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Research in Progress

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Abstract. Physical retail faces the challenge of remaining attractive to customers in the age of e-commerce. In-store navigation systems are one way to mitigate this issue. These software systems allow customers to be navigated through the retail store. We derive design requirements (DRs) for in-store navigation systems based on eight interviews with customers and employees of furniture stores. We illustrate the implementation of the DRs in a conceptual prototype designed with the platform "Hololink." Initial evaluation results (n = 20) show that customers perceive such a solution for physical retail as mainly positive. We contribute to research and practice by showing how to design in-store navigation systems.

Keywords: In-Store Navigation, Augmented Reality, Retail, Requirement

1 Introduction

Due to the rise of e-commerce, physical retail got under pressure (Hagberg et al., 2016; Northington et al., 2021). Retailers get into economically difficult situations. Sales move into cyberspace, and shops in cities are closing down or moving to the outside areas of the cities (Deckert and Wohllebe, 2021). Customers get used to the convenience of online shopping; thus, they also expect hassle-free shopping and rich user experiences in physical retail (Barann et al., 2022; Betzing et al., 2019). Studies show that customers are frustrated when they can not find products in the store or service personnel are unavailable to help them (Alexander and Alvarado, 2017; Riegger et al., 2021). In-store navigation is a solution to counteract this frustration and to meet the customer expectation of hassle-free shopping to improve customer experience. Such systems enable customers to quickly find the products they are searching for by showing the customer directions within the store (Deckert and Wohllebe, 2021). Betzing et al. (2019) mirrored different e-services for physical retail and investigated customers' likelihood of using them. The study shows that 80% of customers are likely to use in-store navigation systems in physical retail (Betzing et al., 2019). For future research,

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they suggest building upon the discovered insights by designing pilots of those promising technologies. We pick up on this research gap and aim to identify factors that promote the use of an in-store navigation system and to capture these as initial design requirements (DRs) that aim to guide future developments of in-store navigation systems. Since in-store navigation offers added value, especially in large stores where products are not easy to find, we use furniture retail as a use case. We address the following **research question (RQ)**: *How can an indoor navigation system for furniture retail be designed to foster user experience and customer satisfaction?* We focus on user experience (UX) because it is a critical success factor for accepting this novel technology (Robier, 2015). We assess customer satisfaction because this variable is crucial for retailers, affecting customers' retention and loyalty toward a store (Inman and Nikolova, 2017). In this research-in-progress, we showcase the application of our DRs in a conceptual prototype and provide the first results of its evaluation.

2 Research Background and Related Work

In-store navigation systems are digital software products applied in (large) retail stores aiming to simplify locating specific departments or items, which may reduce customers' dissatisfaction with being unable to find what they are searching for (Merkle, 2020). Studies show that the likelihood of customers using search and navigation systems, including in-store navigation, product exploration, and product recommendation, is high (Betzing et al., 2019; Márquez and Ziegler, 2023; Merkle, 2020). In-store navigation systems often rely on augmented reality (AR) to offer a live view of additional information or virtual objects in physical environments (Merkle, 2020; Tan et al., 2022; Xue et al., 2023). They help to visualize non-existent, virtual objects in the physical world, e.g., via cameras. This enables a live view of the real environment complemented with movement-responsive virtual elements (Tan et al., 2022). In-store navigation systems with AR can be used from tablets, smartphones, head-up displays, or AR-Glasses (Cesinger et al., 2020; Tan et al., 2022). While the first commercial in-store navigation solutions exist, they are not widely implemented. According to a representative study by Linzbach et al. (2019), only 32% of German consumers know such systems and only 10% have ever used them. Despite the outlined potentials, prescriptive design knowledge of in-store navigation systems is lacking (Betzing et al., 2019). A recent review shows that in-store applications are rarely considered in the literature on AR in retail and do not focus on navigation but on other features like product presentation (Riar et al., 2021). Some studies deal with the technical requirements of in-store navigation systems (e.g., Cruz et al., 2019; Molina et al., 2018), but there are yet no design science research (DSR) studies that propose DRs while highlighting users' and retailers' needs. We take a first step toward reducing this research gap.

