hypothesis:

H2: Location-(semi)congruent advertising is perceived as more relevant than location-incongruent advertising.

Perceived value & location-congruency

Perceived value is usually defined as "*the customer's overall assessment of the utility of a product based on perceptions of what is received and what is given*" (Zeithaml, Berry & Parasuraman, 1996). In other words, value represents a tradeoff between benefits and costs. However, there are perceived value models that specify which dimensions are involved in this tradeoff. Pihlström (2008) proposes six dimensions, namely *conditional, epistemic, emotional, social, convenience* and *monetary value*, to fully acknowledge the factors that determine the perception of a service within the new electronic service environments that have been created by mobile technology. Of particular interest is the conditional dimension to perceived value which was firstly introduced by Sheth et al. (1991) but which has been adapted to the mobile field by Pihlström (2008) resulting in the following definition: "*Value existing in a specific context derived from circumstances that characterize a situation related to the interaction between humans, mobile content, the self-service interface and the surrounding environment*". Moreover, conditional value is a function of temporal and spatial factors (Pihlström, 2008). The definition shows that value is not only dependent on the content of a media message, but also on the social, technological and physical context in which it is placed. Pihlström (2008) continues saying that monetary value, social value, convenience value, emotional value are in part determined by conditional value. Based on these definitions we could argue that LBA could positively influence the cost-benefit tradeoff by using location-congruency to create the circumstances (conditional value) under which the expected costs (monetary value) and effort (convenience value) to obtain the advertised product/service are optimal. Hence the following hypothesis:

Hypothesis 3: Location-(semi)congruent advertising is perceived as more valuable than location-incongruent advertising.

METHOD

To survey participant experiences, we made use of the Experience Sampling Method (ESM) (also called Ecological Momentary Assessment, EMA) which allows participants to evaluate their experiences as they take place (Larson & Csikszentmihalyi, 1983; Dimotakis, Ilies, & Judge, 2013; Hektner, Schmidt, & Csikszentmihaly, 2007). Thereby, ESM helps mitigate memory biases that manifest in self-reports as they become distanced from the events in question (Gorin & Stone, 2001; Keyson, 2010). This

enables us to directly retrieve in situ consumer attitudes towards mobile ads within contexts that are either congruent or incongruent with the ad content.

Moreover, early implementations of the method required users to carry with them a diary to fill in paper questionnaires. Sampling designs would vary between letting participants complete self-reports at predetermined moments (interval-contingent sampling), in response to events of interest (event-contingent sampling) or at random intervals triggered by an electronic device like a beeper (signal-contingent sampling). However, gradually ESM has moved on to becoming computerized, making use of devices such as Personal Digital Assistants (Mehl, Pennebaker, Crow, Dabbs & Price, 2001) and more recently the now ubiquitous smartphones (Khan, Markopoulos, Eggen, IJsselsteijn & De Ruyter, 2008). Consequently, the combination of ubicomp sensing technologies, ESM, and mobile device platforms creates the opportunity to trigger questionnaires based on contextual aspects (e.g. location, movement, user input) also known as context-triggered sampling (Intille et al., 2003; Consolvo et al., 2007). We conducted a within-subjects field-experiment in a period of four weeks. Thereby each participant received both location-congruent and incongruent ads.

Material

Application

As a carrier for our study, we developed an Android app targeted at students. The app –in beta version at the time of our study- provides students with personal scheduling information as well as university-related news, but also with national and international news. The mobile ads are listed in the menu of the app, between the other application items. As soon as a news item or an ad is available (relevant to the time and place of the user) the app sends a notification in the conventional way for Android apps. The navigation bar at the bottom of the app gives the possibility to filter and only view the ads or a combination of the ads and other elements of the application (Figure 1). Location-congruent and incongruent ads were presented within the app.

Ads

The ads are digital discount coupons that participants could redeem during the study period at the university's restaurant. The restaurant has a coffee bar and a main restaurant area that are about 30 meters apart in the ground floor of the university's main building. Participants would initially view the product at offer. Then they would be asked to fill out a questionnaire consisting of four questions and only after submitting it they would receive the actual coupon code (Figure 1). They could then show the coupon code to the employee at the restaurant to redeem the offer. The

employee would then check the validity of the code through another app we developed that linked to a simple coupon-tracking system. In that way we could also track participants' buying behavior. Obviously, participants were free to not redeem coupons.

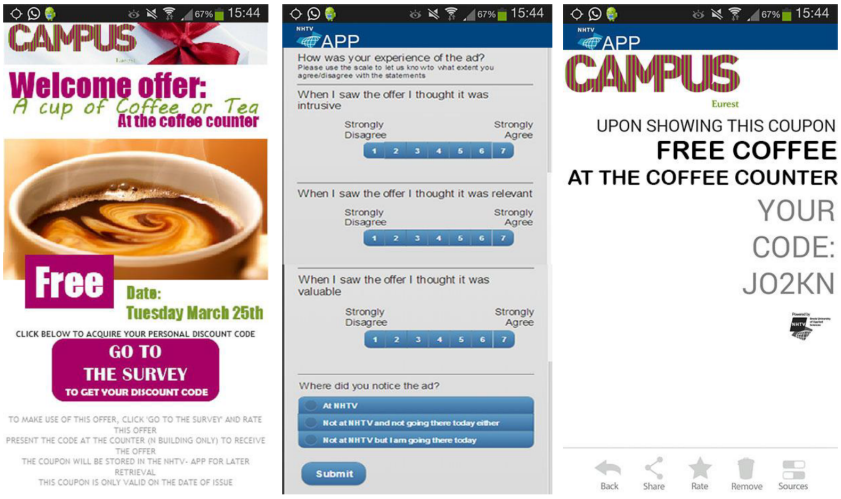

Figure 1: Sequence of screens participants viewed. From left to right: the first screen advertised the product, the screen in the middle requests participants to fill out the questionnaire and the last screen presents (after the questionnaire has been filled out) the actual coupon code that can be redeemed in the university restaurant. Only the very first coupon offers a free coffee to participants.

GPS sensor data were used to detect the actual location. Since GPS data were salient to the study, participants would receive a notification in case their GPS sensor was turned off. The ads were to be congruent or incongruent based on the phone's location, creating the two conditions. In the first condition, the location-incongruent (LI) condition, participants received the ad wherever they were located at that time – nevertheless, outside of the university's premises. In the LI condition, ads were sent when participants were not expected to be at the premises of the university, based on their class schedule. In the second condition, the location-congruent (LC) condition, ads were sent to students who entered a trigger area surrounding the university restaurant. The trigger area was set at three coordinates: (1) Lat: 51° 35' 25.119" Long: 4° 47' 43.8576"; (2) Lat: 51° 35' 26.0088" Long: 4° 47' 47.1006"; (3) Lat: 51° 35' 24.0858 Long: 4° 47' 43.818". These coordinates are located within the university's main building in which the restaurant is located. The ad was received when the participant was located within the red circles (Figure 2). The restaurant's exact location is in the

building of the top left circle in Figure 2. The surface of the trigger area is roughly one hundred square meters.

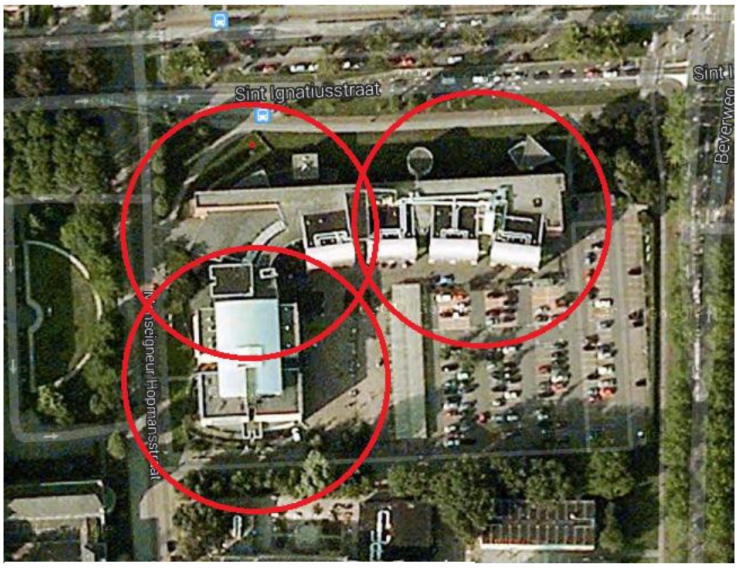

Figure 2. Screenshot from Google Maps of the coverage of the ad triggering areas

For the ads, we selected a range of products that we expected would be widely liked. Product categories that were used included: fresh juices, sandwiches, soups and hot beverages with discounts varying between the 20% and 40 % (see Figure 3). The products were evenly distributed amongst the conditions to prevent participants' bias towards specific products. There was one coupon sent each weekday (Monday to Friday) to all participants for a period of four weeks. We decided that one coupon per weekday was the maximum frequency since over-exposure to mobile ads could lead to ceiling effects due to irritation (Haghirian, Madlberger, & Tanuskova, 2005).

