Usability for Blended Shopping
Solving Major Flaws by Applying Usability Engineering and Proven Integration Technologies

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Abstract: The relevance of usability with regard to Blended Shopping concepts is addressed in this paper. First an introduction into usability as a crucial acceptance factor for applications is given. Then Blended Shopping - the combination of traditional retail and eCommerce – in practice is analyzed. Research findings presented reveal that merchants do not apply Blended Shopping concepts in practice until now. It is assumed that usability flaws are one of the main barriers for Blended Shopping. Different dimensions of usability problems that prohibit a wide acceptance among users are explained and analyzed. Then a methodological approach is suggested to address vertical problems. A technology-driven approach to address horizontal problems is described. The paper will close with a future outlook.

1 INTRODUCTION

During the past few years it became subject of research to combine traditional retail and eCommerce. Approaches like Blended Shopping (e.g. Fuchs & Ritz, 2009a; Fuchs & Ritz, 2009b; Fuchs & Ritz, 2011) focus on this issue. In the article at hand we introduce related usability issues and closely examine missing interaction standards for Blended Shopping applications.

We start with an brief introduction into usability and engineering methods to guarantee a high level of usability, which is crucial for a significant acceptance level of IT soluctions. Then Blended Shopping is introduced. A short overview of Blended Shopping field studies is given. The analysis of research results reveals that there is a lack in conformance with users expectations which is a major usability demand. The reasons for this are investigated in this paper. Next to a lack in interaction standards and patterns we assume that especially the technical integration of mobile Commerce solution in the physical shopping world does not respect usability issues. QR Codes as one representative connecting technology is investigated in more detail. the paper delivers methodological approaches to cope with different dimensions of usability problems. The proposed methods would result in a significant higher level of fulfillment with user expectations and emphasize the ease-of-learning paradigm for the use of QR-Codes as integration technology between virtual and physical world. The paper ends with an outlook on future research.

2 USABILITY

Acceptance and success of software solutions depend i.a. on usability. Usability refers to “the degree of effectiveness, efficiency, and satisfaction with which specified users can achieve specified goals in particular environments” (see DIN/ISO 9241-11). Effectiveness is understood as the accuracy and completeness with which specified users can achieve specified goals in particular environments. Efficiency describes the resources expended in relation to the accuracy and completeness of goals achieved. Satisfaction means the comfort and acceptability of the work system to its users and other people affected by its use. In this context, process models have been established that consider usability as a performance measure throughout the entire product life cycle. These

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process models are summarized under the term Usability Engineering (Mayhew, 1999). Only with a deep understanding of the cognitive processes of the end user the mental thought processes can be transferred to interactions at the computer. This guarantees expectation conformity of the user interface (Norman & Draper S., 1986).

While user interface design addresses mainly the visual design of the user interface, Usability Engineering describes both the development of interactive systems and the design of appropriate functions and user interactions in a specific use context. It influences the design surface but is not limited to it. Besides usability recent software development increasingly aims to satisfy the customer when using the newest developments. This is dedicated to the field of user experience. User experience describes the perception and reactions resulting from the actual and / or expected use of an application (see DIN/ISO 9241-210). This adds a hedonic component. Experience includes cognitive, affective, emotional, social and physical responses from the user regarding the application. Aesthetics, fun, functionality, enjoyment and personal development (Hassenzahl, 2004) and brand image influence the user experience. The developments of the past show that not only interaction design domains enjoy user experience as seen by the success of the Apple iPhone (Koskinen & Keinonen). At a first glance user experience influences mainly interaction and interface design, but also has impact on user documentation, support and maintenance. In order to meet those requirements, the user's strengths, limitations, preferences and expectations are taken into account (DIN/ISO 9241-210). Usable systems and products tend to be more successful in commercial and technical terms (DIN EN ISO 9241-210). An easy-to-use system that supports the user in his tasks can save training cost and can help to reduce support and service cost.

User-centered or human-centered design was coined by Donald Norman (Norman & Draper S., 1986) in the 80s of the last century. This design philosophy takes the users' needs as a basis from the start when developing software. It indicates the procedure to ensure usability in the development of interactive systems. This is done with the help of skills and techniques of ergonomics and usability (DIN EN ISO 9241-210). User-centered design is based on the idea that a specific solution is not supposed to satisfy all people in general, but the specific user. The knowledge about the user enables the developer and designer to consider usability aspects and helps to increase the chance that the user accepts the new development. Following the field of Blended Shopping is introduced and usability problems in this area are identified.