3 Methodology

We follow DSR by first deriving DRs (as a level 2 artifact) and showing how they can be conceptually implemented (as a level 1 artifact) (Gregor and Hevner, 2013). We chose first to derive DRs rather than design principles (prescriptive rules for a proposed design) because DRs are often considered the starting point of DSR because they reflect

the target audience's needs and issues (e.g., Möller et al., 2020). We aim to contribute to solving a practical problem (challenges in retail) and present an innovative solution (Hevner, 2007). We conducted guided interviews with customers and retailers lasting 30-59 minutes (Stier, 2013). We chose to survey both customers and retailers because researchers emphasize that DSR should involve multiple stakeholders to design artifacts relevant to practice (e.g., Hevner, 2007). The interview guide consisted of questions regarding shopping habits in the physical retail, customer needs, and wishes for the design of an in-store navigation system. We interviewed four customers (one director, one manager, and two students) and four experts from a furniture manufacturer (a sales assistant, the head of sales, the retail development director as an expert on store design, and the head of business development). Two participants had prior experience with AR in retailing. We deliberately decided to include the views of people without prior AR experience to identify together with our target group factors that would encourage them to actually utilize AR-based in-store navigation systems. We analyzed the interviews qualitatively, according to Mayring (2015). We created one category system for the customer interviews and one for the retailer interviews to examine the results separately. We deductively created a coding guide based on our interview guide containing decision criteria and anchor examples for each category to enable a match with our RQ, and added categories inductively (Mayring, 2015). The category system for the customers consisted of the main categories "shopping behavior," "functionalities of the solution," "limitations of the solution," "impact of the solution," as well as "presentation and accessibility of the solution." The category system for the retailers consisted of the main categories "customers and their behavior," "measures to ensure customer satisfaction," and "new technological solutions." After separately evaluating the results from both category systems, we reviewed them and formulated DRs that summarize the stated needs. The retail experts stated that their customers can be divided into three groups: **value/bargain hunters** (customers that are driven by good deals), **solution seekers** (customers that want to buy the complete solution in one place), and **easy shoppers** (customers that come to a store for a very specific product). We assigned the results according to which DRs apply to all groups (overlapping) and to individual groups. Finally, we exemplify our DRs in a UX prototype, which, according to Richter et al. (2016), should visualize how functions desired by interviewees can be realized to fulfill the mentioned goals instead of focusing on the visual design of the user interface.

4 Results

We clustered the final DRs into six categories: **navigation, recommendations, information, assistance, general DRs, and adaptation to customer needs** (Figure 1). The main functionality of the software system is **navigation**. Participants desired that products could be found quickly to not cause frustration (DR1.1), e.g., "If you want a specific duvet, then it's annoying going down to the duvets and then it's not there, and you have to find a sales assistant and then back and forth." Retailers reported that customers often ask where to find products and want an efficient shopping experience. The in-store navigation system should hence calculate the shortest route (DR1.2). Easy shoppers should have the option to get guided to the relevant products directly (DR1.3).

Retailers emphasized that the system should integrate features to highlight products of interest on the shelf to reduce stress if customers have many items on the shopping list.

Category	Requirement	Customer Type
Navigation	**1.1** The system should offer navigation through the store.	Overlapping
	1.2 The system should navigate on the shortest way.	Overlapping
	1.3 The system should always allow the user to be guided to a product directly.	Easy shoppers
	1.4 The system should highlight the right products on the shelf.	Overlapping
Recommendations	**2.1** The system should show recommendations based on the customers' needs (e.g., a cheaper product).	Bargain Hunter / Solution Seeker
	2.2 The system should show special offers.	Bargain Hunter
	2.3 The system should offer inspiration.	Solution Seeker
Information	**3.1** The system should provide basic product information.	Overlapping
	3.2 The system should be limited in the amount of information.	Overlapping
	3.3 The system should provide additional product information if required.	Overlapping
Assistance	**4.1** The system should provide assistance.	Overlapping
	4.2 It should be possible to notify the sales personnel if personal advice is needed.	Overlapping
General	**5.1** The system should cover all in-store processes.	Overlapping
	5.2 The system should be intuitive to use.	Overlapping
	5.3 The main functionality should not be disturbed.	Overlapping
	5.4 The system should provide clarity.	Overlapping
Adaptation to customer needs	**6.1** The system should analyze the customers' needs.	Overlapping
	6.2 The system should offer different functionalities based on the customers' needs.	Overlapping
	6.3 The system should be adaptable to the customers' needs.	Overlapping