Figure 3. An impression of the ads/offers participants viewed.

Participant Recruitment

We recruited students of NHTV Breda University of Applied Sciences (from now on referred to as "university") -between 18 to 21 years old- through email and personal contact, forming a convenience sample. To participate in the study they had to own an Android smartphone and agree to install our app. The app was presented to them as a beta-testing version of a student app that would be launched in the near future. All its features were equally highlighted along with the restaurant's discount coupons. No special mention was made on the location-based character of the coupons. After installing the app, participants were asked to respond to every notification as soon as they noticed it and fill out a questionnaire consisting of four items. Although we initially recruited 40 students only 23 responded. Therefore, the results we report in this study are based on these 23 participants. On top of the discount coupons that they received on their phone those 23 participants were also rewarded at the end of the study with a €25 gift voucher.

Measurement instruments

Coupon tracking system

The coupon tracking system collected information on whether the coupon was received, was read, or not read, or whether it was deleted. With the use of GPS coordinates it tracked where the participant first received and noticed the ad.

Mobile questionnaire

The questionnaire was presented on the participants' phone immediately after the ad using Tempest, a tool for in situ data collection (Batalas & Markopoulos 2011). Tempest allows researchers to compose data collection instruments, such as questionnaires. For our purposes we used the web-based client that Tempest provides, embedded in our ad-serving app. The questionnaire we composed on a separate authoring interface, and would be made available to each installed instance of the application upon request. It consisted of four questions. Since the questions were presented on a small screen they were designed to be short and quick to fill out. Bergkvist and Rossiter (2007) demonstrated that single item attitude towards-the-ad measures are equally predictive as multiple-item measures. Therefore, one item was used to measure the participants' perceived ad intrusiveness, ad relevance and ad value. The items for ad intrusiveness and ad value were adapted from prior scales developed for similar studies (Table 1) and chosen based on factor loads in these studies.

Table 1. List of constructs on mobile questionnaire: ad intrusiveness, ad relevance and ad value (all items were 7-point Likert-scale, 1= strongly disagree, 7=strongly agree).

Construct	Origin	Items
Perceived ad intrusiveness	Li et al., 2002; one item selected for the mobile application purpose	When I saw the ad I thought the ad was intrusive
Perceived ad value	Xu, Oh & Teo, 2009; one item selected for the mobile application purpose	When I saw the ad I thought the ad was valuable
Perceived ad relevance	Self-developed	When I saw the ad I thought the ad was relevant

Lastly, even though we had the ability to trigger the ad based on preset parameters, it did not ensure that the participant would also see the ad at the desired moment. Hence, whether an ad in the end was assigned to the congruent or incongruent depended on where the participant noticed the ad for the first time. Therefore, we asked participants to report where they noticed the ad. In case they noticed the ad outside of the university building we then were also interested in their intention of going to school or not. Participants could then choose between the following options:

- At university campus (congruent condition)
- Not at university campus and not going there today either (incongruent condition)
- Not at university campus but I am going there today (semi-congruent condition)

Feedback system

Next to the questionnaire, participants had the option to send feedback to the app developers at their own convenience through a 'feedback feature' in the application. In case they experienced any issues with the app they were able to send short texts to share their opinion. We will report these comments in our results as they give us a more nuanced perspective on the users' experience of the application.

Method of data analysis

To test our hypotheses, we used a fixed effects model with a set of weighted effects coded dummies that identify individual subjects on the first level and not on a second

level (Cohen, Cohen, West & Aiken, 2003; Kenny, Bolger & Kashy, 2002; Snijder & Bosker, 2012)[9]. Through this approach we have been able to account for the within-subject variation while at the same time respecting the unbalanced nature of our data and the limited observations per level. Furthermore, to detect whether the two conditions differed significantly from each other, we conducted two linear regression analyses with each a different dummy reference variable for location-congruency (incongruent and semicongruent).

The analysis of within-subjects data is usually approached with multilevel analysis or repeated measures anova (Field, Miles & Field, 2012; Kenny, Bolger & Kashy, 2002). However, Maas and Hox (2005) conclude that a low number of subjects may result in inaccurate standard errors on the subject level of multilevel analysis, and Larson and Csikszentmihalyi (1983) argue that data from ESM research are unbalanced by their very nature, which makes such data incompatible with repeated measures analysis (Field, Miles & Field, 2012).

RESULTS

Sample description

The 23 participants who finally participated filled in 107 experience sampling questionnaires. 43% of those were congruent (46 answers "At university campus" to the question where they were when noticing the ad), 57% incongruent (42 answers "Not at university campus and not going there today either") and 19 answers were semi-congruent ("Not at university campus but I am going there today").

Hypotheses testing

As described under paragraph 3.2.4 we used a fixed effects model with weighted effects coded dummies to account for intra-individual variations. Table2 presents the results of the ANOVA analysis. With regards to our first hypothesis results show that there was no significant difference between the three conditions regarding perceived

[9] To check our weighted effect coded dummies we conducted analysis twice with a different reference dummy variable. Both analyses provided identical parameters.

intrusiveness. In contrast, the intra-individual variations prove to be a significant factor with a considerable effect size. Based on these results we reject our first hypothesis.

With regards to our second hypothesis results show that location-congruency has a significant effect on perceived relevance. In addition, we see that personal differences also have a significant impact on the level of perceived relevance with a considerable larger effect size. When looking at the coefficients in Table 3 we can see that both the location-congruent and (to a lesser degree, though not significantly) semi-congruent condition are perceived as significantly more relevant than the location incongruent condition. Taken together, these results suggest that a location-congruent and semicongruent ad are considered as more relevant than a location incongruent ad. Hence, we can accept hypothesis 2.

Lastly, in relation to our third hypothesis results in Table2 show a significant positive effect of location-congruency on perceived value. Again, the intra-individual variations have a significant impact on the level of perceived value with a comparatively higher effect size than location-congruency. Results in Table 3 show that once again the location-congruent condition and to a lesser degree the semi-congruent condition lead to a significantly higher perceived value than the incongruent condition. This suggests that the ad is perceived as more valuable when the ad is noticed in a location-congruent context compared to a location-incongruent context. As with our previous hypothesis the semi-congruent condition once again lies between the congruent and incongruent conditions, however in both instances the difference between congruent and semi-congruent was not significant. Therefore we can also accept our third hypothesis.

Table 2. Multivariate ANOVA results for location-congruency and individual variation on dependent measures

Model			Sum of Squares	df	Mean Square	F	Sig.	R Square Change
Intrusive	Subset Tests	Location congruence	1,089	2	,545	,606	,548[a]	,004
		Individual variation	199,812	22	9,082	10,106	,000[a]	,720
	Regression		203,991	24	8,500	9,458	,000[c]	
	Residual		73,692	82	,899			
	Total		277,682	106				
Value	Subset Tests	Location congruence	20,900	2	10,450	8,540	,000[a]	,111
		Individual variation	77,877	22	3,540	2,893	,000[a]	,413
	Regression		88,200	24	3,675	3,003	,000[c]	
	Residual		100,342	82	1,224			
	Total		188,542	106				
Relevance	Subset Tests	Location congruence	24,560	2	12,280	8,557	,000[a]	,120
		Individual variation	69,893	22	3,177	2,214	,005[a]	,343
	Regression		86,375	24	3,599	2,508	,001[c]	
	Residual		117,681	82	1,435			
	Total		204,056	106				