3 BLENDED SHOPPING

Until some years ago traditional retail sale was the distribution channel mostly used for consumer goods. Then eCommerce became well-stablished (Laudon & Traver, 2008). When retailers with a branch network started to enter the digital sales channel they often organized and offered eCommerce separated from their branches (see figure 1).

Blended Shopping is the idea to respond to the changed shopping behavior of consumers (Hudetz, 2011) by combining all sales and communication channels to benefit both, retailer and consumer. Blended Shopping is understood as the "execution of the transaction phases (information, mediation, negotiation, contracting, fulfilment and after-sales) involving both, real sales and presentation mechanisms as well as network based sales functionality" (Fuchs & Ritz, 2009a). A couple of available approaches deal with issues like no-line commerce (Heinemann, 2013), multichannel or omnichannel (Institut für Handelsforschung, 2008), but they focus on different levels of integrating processes.

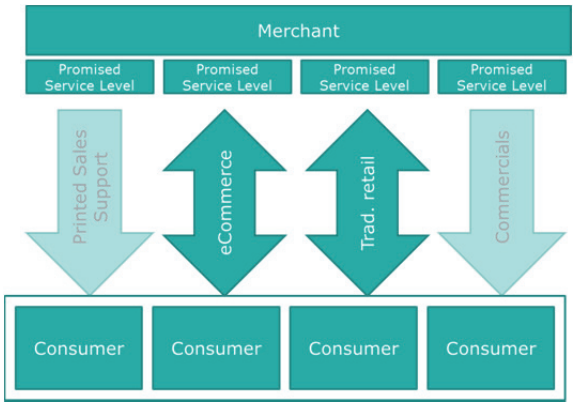

Figure 1: Separated channels.

In this paper the definition of the term Blended Shopping is used with regards to former publication in this field. Figure 2 illustrates the idea of Blended Shopping in comparison to the traditional approach (figure 1).

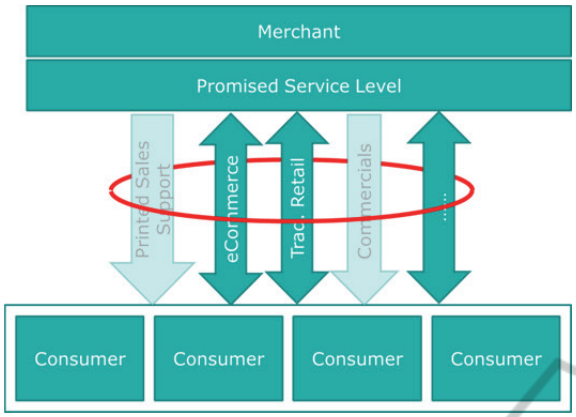

Figure 2: Blended shopping.

Since 2008 we study the penetration of Blended Shopping approaches in practice. The first field study was published in 2009 (Fuchs & Ritz, 2009a). The field study focused on the integration of processes as an enabler for Blended Shopping approaches. As one outcome it revealed that integrated processes were not established by merchants in 2008. Since then yearly test purchases show that this outcome is still valid.

Based upon this first study we analyzed the linkage (e.g. by QR-Codes) between newspaper ads or other printed sales material used in branches and eCommerce (Fuchs & Ritz, 2009b).This second field study found out that no linkage between printed sales material and eCommerce (e.g. with the help of QR-Codes) was offered in 2009, even in cases where advertiser had an online shop or web site. Latest updates of the second field study revealed that trade chains start to employ QR-Codes to link printed sales ads to products.

Many traditional retailers feel threatened by eCommerce competition but miss to take advantage from their position in local shopping environments. Every single city center merchant competes with huge internet retailer like Amazon showing one face to the customer but involves different distance sellers. To use a joint appearance as a merchant community mapping the real city center to the virtual world could strengthen the competitive position of all local merchants. Those approaches would fit in the top right rectangle of the matrix shown in figure 3 (Blended Shopping 2.0). Blended Shopping 2.0 will be addressed in subsection 5.3.

In general developing Blended Shopping concepts requires a lot of analytic capabilities and flexibility of merchants to enter this new field.