Figure 1. Requirements for In-Store Navigation Systems

In addition, customers and retailers wished to receive product **recommendations** from the system and be inspired to buy new products. This can counteract that some customers are frustrated by an overwhelming assortment. This feature requires an analysis of customer needs (D2.1). The interviewees stated that it is beneficial for bargain hunters when the system gives special offers of reduced products, even though they did not plan on buying the product (DR2.2). This feature particularly appeals to customers with low loyalty to individual providers (Merkle, 2020). The system could, for instance, recommend cheaper alternatives to the chosen product. Furthermore, recommendations can be given for style-matching and complementary products, e.g., by suggesting a bedsheet when a mattress is purchased (DR 2.3). Matching products is vital because otherwise, customers get frustrated when they do not buy the right product: "And for the negative, I think it's when you don't find something. Or, as I mentioned earlier, you bought something, and then later, you think there was something even better for me, and I did not see it." The system should include product **information**, e.g., how to use the product and the opportunity to compare products (DR3.1). One retailer emphasized that only relevant information should be displayed to avoid cognitive overload (Robier, 2015) (DR3.2). Providing information is relevant so that physical retail can cope with the information diversity of online shopping, including usage tips or construction instructions (Merkle, 2020) (DR3.3). According to the retailers, **assisting functions** are helpful throughout the customer journey (DR4.1), i.e., providing information, finding

the right product, ordering products from stock, and paying. It should be possible to call sales staff for help if necessary by clicking a button, similar to what further studies demonstrated (Meyer et al., 2021) (DR4.2). One customer said: "When I go into the store, I don't need a person right there. I would like to go around, but I would like the possibility of getting the help." Furthermore, **general wishes** were expressed regarding UX. The system should take into account all in-store processes (DR5.1), enable intuitive use with not too many choice options (DR5.2) to not impair the main functionalities of the application (DR5.3), and provide clarity (DR5.4). To address the DRs, the system should enable **adaptivity** (Bontcheva, 2002) by collecting data about the customer to enable appropriate recommendations (DR6.1) and multiple functions to address individual customer needs (DR6.2). It should be possible to deactivate functions, e.g., undesired product recommendations (DR 6.3). This is vital because retailers emphasized that shopping needs vary: "Some customers just want to be inspired, and some have a fixed goal: I need a bedspread. Another has an even firmer goal: I need the bedspread from page four in the newspaper." We instantiated the DRs with a low-fidelity prototype as a smartphone app using the AR platform "Hololink" (Figure 2). Our UX design focuses on translating the desired DRs into concrete functionalities, thus instantiating design knowledge rather than focusing on the visual representation of the prototype.