Table 3. Coefficients for location-congruency hypothesis testing

Model			Unstandardized Coefficients		Standardized Coefficients		
			B	Std. Error	Beta	t	Sig.
Intrusiveness	Semicongruent (reference variable)	(Constant)	3,080	,242		12,742	,000
		Congruent	,109	,310	,033	,351	,727
		Incongruent	,295	,288	,089	1,023	,309
	Incongruent (reference variable)	(Constant)	3,376	,163		20,671	,000
		Congruent	-,186	,252	-,057	-,739	,462
		Semicongruent	-,295	,288	-,070	-1,023	,309
Relevance	Semicongruent (reference variable)	(Constant)	4,840	,306		15,842	,000
		Congruent	,554	,391	,199	1,416	,160
		Incongruent	-,747	,364	-,264	-2,050	,044
	Incongruent (reference variable)	(Constant)	4,093	,206		19,833	,000
		Congruent	1,302	,319	,467	4,083	,000
		Semicongruent	,747	,364	,207	2,050	,044
Value	Semicongruent (reference variable)	(Constant)	5,007	,282		17,748	,000
		Congruent	,651	,361	,243	1,801	,075
		Incongruent	-,563	,337	-,207	-1,674	,098
	Incongruent (reference variable)	(Constant)	4,443	,191		23,318	,000
		Congruent	1,214	,294	,453	4,125	,000
		Semicongruent	,563	,337	,162	1,674	,098

Note: Coefficients for participant dummies have been removed from this overview

Qualitative findings

Based on the feedback given in the application several issues were highlighted. Some comments referred to the information overload caused by the other news notifications of the app: "*The deals are very good for in the restaurant. There is useful information however there are too many messages which are slightly annoying.*". Similarly, another participant commented: "*Clutter due to all notifications received, way too many news items. Good that you can turn it off in the menu though.*".

Some participants also had difficulty with the app's navigation "*The overview menu is not clear enough. I don't know where to find pages easily.*". Along the same lines another participant said: "*I don't know where to find my schedule and everything clutters because all messages are mixed and unordered.*" "*Nothing is shown in the app. Only a gray screen*". It was noticeable that the unclear navigation seems to lead to frustration. Even though these comments do not directly relate to the ads, the impaired experience of the app could have indirectly influenced the reception of the ads.

Most comments were related to the GPS tracking. One of the most important objections were related to battery drainage as a consequence of the GPS. One comment proposes the option to let the user control the GPS functionality: "*Why should I put the GPS on? It drains the battery dramatically. Or create an option to remove the GPS!*"

Even though these insights are valuable to bring certain issues under the attention, it is important to realize that the comments are not necessarily representative of the overall assessment. Since these comments are taken from the feedback function within the app, which usually is used in case of troubleshooting, it is highly likely that the sentiment is generally skewed towards the negative.

DISCUSSION

Discussion

The aim of this study was to investigate the effect of location congruence on perceived ad intrusiveness, value, and relevance in the field in which the actual context is addressed. To that end, we hypothesized that ads that are congruent to the location of the user, are perceived as less intrusive, more valuable and more relevant.

Our findings did not show any differences regarding perceived intrusiveness between ads that are congruent and ads that are incongruent with the location of the user. The result seems to be in conflict with earlier findings from Hühn et al. (2012), Lee et al. (2015) and Edwards et al. (2002) who have shown that tailoring messages to the context in which it is received reduces perceived ad intrusiveness.

An explanation for this difference could come from the way intrusiveness has been measured. First of all, we did not have as much control over the situation in which intrusiveness was measured which could have increased the risk of extraneous variables. For example, it could have very well been possible that at university students were more occupied with high cognitive load activities (chatting with other students, learning etc.) than at home, which could render an ad as even more intrusive (Rau, Liao and Chen, 2013) even though it would be location-congruent.

On the one hand, this underlines the advantages of lab approaches in terms of control. It enables the researcher to expose participants to the stimulus and subsequently measure their reaction in a more isolated and stable setting, keeping extraneous variables in check. On the other hand, the field study ensures higher ecological validity, thereby respecting the fragmented nature of mobile interaction and the high cognitive load that accompanies it (Oulasvirta, Tamminen, Roto, & Kuorelahti, 2005).

Further, our findings show that location-congruent ads are perceived as more relevant than incongruent ads, thereby accepting H2. This is in line with CLT (Liberman et al., 2007) and previous research by Luo et al., (2014) and Pelsmacker et al. (2002), which show that context-congruent ads result in higher ad involvement and in turn increase perceived relevance. However, our finding stands in contrast with a newly published study from Van ‘t Riet et al. (2015) which has not been able to find a correlation between location-congruency and relevance. According to that study the relation between relevance and context-congruency is still rather diffuse and needs additional research (p.11). It turns out that there are still a few theories that apparently hypothesize different relations between location-congruency and relevance. As stated earlier Heinonen and Strandvik (2003) theorize that it is mainly the involvement with the message content that determines the relevance of the ad, whereas ad placement, which includes location-congruency, is more related to disturbance (perceived ad intrusiveness) /acceptance of the ad. Similarly, based on the Relevance-Accesibility Model, Van ‘t Riet et al (2015) speculate that location-congruency is mainly responsible for increasing the accessibility of the advertised product, whereas the relevance of the ad could be associated more with the content. Construal Level Theory on the other hand allows for a direct effect of location-

congruency on relevance: Luo et al. (2014) reason that objects that are psychologically close by generate more involvement which in turn increases the perceived relevance of the ad (Luo et al., 2014). Our results seem to corroborate this idea.

Lastly, we have seen that ads that are location-congruent are perceived as more valuable than incongruent ads. This suggests that location-congruency has a positive influence on perceived value, thereby accepting H3. Even though this study as a first empirical attempt shows that there is a direct relation between location-congruency and perceived value in the context of LBA, it is in line with circumstantial evidence from the literature. In Heinonen's (2006) conceptual framework for temporal and spatial e-service value, perceived value is partly dependent on spatial aspects such as location. Similarly Pura and Gummerus (2007) draw a difference between epistemic and conditional value, connecting the concept of value respectively to psychological and environmental factors such as location.

In addition to our main findings we found that individual differences had a significant influence on all of our dependent variables. Moreover, when comparing effect sizes it turned out that intra-individual variations explained more of the variance than location-congruency. Past studies have shown that mobile ad effectiveness can partly be affected by individual characteristics including but not limited to general attitude towards advertising (Wehmeyer, 2007), social norms (Soroa-Koury & Yang, 2010), personal innovativeness (Xu, Oh & Teo, 2009).

Managerial & Researcher Implications

Overall this research shows that the use of LBA can add value and relevance to mobile advertising. Thereby advertisers should feel encouraged in their endeavor to tailor advertising to the context of the individual user. Although prior studies have shown that location-congruent ads positively influence the perceptions regarding the mobile ad through lab studies, this study has found preliminary evidence that this effect also takes place in the real world. Ecological validity is especially valuable to practitioners, as it takes away the doubts about how lab results translate to the real world.

Furthermore we also believe that our results with regard to the location semicongruent condition offer interesting insights to advertisers. As it turned out, user perceptions are not only positively influenced by ads that are congruent with the current location, but also by ads that are congruent with locations the user will visit in the foreseeable future. These insights are meaningful against the backdrop of large-scale user data and predictive analytics which increasingly enable the possibility of anticipating where users will be.

A few interesting observations can be made about studying LBA in the field using ESM. As stated earlier, the significant advantage of this approach is that the research took place in a real world setting instead of an artificially recreated one. Moreover, the use of ESM enabled us to retrieve user perceptions and attitudes directly from within the context which is being investigated, instead of asking to reflect back on the situation. In our case, we were also able to use the participant's own phone, instead of a device that is given out by the researchers. Another advantage was that the researcher was able to remotely follow results without interfering in the context of participants, whereas in the lab the context for participants needs to be reconstructed and controlled. On the other hand, the field study required continuous monitoring, whereas the lab study had the comfort of having dedicated timeslots in which the study took place.

Furthermore, based on our analysis we found that intra-individual variations were determinative with regard to our outcome variables. Thereby our study reconfirms that personal characteristics should be accounted for when conducting these kinds of studies.

Limitations & Future studies

One limitation of our study was the relatively small sample size. Having more observations at our disposal would have allowed for more robust analyses. Statistical methods such as multilevel analysis would have enabled us to respect upper-level predictors such as certain characteristics of the individual person, type of ad, time and type of location (Hektner, Schmidt & Csikszentmihalyi, 2007). On the other hand, our study could be exemplary for other ESM studies with regards to which statistical means to use when dealing with sparse and unbalanced data.