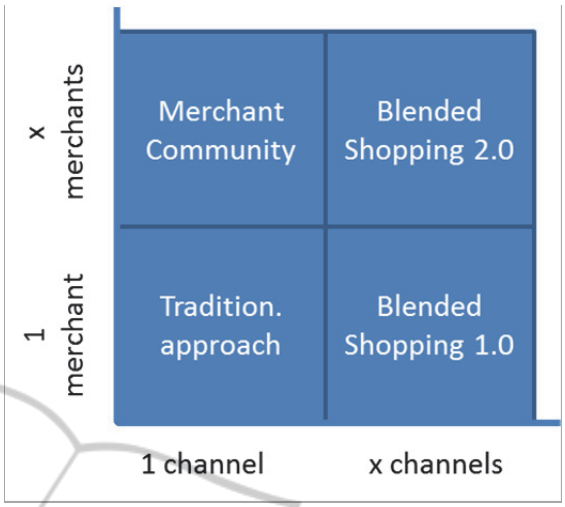

Figure 3: Blended Shopping matrix.

Besides this, merchants have to deal with the problem that no expectation conformity is established yet. According to ISO 9241-110 expectation conformity is given when a dialog is consistent and "corresponds to the user's characteristics, for example his domain knowledge, his education level and experience as well as the generally accepted conventions." (International Organization for Standardization). This definition refers to established factors. Blended Shopping is not offered often by merchants. Consumers don't have experience with Blended Shopping and don't know what to expect from it. This lack in expectations leads to a lack in demand which does not force merchants to satisfy consumer demands. Based on all research results in the described areas we identified main usability problems that block the dissemination of Blended Shopping concepts. Those are described in the following section.

4 USABILITY PROBLEMS

We identified two dimensions of usability problems (see figure 4).

1. Users are confused by the Blended Shopping process. Our research will show that this is a result of heterogeneous attempts (referred to as vertical usability problems).
2. Additionally, users are confronted with new integration technologies like RFID, NFC and two-dimensional barcodes like QR-Codes. The research will reveal a lack of user acceptance (referred to as horizontal usability problems).

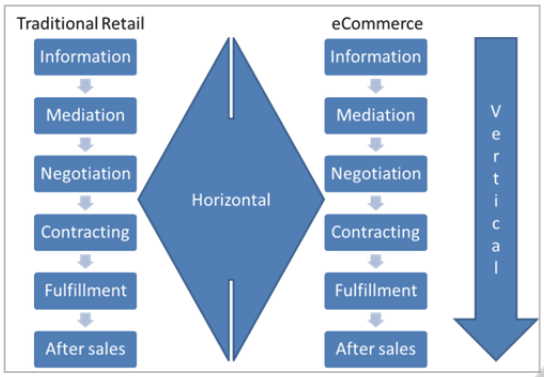

Figure 4: Usability Problems.

4.1 Vertical Usability Problems

As shown in subsection 3.2 first merchants start to seize the idea of Blended Shopping and develop own concepts. As mentioned the attempts are more in an experimental stage. Thus the results are very heterogeneous regarding their interaction concepts and process organization.

Every merchant decides on his own which process steps are blended. One decides that return of goods ordered in the webshop is excluded, others allow it. In the end the consumer never knows what to expect. Because of this diversity consumers were not able to establish an expectation towards Blended Shopping so far. When developing IT solutions and taking usability into consideration it is important to know about the users (as explained in section 2) and their expectations regarding surface and interaction of an application. Interaction concepts of different platforms result in a platform-dependent "user experience" for every user. To achieve a high degree of expectation conformity usually developer need access to this user experience. Otherwise development projects result in applications that work technically but neither can exploit the potential nor generate a high degree of recognition.

Users often have a very unique picture and understanding of what they do and what the system can do. This phenomenon is reflected in dealing with everyday things as well as in the use of software applications. Their mental model may differ from the actual functionality – e.g. the idea of electricity as something that flows through the power line is popular. Even if this is technically not true it does not hinder the use of electricity. Such ideas are first "sticky" which means that the information is difficult to convey (Hippel & Katz, 2002). Particularly when developing solutions for new usage scenarios for users with no available compilation of expectations such as Blended Shopping, a lot of experience is required. In subsection 5.1 we will present a methodological approach which allows:

- To derive added value Blended Shopping scenarios
- To derive user profiles to prepare custom tailored experience
- To derive usability requirements