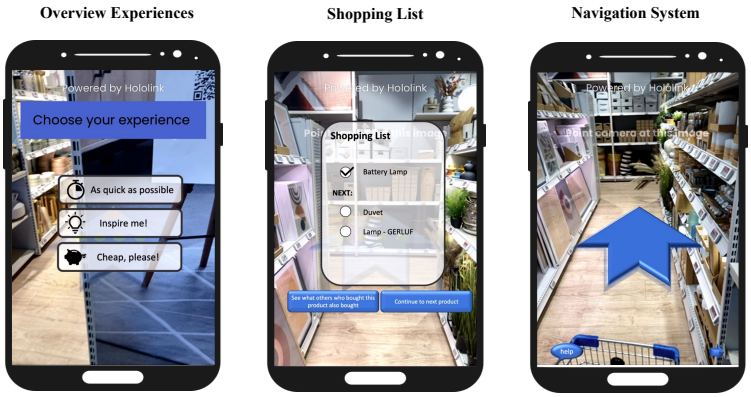

Figure 2. Excerpts of our Conceptual Prototype

First, users can select the desired experience (in line with the customer types): "as quick as possible," "inspire me," and "cheap, please!" Users who select "as fast as possible" receive quick navigation based on a pre-defined shopping list. With the "inspire me" option, the system recommends, e.g., matching products purchased by others with similar preferences. The route is adjusted if the customer adds one of the suggested products to the shopping list. The app uses a short questionnaire on customers' preferences to make appropriate recommendations. For bargain hunters, the app points out when a similar product is offered at a lower price. The system includes a shopping map and a feature to calculate the shortest route. Customers can capture products with their cameras to see additional product information displayed as an overlay, including basic product information, product ratings, and further images. Once they select a product, it is added to the shopping list. Users then see that the chosen product on the shopping

list is checked, and the app proceeds to navigate to the following product on the list. If customers need help, they can click a help button. Customers can choose to receive help in the app or by notifying an employee. When seeking help in the app, they can fill out a questionnaire. For instance, when searching for a duvet, the app asks whether the user prefers to sleep warm, normal, or cold and suggests a suitable product. The app includes payment processes and orders from stock. When ordering a product from stock, the app informs the customer that it will be sent to the checkout. When selecting the payment, the customer can go to the checkout or pay in the app. We evaluated the prototype with 20 participants (13 female, seven male) using video demonstrations of a possible shopping experience. We used the user experience questionnaire (UEQ) (Laugwitz et al., 2008) with 26 items distributed over six scales and a three-item scale for customer satisfaction (Lin and Wang, 2006) (7-point Likert scale for all items). We calculated reliability and conducted a confirmatory factor analysis to validate our data set. We only had to remove four UEQ items because of too low corrected item-scale correlation (< 0.3) or Cronbach's alpha (< 0.7) (Hair et al., 2014; Nunnally and Bernstein, 1994). We will report the mean values (MV) and standard deviations (SD) in the following. Regarding the UEQ, we assessed attractiveness (MV = 5.65; SD = 1.11), understandability (MV = 6.13; SD = 1.01), efficiency (MV = 5.25; SD = 1.09), dependability (MV = 5.23; SD = 1.56), stimulation (MV = 5.34; SD = 1.14), and novelty (5.44; SD = 1.34). Customer satisfaction was rated with MV = 5.53 and SD = 1.34. Overall, participants tended to rate the prototype positively, with all MV > 5. Open-ended questions indicated that they liked the following aspects: different experiences for different needs (fast, cheap, inspiration), the guided tour, the recommendations, opportunities for additional information like product reviews, and the feature of getting assistance from the salesperson. Improvement ideas were: customizability of the shopping list while shopping, recalculation of the route when leaving the route, setting a maximum budget for shopping, customer profiles, and audio guidance from a voice assistant. Participants moreover mentioned that holding a smartphone while shopping could be annoying, so smartphone holders for shopping carts would be necessary.

5 Conclusion and Outlook

In-store navigation systems could create a convenient customer experience in physical retail. We have derived DRs for in-store navigation systems that aim to support researchers and practitioners in designing them. The evaluation of our conceptual prototype (n = 20) shows that customers perceive such a system mainly positively. We admit the limitations of our study. So far, we could only give preliminary results from a small group of respondents. The prototype is only conceptual, and the evaluation focused on video demonstrations. As a next step, we conduct a larger-scale online survey to ask customers about their shopping behavior and preferences for (in-store) digital shopping technologies to identify which consumer groups are most likely to use such technologies and for which purposes to gain a better understanding of the issues to be solved. We further plan to validate and refine our DRs in a follow-up interview study and extend the DRs, e.g., with additional functions such as integrating a voice assistant.

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