In part the low response presumably comes from the use of ESM. ESM relies on the use of self-report, which makes the data collection largely dependent on the willingness of the participant. This may have contributed to self-selection bias and selective non-response (Keyson, 2010). In contrast, experimental studies that have researched LBA in a lab setting (e.g. Hühn et al., 2012; Lee et al., 2015) usually relied on more coerced forms of data collection which resulted in a better response rate. On the other hand, the use of coercion usually interferes with the naturalistic setting, thereby degrading the ecological validity of these studies.

To detect a possible self selection/non-response bias as a consequence of a low response rate, future studies conducting similar research could supplement the ESM questionnaires with a mandatory closing interview or survey. Thereby researchers can

retrieve the overall perception from all participants which then could function as a reference to which the results from the ESM can be compared.

Preferably, future LBA studies could utilize large-scale LBA platforms, similar to the study by Molitor et al. (2015), thereby solving problems around small sample sizes and ecological validity while at the same time retrieving real time insights on user perceptions. However, in addition to measuring user interactions, ESM questionnaires could be deployed to measure perception and attitude.

We also would like to emphasize a possible downside of using ESM. In order to limit the nuisance of filling out questionnaires on the mobile we had to keep the amount of items at an absolute minimum. However, with one item scales it is hard to determine the reliability. Furthermore, our study made use of Likert items based on declarative statements, which are known for acquiescence issues. If we had the luxury of multiple item scales, we could have formulated items in both directions to diagnose cases of acquiescence during the analysis.

Another limitation was the lack of sensitivity with regard to user activities, which may have confounded our results. To address this issue, future studies could include an ESM question which measures to what extent the participant was occupied during the reception of the ad. Once measured the variable could function as a control during the analysis.

Additionally, as our qualitative findings have shown, the general usability and user experience of the application could determine the overall success of the research. In our case we have experienced that aspects such as program stability, battery life and a user friendly UI determine to what extent participants will remain invested in the application and thereby also in your research.

CONCLUSION

The results of our real world investigation show that location-congruency has a positive effect on the perceived relevance and value of the mobile ad. In contrast, against our expectation, we did not see a significant effect of location-congruency on perceived ad intrusiveness.

Our study contributes in being the first field study investigating the user exerpience of LBA, providing both theoretical and methodological insights. More specifically, the results show us for the first time in the field that location-congruency increases the user's perceived relevance and value of mobile ads (we elaborate more on this point under comment 6g), thereby tentatively corroborating prior research on location-congruency. In addition, as opposed to earlier LBA field studies where only user

behavior is measured (e.g. Molitor et al., 2015) or in which user perceptions are measured long after the exposure (Aalto et al., 2004) this study utilized ESM to gather experiential data right at the moment of exposure within the context that is being investigated. Consequently, we believe that our results are more ecologically valid and are less subject to memory bias. Practically, the paper provides some guidelines with regard to conducting mobile advertising research using ESM and context-triggered sampling. Lastly, the results from our location semicongruent condition also show that mobile advertising could also be effective when content is anticipating future locations.

CHAPTER 7 | CONCLUSION AND DISCUSSION

The main goal of this thesis is to extend the investigation of contextual variables that determine the effectiveness of LBA. Based on our literature study we found that location-congruency (location congruent vs location incongruent), goal congruency (goal congruent vs goal incongruent) and medium type (mobile vs point-of-sale) potentially are determinative for the effect of LBA but have been under-researched. Hence, these variables formed the central focus of our empirical studies. In addition, we had the ambition to depart from the use of verbal scenarios and explore and juxtapose contemporary reconstruction methods, namely Virtual environments, video scenarios and field studies. Based on our experience and statistical comparison we attempted to provide some meaningful insights with regard to these reconstruction methods against the backdrop of LBA research. For clarity purposes we provide a short summary of the objectives of each chapter and its corresponding findings before discussing the overarching conclusions.

Chapter 2 evaluated the intrusiveness of a mobile location-based advertising app in a virtual supermarket through two lab experiments. In addition, we elaborated on the use of a virtual environment to reconstruct the LBA use scenario. The results confirmed our hypothesis that context-congruent ads decrease the experienced intrusiveness. In addition, the second study showed that the participants who received a congruent ad tend to form more positive attitudes toward the application and in turn are more likely to use the application in the future and more likely to buy the advertised product. Concerning our reconstruction method we demonstrated that our setup could render meaningful results with regards to user experience.

Chapter 3 compared the use of virtual environments to simulate the user's experience for ad recipients as reported in chapter 2 and a projective technique where feedback is solicited based on the use of video scenarios. We report two experiments, one using video scenarios (N=520), the other using Virtual environments (N=53), which both studied the effect location-congruent ads have on perceived ad intrusiveness. A significant difference was found in the ad intrusiveness experienced between the two experimental groups in the virtual environment, as opposed to the video scenario study where no difference was found, and additionally both congruent and incongruent adverts were evaluated more negatively. Reflecting on the two studies we argue that the extra effort required for evaluation of location-based applications using virtual environments is justified by its suitability for conveying context and obtaining feedback and its potential for soliciting feedback based on actual rather than imagined experiences by participants.

Chapter 4 investigated whether ads that are tailored to consumers' location are indeed more effective than ads that are not in the presence of either but also relevant

to consumers' goals. Therefore, a 2 (location congruence) X 2 (involvement) experimental design was employed. The data collection was done through the use of virtual environments, as has been developed in Chapter 2. These expectations were partly confirmed by our experiment: the location-congruent ad resulted in more purchases than the location-incongruent ad, but only for highly involved participants. These results suggest that it is only profitable for advertisers to send 'local' messages when these messages are involving.

The objective of chapter 5 was to disentangle two constructs that underlie LBA, namely medium type (mobile vs point-of-sales) and location-congruency (vs location incongruency) by showing that they differentially affect the efficacy of an ad. Like the studies presented in chapter 2 and 4 this study also makes use of a virtual supermarket. The results show that location-congruent ads result in increased choice for the target brand as compared to location-incongruent ads, independent of medium type. However, in location-incongruent situations, mobile ads attracted more attention than point-of-sales display ads.

In Chapter 6 we presented an ESM field experiment which investigates the effect of location congruent mobile ads on perceived intrusiveness, value, and relevance. A student application was developed to deliver daily ads for the University restaurant, which were either location-congruent or location-incongruent. During these four weeks daily offers were sent to 40 students, resulting in 107 responses from 23 out of the 40 participants. The results showed that location congruent ads were perceived as significantly more valuable and relevant, whereas no significant results were found for perceived intrusiveness. By investigating location congruence within a semi-experimental setting by using ESM this study provides new empirical insights with regard to LBA effectiveness.

DISCUSSION

Here we would like to take the opportunity to transcend the findings per chapter in order to look for consistency across studies and corroborate them with literature. When it comes to discussing the theory, we will focus on the construct of location-congruency, whereas when the methodology is concerned we will mainly talk about the comparison between the different reconstruction methods we have used. Both aspects were constants throughout the 5 studies and thereby lend themselves for a systematic review.

Reflection on location congruency

In sum, when looking back on the 5 studies we can cautiously state that location-congruent ads under certain circumstances tend to result in more favorable beliefs, intention and behavior regarding the ad: location-congruency reduces the perceived ad intrusiveness (chapter 2), increases both intention to buy the product (chapter 2) and actual buying behavior (chapter 4; chapter 5), positively affects attention[10] (chapter 5) and is associated with higher value and relevance (chapter 6).

At the same time there are some important reservations that also need to be considered. First of all, in chapter 5 we have shown that the positive effect of location-congruency cannot only be attributed to the mobile medium but also to POS-advertising. Furthermore, in chapter 4 we showed that location-congruency can have detrimental effects in case the ad is not goal congruent. However, more importantly, there were also certain circumstances under which location-congruency unexpectedly did not have an effect (chapter 3, chapter 4, chapter 6) which lead to inconsistencies regarding the impact of location-congruency on perceived ad intrusiveness across the different studies. Moreover, there was also an irregularity with regard to the relationship between location-congruency and perceived ad relevance (with our manipulation check) in chapter 4 and chapter 6. As a result, these findings demand some explanations and invite us to explore other psychological mechanisms through which the impact of location-congruency can be understood. Thereby our discussion regarding location-congruency serves two purposes: 1) create consistency among our research results 2) provide an overview of the different psychological mechanisms which could coherently explain the effect of location-congruency within the different studies.