4.2 Horizontal Usability Problems

To address the second problem area we assume that the strongly growing popularity of smartphones leads to a mobile use of Blended Shopping possibilities. That means that we have to deal with ways to connect "the Internet" to the branch with the help of mobile phones. There are different technologies to establish interaction between customer and merchant (or his products / services), namely e. G. iBeacons, RFID, (RFID Basis, 2012), NFC (Gartner Group, 2013), Barcodes, QR-Codes. While iBeacons, RFID and NFC use wireless connections (radio frequency) codes operate optically. The main advantages of optical methods are that the production costs are very low and that the necessary applications are already relatively wide distributed. Mobile tagging with QR-Codes allows context-sensible linking and is easy to implement into organizational processes. In the field studies we found out that two-dimensional codes are increasingly employed by merchants. In subsection 5.2 we will transfer already available research on the usability of QR-Codes to Blended Shopping and enrich the known findings by individual requirements resulting from Blended Shopping field of application.

5 SOLUTIONS FOR THE USABILITY PROBLEMS

After describing the usability problem fields in section 4 we now suggest approaches to overcome those problems. Again, we address vertical (subsection 5.1) and horizontal (subsection 5.2) problems and describe then an overall approach in subsection 5.3.

5.1 Integrated Method to Cope with Vertical Usability Problems

A possible solution for vertical usability problems described in 4.1 is to apply available approaches consequently (see figure 5).

1. Situation and basic conditions of merchant and product portfolio have to be evaluated as a basis for the development of appropriate Blended Shopping concepts. This can be done with the help of a method presented at WEBIST 2011 (Fuchs & Ritz, 2011) which offers structured guidance in the field of product information systems but demands individual assessment of each situation. Three core factors were identified:
   - Customer
   - Product
   - Shopping experience.

   The factors customer and product are closely connected. The product influences the customer's information demand. Involvement (Nieschlag, Dichtl, & Hörschgen, 2002) may be used to distinguish products on the basis of the consumer's motivation to select and handle product-related information. Products with high involvement like smartphones need another kind of product information system compared to low involvement products like shampoo (Kuß & Tomczak, 2007). Additionally shopping experience which should be created by the product information system is emphasized in the described method. Shopping experience (Weinberg, 1992) is understood as a subjectively sensed contribution to the consumer's quality of life generated by a product, service, sales conversation or anything related to the product presentation. The introduced method allows the evaluation of the product information system requirements in a given framework (product, situation) and supports the development of realization approaches (e.g. mobile or terminal solution, shape, necessary features,…).
2. User, use context, conditions like light, weather, connection to network, etc. have to be methodically surveyed. The tool supported requirement analysis (Damm, Ritz, & Strauch, 2010), (Ellerweg & Ritz, 2008) may be employed to do so. In general the determining factors when developing mobile solutions have to be taken into account (Ritz, 2007).

The results of step 1 – reasonable Blended Shopping use cases with regard to product, merchant and user characteristics – and step 2 – context model, with regard to user profile, technical infrastructure and location characteristics – allow to derive usability requirements for the pursued Blended Shopping solution. Then it is possible to define tasks and appropriate usability goals, assign measures and thresholds. The usability requirements aim to serve as guidelines for the developer and later additionally as acceptance criteria to document fulfillment.

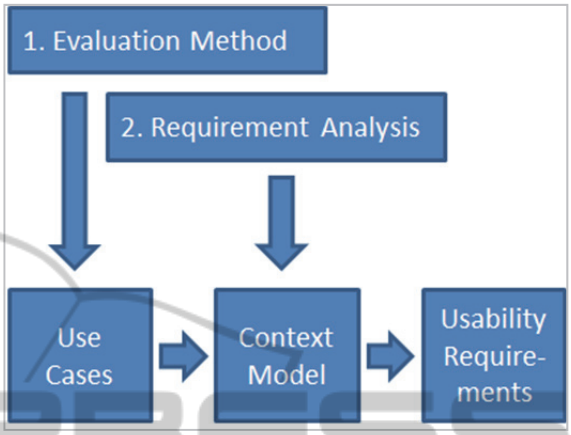

Figure 5: Integrated method.

5.2 Usability Requirements for Applying QR-Codes to Cope with Horizontal Usability Problems

QR-Codes as a bridging technology were described in subsection 4.2. As explained we assume that a lack of user acceptance leads to a hesitant use in practice. Already in our second field study in 2009 we analyzed the process of linking eCommerce to the printed sales support. In the paper at hand we transfer the findings with regards to usability from paper-eCommerce to traditional retail-eCommerce (Blended Shopping) where it requires a reasonable and derived style. Usability is an important success factor for the implementation and dissemination of mobile tagging. When a 2D-Code for example can't be read several times, the user probably will not test this technology another time.

Possible reasons for failures can be a too small printed code, a bad cell phone camera and poor lighting conditions. Depending on the size of the printed code the angle at which one stands to the printed QR-Code is important as well as the contrast ratios and the size of the neutral (white) frame. In the survey several scenarios of the usability of QR-Codes in daily routines were tested. As an example following scenarios are described in which mobile tagging can come to use. The situations have in common that

- the user's hands are free (e.g. holding newspaper)

- the user might consume something alongside (coffee, breakfast, wine, etc.)
- the user has a mobile phone with camera, internet access and tag reader with him/her.

The selected situations might be different in light, seat position and position towards the QR-Code. Figure 6 and 7 show two different situations of the same use context: the user tries to scan a QR-Code with different lighting conditions, positions to the QR-Code, time pressure, etc.

Figure 6: Example usability test A.

Figure 7: Example usability test B.

Figure 6 shows a user sitting at a table for breakfast. She tries to get the first news of the day with the newspaper next to the plate or in the hand while eating. Figure 7 shows a user reading at home after work, reading the newspaper to relax in an unhurried way while sitting in an armchair. Here, lighting, seating position, attitude towards the newspaper, web access and permitted time for the scanning process are different and influence the usability as well as the quality of the printed QR-Code, sometimes dependent on the quality of material printed on (e.g. crinkled paper). The readability and fault tolerance was tested as showed in figure 8. The picture does not refer to a usual usage context but is customized for testing.

The test results revealed that QR-Codes with a white frame – the so called quiet zone – with the size of 4 mm can be scanned fast. Giving access to the website via Wi-Fi is efficient with the established tag reader. Mobile tagging works very reliable. QR codes without the quiet zone are difficult to scan and thus unreliable in practice. Mostly it does not work at the first attempt. Because such a high error rate would frustrate the user it is necessary to

- print QR-Codes always with a quiet zone
- print QR-Codes at least at a size of 4x 4 mm including the quiet zone.

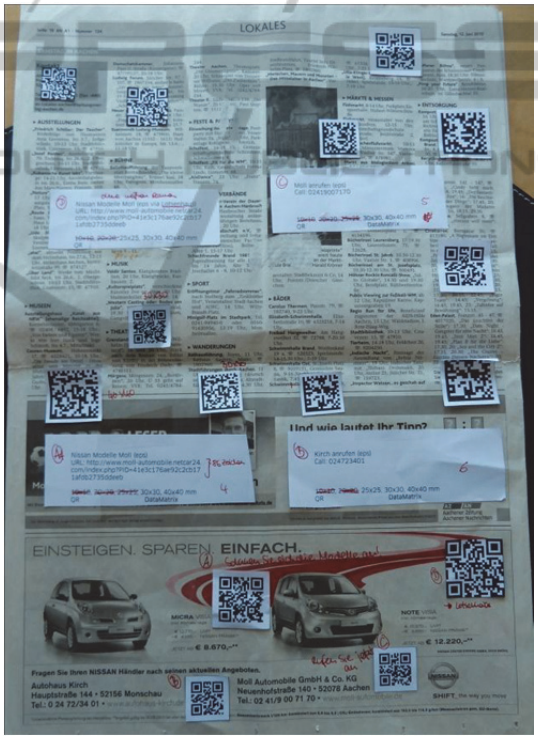

Figure 8: QR-Code tests.

Some tag generators automatically add the quiet zone, such as at the Tagnition generator. The results regarding the flexibility of camera angle during the scanning process (tilting of the camera to the side or to the front or rear) reveal the trend that QR-Codes allow the necessary flexibility of up to 40° to the side and to the front and to the rear (distance between code and camera about 10-15 cm).Users should not scan the code slantwise. Since it is not always possible to influence users it is preferred when technology forgives mistakes. Even in mobile

scenarios, e.g. when movements or tremors of the hands prevent a steadiness of the mobile phones, QR-Codes can be easily scanned. Only the time will be affected by movements, mistakes do not occur. There was not a single test situation in which a code could not be decoded. The same result was recorded for crinkled paper and minor damages of the code. The findings of the paper-eCommerce use context responds to the shop-eCommerce use context as follows:

- In order to offer Blended Shopping, QR-Codes have to be made accessible for consumers. The tests regarding readability and quality requirements can be transferred.
- The focus for Blended Shopping scenarios base upon the idea that mobile devices are used. The tests regarding flexibility of camera angle and mobile context are relevant in this context as well.