Regarding the effect of location-congruency on intrusiveness, our initial assumptions were largely based on the groundwork of Edwards, Li & Lee (2002, p.86) who theorized that advertisements that are incongruent with their context ask for more cognitive processing capacity due to divergent knowledge structures. Because of the added processing demand, the recipient's freedom is threatened to continue with current cognitive activities which in turn results in reactance. Thereby advertising has the potential to be perceived as being intrusive when it complicates ongoing cognitive processes by interrupting the flow of the environment in which the ad appears (Li, Edwards & Lee, 2002). Nevertheless, only partly have we been successful in confirming

[10] except when mediated through mobile, then location-incongruent advertisements elicit more attention than location-congruent advertisements

the relation between location-congruency and ad intrusiveness within the context of LBA.

One possible explanation for the absence of an impact of location-congruency on perceived ad intrusiveness in chapter 4 and 6 is that the contextual aspects differed between these three studies. In chapter 6 we came to the conclusion that even though we classified the perimeter at the university restaurant as location-congruent, we were not able to control for the activities taking place at the location that could have negated the benefits of the ad being location-congruent. After all, even a location-congruent ad can still be perceived as intrusive when students are busy studying. In line with this possibility is the study from Banerjee & Dholakia (2008) which found that ads received in work related contexts (as opposed to leisure related contexts) tend to be perceived as more intrusive due to the cognitive mismatch. Similarly, in chapter 4 the discrepancy with regards to perceived intrusiveness could come from the particular task that was given to participants. The study used a closed task (a shopping task either being congruent or incongruent with the ad) as opposed to the studies in chapter 2 and chapter 3 which used an open task (pick 5 products of your own choice). It could very well be that the open task puts a higher cognitive load on the user as he or she needs to actively observe their environment and decide which product to buy. Consequently, stimuli that do not line up with someone's browsing behavior (e.g. incongruent ad) could result in a higher perceived intrusiveness as opposed to a situation in which the product selection has already been decided by the shopping list (like in chapter 4) resulting in a lower cognitive load and consequently in less cognitive disturbance.

An additional explanation for the different outcomes in perceived ad intrusiveness across studies could be found in the operationalization of the location-congruent and location-incongruent condition. There is the possibility that the contrast between these two conditions was too low to elicit a significant difference in the dependent variables. After all, since both conditions received an ad for the same supermarket, both conditions could have been perceived as equally location-congruent. Construal-Level Theory (CLT) seems relevant here, as it introduces the concept of psychological distance, which in part is next to temporal, social and hypothetical distance also determined by spatial distance (Liberman, Trope & Wakslak, 2007). More specifically, the effect of spatial distance seems to be discontinuous in nature, meaning that the psychological distance is not necessarily fixated to the exact physical distance but rather determined by the perception of spatial distance (Molitor et al., 2013). This could potentially explain why we did find a significant difference in Chapter 2 and 3 and not in chapter 4. As mentioned earlier the experiments in chapter 2 and 3 were

conducted in a supermarket that was mostly empty due to a limited product set with only a couple of filled aisles. One can imagine that the presence of filled aisles and empty aisles explicitly creates areas within the supermarket along which perceived spatial distance (inside the filled aisle, outside the filled aisle) could be manipulated. In contrast, a completely filled supermarket could just be perceived as one homogenous space thereby making it difficult to manipulate perceived spatial distance.

Based on CLT, it would have been better to operationalize our studies in such a way that the perceived distance for the incongruent condition is more distinct, thereby taking into account its discontinuous nature. Concretely, instead of looking at absolute physical distance, location-congruency could instead be operationalized by differentiating areas that stand in stark contrast with each other (e.g. inside and outside the supermarket, at the cash register vs aisles etc.) Interestingly, CLT also provides an extra explanation for the effect of LBA by hypothesizing that information which is perceived as spatially nearby results in more concrete (low) mental construals, which in turn leads to higher involvement and potentially higher purchase intentions (Luo, Andrews, Fang & Phang, 2014).

Alternatively, instead of looking at the negative effects of location-congruency on cognitive processing it might very well be possible that the effect of location-congruency on cognitive processing is positive in nature. For instance, the congruency-accessibility approach (Perry et al., 1997) also looks at the influence of context on cognitive processing. The theory explains that context-congruent ads activate familiar knowledge structures for processing the message, which leads to better understanding which in turn leads to a more positive reaction. Similarly, the processing-fluency model suggests that a person's attitude toward an object (in our case an ad) becomes more favorable when they can easily process that particular object (Lee & Labroo, 2004). One way of enhancing processing fluency is to place the object within a predictive environment (Whittlesea, 1993). Interestingly, Katz & Byrne (2013) apply CLT to processing fluency by asserting that the fluency with which a persuasive message is processed increases when the message caters to the spatial distance by taking into account the construal level that is associated to that specific spatial distance. In other words, the message becomes more abstract (e.g. from product price promotions to brand advertising) as the perceived spatial distance increases (or less abstract when the perceived spatial distance decreases). In all, it could be meaningful for future studies to also include dependent variables that are indicative for the positive effect on cognitive processing.

Nevertheless, we also need to seriously consider the possibility that ad intrusiveness is simply not sensitive to location-congruency. Besides our studies the

effect of context-congruency on perceived ad intrusiveness has only been proven within media contexts (Lee, et al., 2002; Edwards et al., 2002; Wehmeyer, 2007) and not yet with regard to the physical context. However, coincidentally in the meantime the LBA study from Lee et al. (2015) has been able to reproduce similar results as found in chapter 2. In their study they also found a negative relationship between location-congruency and perceived ad intrusiveness. However, in their case the contrast between their conditions was more distinct than within our experiments, which seems to add to our suspicion that the absence of an effect on perceived ad intrusiveness in some of our studies is not so much a result of an incorrect theoretical assumption, but a consequence of our operationalization of context-congruency. In addition, if perceived ad intrusiveness is not sensitive to the physical context, it would be at odds with its very definition namely the perceived disturbance as a consequence of the interference of ads with 'every possible environment in which ads appear' (Li et al., 2002).

Next to the effect of location-congruency on cognitive processing, we also want to address an inconsistency regarding the relationship between location-congruency and the perceived relevance of the ad. As mentioned earlier the results from chapter 6 suggest that there is a relation between location-congruency and relevance, whereas chapter 4 could not find a significant correlation between the two control variables, perceived relevance and perceived location-congruency. We initially started out with the hypothesis that location-congruent ads will be perceived as relevant simply because the advertised product is available (Pelsmacker et al., 2002; Kuo, Chen & Liang, 2009; Lee, 2010;). This is also in line with CLT, which supposes that objects that are psychologically close by, e.g. due to a small perceived spatial distance, generate more involvement which in turn could heighten its perceived relevance (Luo et al., 2014). However, on closer inspection, the causal nature of the relationship between relevance and location-congruency seems unclear as there are also scholars who associate relevance primarily with the goals and interests of the consumer in relation to the content of the ad (i.e. what the consumer receives) and not so much with the placement of the ad (i.e. where, when, how the ad is received; Heinonen, 2003; Baker & Lutz, 2000). Instead the placement, including location-specific elements, has more to do with disturbance/acceptance as a consequence of its direct influence on cognitive processing (Heinonen, 2003); basically what we have previously discussed. A similar distinction between relevance and context can be seen with the Relevance-Accessibility-Model of Baker & Lutz (2000). RAM predicts that an advertising message is most likely to be perceived as being useful when it is both relevant and accessible at a place and time when purchase is possible. Thus, it suggests that goal-congruency and

location-congruency, although separate constructs, are codependent in affecting one's perceived usefulness of the ad. When we apply these theoretical insights in hindsight, it seems that it offers a solution to our apparent inconsistency between chapter 4 and 6 regarding relevance. Firstly, RAM explains our general finding from chapter 4 where location congruency reinforced goal congruency's positive effect on buying behavior. In turn CLT can explain the effect in study 6; students at the school building (as opposed to not being at the school building) are more involved with the advertised product due to the low construals small psychological distance which resulted in a significant difference with the incongruent condition. However, the reason why we did not see a relation between location-congruency and perceived goal relevance (manipulation check) in study 4 as a consequence of CLT, is that the study's fixed preset task prevented the participant's goals to be affected by psychological distance. Consequently, we sacrifice the clear distinction between situation and relevance mentioned by Heinonen (2003), since we suggest that location-congruency has the potential to both affect one's relevance and cognitive processing depending on the flexibility of one's tasks/goals.

Apart from the quest for consistency, the objective of this theoretical discussion was also to arrive at a theoretical overview of the mechanisms responsible for the effectiveness of location-congruency. In summary, it seems that with the evaluation of location-based messages multiple psychological mechanisms could be at work simultaneously. Firstly, location-congruency can lead to purchase behavior by not only exposing consumers to goal-relevant ads but also at a moment and place where the product is accessible (Chapter 4; Heinonen, 2003; Baker& Lutz, 2000). Secondly, location-congruency possibly affects one's evaluation and behavior through its impact on cognitive processing, either by decreasing perceived ad intrusiveness by not letting an incongruent context get in the way of ongoing cognitive processes (chapter 2; Lee et al., 2002; Edwards et al., 2002; Lee et al., 2015), or by easing the cognitive processing of the message by making use of the predictive environment (Whittlesea, 1993). The third potential mechanism is that location-congruent ads tend to decrease the psychological distance (Luo et al., 2014) which in effect lets users form more concrete construals which in turn could lead to more involvement. Fourthly, although outside our previous discussion, but for the purpose of completing our theoretical overview, we also found preliminary evidence that location-congruency has the ability to prime through its semantic or conceptual match, resulting in increased attention towards the ad (chapter 5; Zanjani, Diamond & Chan, 2011). Lastly, we found that location-congruent ads have the potential to positively affect the perceived value by

influencing the consumer's cost-benefit analysis (e.g. chapter 6; Forman et al., 2009; Molitor; 2013).

On a theoretical level, our studies were mostly exploratory in nature. In the first place we were interested in investigating the impact of some underresearched contextual aspects. Nevertheless, it also gave us the opportunity to explore theories that could explain how location-congruent messages can have an impact on someone's beliefs, attitude and/or behavior. However, our proposed relation between location-congruency and construal level, processing fluency, perceived ad intrusiveness, relevance-accessibility and cost-efficacy are still based on circumstantial evidence and inferential and speculative arguments. Hence, we would like to conclude with a tentative research framework (see figure 2) which could function as a starting point for future research. More specifically future studies could systematically test these relations and consequently identify and disentangle the different psychological mechanisms responsible for the effectiveness of LBA and possibly pervasive applications at large.

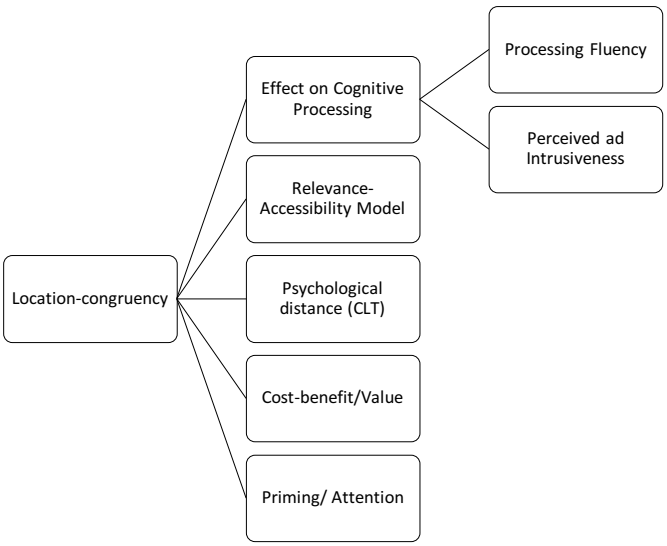

Figure 2. Tentative model for future research: overview of theories that could explain the effectiveness of location-(in)congruent ads.

Lastly, when it comes to future studies with regards to location-congruency and context-congruency in general we also recommend the inclusion of privacy concerns since LBA also relies on the use of personal information (e.g. current location, travel

path etc.). Various studies emphasized the importance of privacy concerns within the context of e-commerce (Ackerman, Cranor & Reagle, 1999; Barkhuus & Dey, 2003; Buchanan, Paine, Joinson & Reips, 2007; Spiekermann, Grossklags & Berendt, 2001). Studies that take privacy into consideration generally rely on the privacy calculus framework *"in which the potential risks of disclosing one's personal data are weighed against potential benefits of the data disclosure"* (Kobsa, 2007, p.646). In the case of LBA it suggests that tailoring messages does not only lead to increased benefits (value) and accessibility (RAM) as discussed previously, but also introduces perceived risks as a consequence of sharing one's location, or more generally referred to as privacy concerns, i.e. *"the desire to keep personal information out of the hands of others"* (Buchanan, Paine, Joinson, & Reips, 2007, p.158). Both these risks and benefits ultimately determine the acceptance of LBA. When investigating the relationship between perceived privacy concerns it is also important to consider aspects such as privacy concerns in general (Xu, Teo, Tan & Agarwal, 2009), trust towards the brand/service/vendor/app (Malhotra, Kim & Agarwal, 2004; McCole, Ramsey & Williams, 2010; Zhou, 2013) and covert or overt personalization (Aguirre, Mahr, Grewal, de Ruyter & Wetzels, 2015). We expect that with the inclusion of privacy concerns, the investigation of location-congruency (and goal-congruency) will result in a better theoretical understanding on the impact on behavioral outcomes.

Reflection on reconstruction methods

Apart from theoretical findings, our studies have also generated interesting methodological insights. With the five experimental studies we deployed three different approaches for reconstructing the different LBA use scenarios, namely a field study, video scenarios and virtual environments. All three approaches enabled us to recreate LBA scenarios. However, based on our experience and our literature study we were able to differentiate these methods based on their own advantages and disadvantages.

in terms of operational difficulty, we have seen that the use of video scenarios took the least effort in terms of data collection. In comparison, virtual environments relied on the CAVE setup, which demanded a significantly larger upfront investment, e.g. financial investment, setting up and configuring hardware and software and developing the virtual environments. Also collecting the data was more laborious as the CAVE setup required a more extensive briefing of participants, extensive monitoring of the CAVE system and troubleshooting in case of malfunctioning equipment. In our case the video scenarios were recorded inside the CAVE in order to

keep the visual stimuli as similar as possible between the virtual environments and video scenarios and thereby still relied on the development that went into creating the visual environment. Nevertheless, one can imagine that in other instances one could easily create these in a physical environment. The comparison with the field study is a bit more difficult due to the difference in setting and localization system. In terms of localization the field study used GPS which relies on an already existing infrastructure and does not demand any custom-made solutions which made things easier. However, in the case that we would have conducted a similar study in a physical supermarket, we would have needed the cooperation of a retailer plus the burden of developing and installing an infrastructure. Although in comparison the CAVE also demanded a large upfront investment, it is relatively easy to change environments, develop new applications, add new forms of interaction once everything is in place.

When looking at experimental control, both video scenarios and virtual environments offer significant benefits. Both give the researchers the opportunity to control the scene. However, there was a fundamental difference between the two since the video scenario offered no freedom of movement as everything was prerecorded whereas the virtual environment enabled the participant to move freely. Consequently, the video scenario ensured that every participant received more or less the same stimulus whereas the virtual environment resulted in slightly different stimuli from participant to participant due to making different decisions (e.g. by walking different routes). Thereby the coercion to get a participant at our trigger location (the location that triggered the location-based ad) was maximal with the video scenarios whereas the virtual environment had to use subtler and indirect forms, which is more close to the real-world experience. For instance, in chapter 2 we utilized the fact that our virtual supermarket had a limited product set enabling us to attract participants to the aisle that contained products. After all, people are likely to visit the aisle since the other aisles did not have anything to offer. Later, in chapter 4 we had to find other ways since by that time our supermarket was almost completely filled. Instead we chose a more visible and easily accessible location. Additionally, we placed empty cardboard boxes at some locations, in order to 'guide' participants and thereby increased the likelihood of the user reaching the trigger location. This exemplifies one of the many possibilities to control the environment. Also the ease with which assets within the environment such as the product set, trigger area, shelves, POS-material could be changed and manipulated showed the advantages of virtual environments. In contrast, the field study offered very limited control. As with many in situ studies real world situations tend to be messy and dynamic which potentially results in extraneous variables.