Additionally it is necessary to add a further element. As explained in the paper consumers are not used to QR-Codes in shops. They don't know what to expect. To create expectation conformity it is necessary to introduce the aim of the code ("here you get further product-related information", "here you can purchase"). Depending on the target group it might also be necessary to introduce the use process ("Step 1: introduce a QR-Code reader; Step 2: scan the QR-Code,…). Novice users have to be put in the position to take advantage of the offered technology and get advice how to do so.

Finally requirements resulting from technical conditions have to be defined and tested (e.g. is it possible to have access to network in the underground sales rooms). This is a clear linking point to the proposed methodological approach in 5.1. In total the comparison of the paper-eCommerce tests revealed that QR-Codes are a suitable technology for Blended Shopping concepts (shop-eCommerce context) with necessary enlargements.

5.3 Blended Shopping 2.0 Approaches to Address Usability Problems

In subsection 3.2 we assumed that merchants and consumer could take advantage from Blended Shopping 2.0 approaches.

Such approaches combine the processes of traditional retail and eCommerce of a merchant community, e. G. of a city center (see figure 9).

The overall aim is to motivate consumer to purchase in their local city center by addressing their needs (e. G. convenience, shopping experience). An approach to do so would be to organize the distribution of shopped goods in the background while the consumer continues to go shopping in the city center. Another approach could be to support the consumer to select matching clothes and make it easier to take advice from social groups by establishing a joint dressing zone or an interactive dressing room. Those approaches need to be evaluated regarding cost, feasibility, needed infrastructure, legal and organizational impacts. Methods to do this in a structured way are currently developed in our research group.

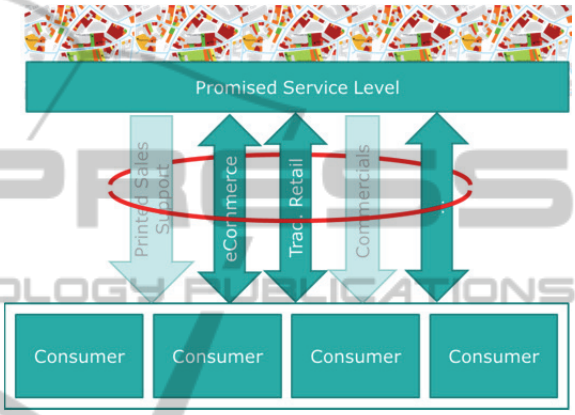

Figure 9: Blended Shopping 2.0.

In general Blended Shopping 2.0 approaches could help to solve vertical and horizontal usability problems. Vertical usability problems can be overcome when the city center merchants agree on a kind of standard regarding Blended Shopping processes. Then consumers know what can be expected from city center Blended Shopping (meeting expectation conformity).

Additionally the city center merchants would have to agree on a standard interaction technology which could increase the acceptance level. Cooperating in Blended Shopping 2.0 concepts could enable merchants to offer outstanding shopping experiences and services to consumers which would strengthen the USP of the whole city center and thus of every single merchant.

6 SUMMARY AND OUTLOOK

The paper started with reminding the potential of integrating traditional commerce and eCommerce into integrated Blended Shopping scenarios. Field studies indicate that there are still usability flaws which prohibit a wide range of user acceptance.

Within this paper the usability problems are categorized in two groups. The first one represent flaws which result from the fact that the solutions recently found are more experimental. Thus the user cannot rely on known interaction patterns and that is why user expectation is hard to fulfill. The second group of usability problems could be assigned with integration technologies to link the physical world with the virtual one. For the problem category an integrated methodological approach was presented, which support reasonable concepts taking user profiles and special characteristics of the product into account. For the second category usability requirements for the usage of QR-Codes are transferred to Blended Shopping and more precisely to the usage of a link from the merchant in the city center to the virtual world. These findings were amalgamated by individual requirements resulting from the field of application. Then Blended Shopping 2.0 is described to jointly address both problem categories. In future research we will extend both problem solution attempts. The vertical problems will be tackled by deriving interaction patterns for Blended Shopping scenarios which could be used as building blocks and deliver a de facto standard in future. Further research for integration technologies will extend our research to new technologies like NFC or Bluetooth based technologies as Beacon. Additionally we focus on developing an evaluation method for Blended Shopping 2.0 scenarios.

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