Furthermore, the accuracy with which we were able to trigger the ad during our field study (chapter 6) was significantly lower compared to the virtual environments (chapter 2,3,4,5). The field study was conducted at a university building which housed several levels. As GPS cannot differentiate between different levels, it became difficult to see whether participants were on the ground floor close to the canteen, or instead were at the top level. Moreover, GPS has a maximum accuracy of several meters to 1 meter. However, since the experiment took place indoors the accuracy dropped significantly. In the case of the virtual environment, trigger areas could be set with extreme precision. Apart from our first study, which relied on a preliminary solution, triggering the ad was also highly reliant. In case we would like to have a similar system in terms of reliability and accuracy in a physical setting, GPS would not suffice and instead once again would need to deploy a custom system (e.g. based on Wi-Fi or beacons).

There were also noteworthy differences between measurement methods. The field study had the benefit of being able to use ESM. Unlike post-questionnaires as used in the virtual environment studies, the use of the ESM enabled us to measure the dependent measures rather quickly after the stimulus which results in less distortion of the data as a consequence of time delay. However, this advantage of ESM is not inherent to the method of field studies as the use of mobile questionnaires could have also been applied to the CAVE. From that perspective, the CAVE actually is even better suited for direct forms of measurement due to the stable and controlled situation. Since the CAVE provided the participant with agency in terms of navigation and buying products, we were able to observe buying behavior. Since the video scenarios lacked any form of agency, we were only able to measure behavioral intention via the questionnaire. However, the full potential of direct measurement in the CAVE was also not fully utilized. Especially in chapter 5 the use of eye-tracking would have been helpful. Instead of measuring attention through proxies such as recall we would have been able to measure it directly, thereby improving the construct validity significantly. Unfortunately, at the time we did not have the necessary means at our disposal.

When it comes to conveying context, chapter 3 showed us that the video scenarios elicit less contextual awareness. Our manipulation check showed that participants in the video scenarios performed significantly poorer than the participants in the virtual environment study in recognizing the context in which the ad was received. As a consequence this could have hindered our manipulation of context-congruency which in turn could explain the absence of a significant difference between the conditions within the video scenarios based study. As stated by Donovan and Brereton (2011) “videos are not a straightforward reproduction of embodied activity –in

themselves video recordings 'flatten' the space of embodied interaction, they impose a perspective on unfolding action, and remove the embodied spatial and social context within which embodied interaction unfolds". Even though video scenarios have the advantage of being able to visualize a scenario (as opposed to verbal scenarios), video scenarios lack agency and space for embodied interaction as Donovan and Brereton stated (2011). Especially the latter is elementary to the evaluation and construction of attitude according to Schwarz (2007). In that respect the use of virtual environments is already a step in the right direction as they enable participants to actively navigate and pick products.

Nevertheless, despite these advantages, our operationalization also has its flaws with regard to ecological validity since the interaction with the virtual environment (e.g. human-joystick-navigation, manipulation of objects), the mediation (e.g. projection, limited image resolution, 4 point surround sound, no olfactory or tactile stimulation) and representation (e.g. absence of a complete product set in chapter 2, virtual objects are still distinguishable from physical objects due to resolution, no simulated social environment) differed from physical reality.

The virtual environment also differed from real life by not having any real consequences for the participants: people were not able to buy real products from the supermarket and it did not cost them real money which in the end may have resulted in different behavior. In contrast, chapter 6 presented a field study which made use of real products, offers and costed real money.

However, the discrepancy between our reconstructed scenarios and real life is not only caused by the lack of realism of our VR setup but is also the consequence of an issue we addressed earlier: experimental control. Usually studies in the field enjoy the lively context of everyday life (e.g. music playing, funny smells, familiar people walking by etc.) resulting in high ecological validity, thereby respecting the cognitive states that come with these complex situations. However, these settings make it on the other hand difficult to study effects in isolation with the possible risk of confounding variables. Thus, in the end this has less to do with the setup but more with the inherent methodological trade-off within experiments between internal validity and ecological validity.

LBA: the dawn of context-aware commercial advertising

In our introduction we have ascertained that as advertising progresses, it attempts to gradually combine the scale of traditional advertising with the contextualized and personalized approach from direct one-to-one marketing. At the moment LBA is the

epitome of that trend by enabling advertisers to tailor their messages to the location of individual customers on a massive scale. Nevertheless, LBA is just a manifestation of what is technically and commercially possible at the moment. When technology allows it, there are potentially many other contextual aspects that advertising could take into account.

As Bauer and Spiekerman's (2011) conceptualized model of context for advertising shows, there are other aspects next to location that make up the physical context of a consumer, ranging from local climate to atmospherics such as sound, sight, smell, taste and haptics. Moreover, besides the physical environment they also show that a system could also take into account properties of the consumer (e.g. task/activity, social environment consumer profile) or the commercial environment (e.g. product and service demand, product and service offering, advertising campaign).

However, in order to match the ad in real-time to these different aspects of the user's context, the necessary infrastructure needs to be in place. Fortunately thanks to advancements in ICT it seems that the computerization has not stopped at providing us with computer mainframes, desktop PCs and mobile phones; computing hardware (processors, storage capacity, networking capabilities, sensors, actuators, etc.) have become so small, cheap and capable that computing capabilities are increasingly integrated in everyday objects (cars, clothing, buildings, furniture, appliances etc.). As a result, engineers and scholars expect that we are currently entering the age of pervasive computing (also known as ubiquitous computing) in which computing converges with our environment (Weiser, 1991). The vision is a computing environment that is truly ubiquitous, automated, context-aware, adaptive, transparent and invisible (Saha & Mukherjee, 2003; Henricksen, Indulska & Rakotonirainy, 2002; Khan et al., 2011; Müller et al., 2011; Conti et al., 2012). Consequently, advertising running on this infrastructure, also known as pervasive advertising (Müller et al., 2011), gains the capability to thoroughly sense the user's context, adapt to it and even potentially respond through the environment in a much more sophisticated way (Khan, Bonné & Shahid, in press).

As the studies in this dissertation have shown, LBA has the potential to lower perceived ad intrusiveness and thereby possibly ease the circumstances under which advertisements are cognitively processed. In addition, it seems that LBA can also potentially direct attention and/or influence the perceived value and relevance of the advertisement. However, when it comes to inferring the intentions and goals of the consumer, location in itself is relatively weak as a proxy due to its ambiguous nature. After all, someone's location alone does not disclose their true intentions (e.g. am I at the train station to catch the train or to pick someone up?). In contrast, pervasive

advertising ideally has advanced analytics and algorithms and a wide variety of contextualized user data with high granularity at its disposal, which creates the opportunity to infer the consumer's intention with a significantly higher degree of certainty (Guangting & Junxuan, 2014).

However, since these systems tend to be progressively intimate and ubiquitous, user privacy, security and ethics becomes increasingly important. Hence Müller et al., (2011) provides a best practice guideline with regards to pervasive advertising; ideally it aims to be calm, in our interest, non-manipulative, overt and provides control to the user.

The use of virtual environments for the evaluation of pervasive advertising prototypes

During the realization of this dissertation the possibilities to collect data from the field have progressed significantly. As the research from Molitor et al. (2015) and Fang et al. (2013) illustrates, researchers now have the ability to access datasets from existing LBS and LBA platforms and thereby sidestep the difficulties of realizing the setup themselves. Furthermore, the lack of control is partly compensated by the large volume of data, which enables researchers to use more advanced statistical techniques to control for confounding variables.

However, despite the advancement of collecting data from the field, the advantages of virtual environments will probably remain. When we started out with our first studies LBA was still in its infancy, thereby making it difficult to make use of real world cases. Similarly, virtual environments could help with concepts which are hard to realize at the current moment due to technological and/or logistic limitations (Leichtenstern et al., 2010; Khan et al., 2011). As we have shown in our previous paragraph future pervasive advertising concepts tend to be more context-sensitive, adaptive, intimate and intricate and as a result more expensive, technically more complex, more interwoven with the environment and in some cases simply still unavailable. This will put researchers in a position similar to mine a few years ago. As with my research, virtual environments could once again enable researchers to simulate these concepts without the hassle of looking for technical infrastructure solutions. Thereby virtual environments become an interesting tool for prototyping pervasive advertising concepts. This is particularly interesting for the industry, as it always seeks cost-effective methods to innovate.

Furthermore, the use of virtual environments should not only fit a quantitative approach but could also be a useful instrument for gathering qualitative data. Instead of letting people only experience LBA for the sake of experimentation, it could also be used as a tool during qualitative interviews to confront them with contextual cues. Since LBA is highly context dependent, the inclusion of context could generate interesting answers and discussion. Moreover, CAVEs lend themselves perfectly for group interaction and collaboration since they are able to contain many persons (which is rather difficult with HMDs or desktop setups) thereby also creating the opportunity for focus group sessions regarding new pervasive advertising concepts (see Figure 2).

Fig 2. The CAVE confronts the focus group with contextual cues

Interestingly, it is expected that virtual reality will become much more common among consumers with the forthcoming launch of several consumer VR systems[11]. This offers a major opportunity for VR research as the endeavor becomes much more scalable; researchers only need to provide the software, whereas participants use their hardware. Consequently, consumers can participate in these kind studies from the comfort of their homes resulting in less manual interventions for researchers, lower maintenance costs and shorter data collection times.

Additionally, with the proliferation of these VR systems it might very well be that people will increasingly perform their daily activities in VR (e.g. shop, work, social

[11] https://www.yahoo.com/tech/virtual-reality-gets-real-sony-psvr-vs-oculus-171430549.html

activities and exercise). Ironically, the findings from these application evaluation studies in virtual environments could thereby also be meaningful for applications in virtual reality instead of only simulating real world scenarios. This could solve our issue discussed earlier whereby studies conducted in virtual environments do not have real life consequences (page 137).

In all, the future for application evaluation in virtual environments seems particularly bright due to the increasing demands to evaluate complex pervasive advertising prototypes and the increasing availability of high-quality VR systems. Both academia and industry could benefit greatly from the implementation of virtual environments in their research toolkit. Nevertheless, these research endeavors should go hand in hand with constant validation in order to guarantee valid results.

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AUTHOR CONTRIBUTIONS[12]

Chapter 2

AH reviewed the literature, conducted all studies, analyzed the data, wrote all the drafts and conference papers, revised manuscript based on reviews. AL, JK, PK provided feedback on all drafts. Conceptual design: AH, JK, PK

Chapter 3

AH reviewed the literature, conducted all studies, analyzed the data, AH wrote all the drafts and conference paper, revised manuscript based on reviews. AL, JK, PM, PK provided feedback on all drafts. Conceptual design: AH, JK, PK, PM

Chapter 4

AH, JR reviewed the literature, AH conducted the study, AH, JR analyzed the data, JR wrote all the drafts and conference papers, JR revised manuscript based on reviews. AH, ER, JK, PM, PK, RK provided feedback on all drafts. Conceptual design: AH, JR

Chapter 5

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Chapter 6

AH reviewed the literature, AH, JK, NB conducted the study, AH, RK analyzed the data, AH wrote all the drafts AH revised manuscript based on reviews. ER, JK, JR, PK, PM, RK provided feedback on all drafts. Conceptual design: AH, ER, JK, JR, PK, PM

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SUMMARY

This dissertation investigates the effectiveness of location based ads by looking specifically at the influence of location-congruency (location congruent vs location incongruent), goal congruency (goal congruent vs goal incongruent) and medium type (mobile vs point-of-sale) on various cognitive, attitudinal and behavioral outcome variables. In addition, the five studies we report provide methodological insights on context-reconstruction methods since we utilized various approaches for the data-collection: virtual environments; video scenarios; and a field study.

Study 1 investigated the effect of location-congruency within a location-based advertising app in a virtual supermarket through two lab experiments. In addition, we elaborated on the use of a virtual environments to reconstruct the LBA use scenario. The results show that context-congruent ads decrease the perceived ad intrusiveness. Furthermore, participants who received a congruent ad tend to form more positive attitudes toward the application and in turn are more likely to use the application in the future and more likely to buy the advertised product.

Study 2 positions itself as a methodological meta-analysis, by comparing our former experiment based on virtual environments to an experiment based on video scenarios which also studied the effect location-congruent ads have on perceived ad intrusiveness. A significant difference was found in the ad intrusiveness experienced between the two experimental groups in the VE, as opposed to the video scenario study where no difference was found, and additionally both congruent and incongruent adverts were evaluated more negatively. We argue that the extra effort required for evaluation of location-based applications using virtual environments is justified by its suitability for conveying context and obtaining both attitudinal and behavioral feedback and its potential for soliciting feedback based on actual rather than imagined experiences by participants.

Study 3 investigated the interaction between location and consumers' goals. A 2 (location congruence) X 2 (involvement) experimental design was employed. The results show that location-congruent ads resulted in more purchases than the location-incongruent ad, but only for highly involved participants. Furthermore, in the case that participants were not involved location-congruent ads seem to lead to more negative attitudes than incongruent ads. These results suggest that it is only profitable for advertisers to send 'local' messages when these messages are involving.

Study 4 disentangled medium type (mobile phone vs point-of-sales) and location-congruency (vs location incongruency) by showing that they differentially affect the efficacy of an ad. The results show that location-congruent ads result in increased choice for the target brand as compared to location-incongruent ads, independent of medium type. However, in location-incongruent situations, mobile ads attracted more attention than point-of-sales display ads. The advantages of LBA thus do not seem to come from medium type, but rather from the congruency between the ad and product location. Only when the ad is received at a different location than the product, the mobile medium is able to enhance consumers' ad attention.

Study 5 investigated the effect of location congruent mobile ads on perceived intrusiveness, value, and relevance by conducting a field-test employing the Experience Sampling Method. A student mobile application was developed to deliver daily ads for the University restaurant, which were either location-congruent or location-incongruent. During these four weeks daily offers were sent. The results showed that location congruent ads were perceived as significantly more valuable and relevant, whereas no significant results were found for perceived intrusiveness.

CURRICULUM VITAE

Arief Ernst Hühn is of German-Indonesian descent and was born (28th of September, 1984) and raised in The Netherlands. He did his Bachelor and Master in Communication Science at the Radboud University in Nijmegen/The Netherlands, where he specialized in advertising, media psychology and Human-Computer Interaction. During this period he was involved as a guest researcher at the media lab of NHTV University of Applied Sciences/The Netherlands. He finished his master's thesis (cum laude) on the evaluation of location-based advertising apps using hybrid simulations for which he won the Hans du Chatinier Best Student Paper Award in the field of communication in the Netherlands. He also received a nomination for the Best Student Paper Award at the International Conference on Research in Advertising (ICORIA 2011, Berlin). After completing his master's continued working as a researcher and lecturer at the NHTV University of Applied Sciences in Breda while pursuing his PhD. Currently, Arief works as a senior researcher and expert for Freedom Lab in Amsterdam and Dasym Investment Strategies in Naarden.

PUBLICATIONS

Journal papers:

van't Riet, J., Hühn, A., Ketelaar, P., Khan, V. J., Konig, R., Rozendaal, E., & Markopoulos, P. (2016). Investigating the effects of location-based advertising in the supermarket: Does goal congruence trump location congruence? *Journal of Interactive Advertising*, *16*(1), Taylor & Francis, 31-43. DOI= 10.1080/15252019.2015.1135089 (chapter 4)

Ketelaar, P. E., Bernritter, S. F., van't Riet, J., Hühn, A. E., van Woudenberg, T. J., Müller, B. C., & Janssen, L. (2015). Disentangling location-based advertising: the effects of location congruency and medium type on consumers' ad attention and brand choice. *International Journal of Advertising*, Taylor & Francis, 1-12. DOI=10.1080/02650487.2015.1093810 (chapter 5)

Hühn, A.E., Khan, V. J., Ketelaar, P., van't Riet, J., Konig, R., Batalas, N., Rozendaal, E., & Markopoulos, P. (accepted with revisions). Does location congruence matter? A field study on the effects of location-based advertising on perceived ad intrusiveness, relevance &value. *Computers in Human Behavior,* Taylor & Francis, xx-xx. (chapter 6)

Conference papers:

Hühn, A.E., Khan, V.J., Lucero, A., Ketelaar, P. (2012) On the Use of Virtual Environments for the Evaluation of Location-Based Applications. In *Proc. of ACM SIGCHI Conference on Human Factors in Computing Systems* (CHI2012). ACM, New York, NY, USA, 2569-2578. DOI=http://dx.doi.org/10.1145/2207676.2208646 (chapter 2)

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