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Research Directions for Digital Signage Systems in Retail

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Abstract

The emergence and on-going development of digital signage (DS) systems result in a growing number of technological capabilities of such systems. While these technological capabilities have attracted considerable research attention in informatics, studies exploring their application and impact are scarce. Marketing, and especially retailing, represents an applied science that might benefit from DS. In support of this assumption, some studies demonstrate that the presence of DS showing emotional content creates favorable shopping experiences and positively influences consumer behavior. However, so far, little is known about what could be achieved with DS including its technological capabilities at the point of sale. Thus, this paper offers a short review of extant findings related to DS in retailing. Subsequently, we elaborate on two retailing-orientated functionalities for retailing and develop two specific research questions.

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1. Introduction

While digital signage (DS) has been researched in detail from a technical perspective (cf. e.g., [1]), studies on the application of DS exploiting the vast technological capabilities of DS are comparatively rare, although a range of disciplines may have a great many of starting points for research involving DS. In the field of management, some work elaborated, for example, on the business value of DS (cf. e.g., [2, 3, 4]). Recent research identifies DS as promising tool to reduce perceived waiting time at the point of wait (POW) in retail stores and to create favorable

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waiting experiences (cf. [5, 6]). Reducing perceived waiting time is of particular importance since customers do not see anything positive in queuing. Long waiting times lead to negative overall service evaluations [7, 8], negative attitudes toward the service provider [9], decreased loyalty [10], and/or decreased store patronage intentions [11]. Other DS studies in retailing demonstrate that emotional DS content creates positive shopping experiences (cf. e.g., [4]), increase impulse purchases and positively influences repeat visit intentions (cf. e.g., [12]).

Despite this evidence, retailers are still challenged to find out how the technological capabilities of DS can help to enhance the shopping experience. The challenge of an efficient DS system is to display the right content to the right person at the right time. This is a complex task due to several reasons, such as product-, location- and target-specific criteria, psychological and/or legal issues to name a few. Still, several technological advancements may support retailers to approach their goal targeting potential consumers.

In the following, we focus on the application of DS in the context of retailing and propose an agenda for interdisciplinary research on DS bonding the technological and the business perspective as both disciplines are predestined to stimulate and push forward research activities on and solutions for DS in retailing. After identifying two relevant retailing-orientated functionalities for retailing (Section 2), we propose two exemplary research questions in Section 3. In the concluding section we summarize the proposed research directions.

2. Enhancing Digital Signage Systems with Additional Retailing-Oriented Functionalities

In the following we introduce and discuss possible effects of two exemplarily chosen DS systems' functionalities, which may foster the use of DS systems by (i) improving the economic value of DS application in a retail setting, and (ii) advancing the general "public" acceptance of DS.

2.1. Continued Stories

In contrast to standalone displays, a DS system benefits by its networked nature. This in turn allows a central controller to determine contents on any of the many displays of a DS system, whereby contents may (but do not necessarily have to) be identical on all displays. While anticipating transition times of consumers when moving from one display to another might be a challenging but feasible task, the supplemental equipment of a DS system with sensors will tremendously improve the efficiency and quality of such functionality of a DS system: Instead of predicting transition times of a consumer, the sensors of the DS system may track consumers in the retailing premise and sense each one's presence at a particular display. This allows for "following" a consumer from display to display with certain well-chosen content. Based on sensor-collected data the system automatically displays the most suitable content at the corresponding display. Thereby, data processing occurs in real-time. Thus, a DS system enables thoughtful and sophisticated scheduling of contents in a way that, for example, dynamic content may be passed over from one display to another, which allows a consumer to continue enjoying a coherent, continued "story" of the dynamic content in sequels and continued stories. Such an approach would support experiential retailing strategies and themed retail stores. Moreover, enjoying a continued story (i.e., a story that had been started in an early phase of a customer's shopping experience) during a waiting phase may be perceived more enjoyable than a separate block of content that is just introduced for the waiting phase (for instance, at the checkout).

2.2. Situation- and Consumer-related Information

Besides localization functions such as determination of a customer's exact position in the retailing premise and real-time identification of a customer's shopping path) other personal, observable characteristics of a customer may be exploited to enhance a DS system.

Capturing a consumer's posture with a depth-sensing camera may allow the system to tell whether or not the customer pays attention to a particular display [13]. A motion detector – or even a camera integrated into a display – may allow for telling whether a person is calmly standing or moves around. Fidgeting people and calmly standing people, may be supplied with different content (e.g., engaging versus less engaging content) to create a beneficial shopping atmosphere; people not paying attention to a display may be attracted with particularly engaging content.

We emphasize that context-awareness and context-adaptivity (cf. [14]) go far beyond tracking an individual consumer in the retailing premise. An overview of the notion of context for context-aware computing is provided by Bauer and Novotny [15]. For instance, based on the beholder's emotion (captured by a standard camera) [16], age group or gender, the system could readily show the "right" (pre-prepared) content that fits this combination of characteristics. Also, non-person-related characteristics are conceivable for context adaptation; for example, Bauer and Lasinger [17] stress that so-called "situationalization" (i.e., adaptation to the situation, which includes, for example, adaptation to the time of the day, to weather conditions, to the degree of crowdedness around the display, to name some examples) does not require person-related data to be captured or processed.

3. Promising Research Questions in the Field of Research on Digital Signage in Retail

Although or rather because highly sophisticated technological implementation alternatives for DS systems exist, new research issues open up. In the following, we discuss exemplary two research questions (RQ) aiming at stimulating research on DS in a retail context.

RQ1. Which specific requirements on DS (content) exist in the domain-specific context cluster "retailing"? Novotny and Bauer [18] show in their work that domain-specific context clusters exist and make a valuable contribution in supporting the design and implementation of applications. While typically rather broad domains (such as "healthcare" or "traffic") are investigated, this approach to domains might be too broad to be useful in practice – especially for the retailing sector – because facets of context-adaptive DS differ over specific goals and applications. Retailing represents a (so far unexplored) domain-specific context cluster for context-aware DS, with many different context elements (e.g., waiting phases, purchase decisions). Characteristics of content that is particularly suited for retail situations or waiting times in retail have to be studied on a fine-grained basis, and should cover various design aspects such as information versus promotional content versus emotion-evoking content [12], slow versus fast tempo of video to attract and to keep a consumer's attention. For instance, with view to gamification, a game that is played on a DS display could contain branded elements (e.g., buttons with a brand logo) or could be designed in a neutral way (e.g., plain buttons). Effects on waiting time perception in retail and the creation of extraordinary retailing experiences are a promising option to be studied in detail. Accordingly, we suggest to study the notion and the potential of context in retailing, and to create a context cluster for this field.

Privacy issues and issues of personal wellbeing are closely related to contextualized content on DS, as targeted customers might feel uncomfortable with contextualized DS. Thus, another important field that needs to be studied are privacy issues related to contextual DS, which leads to another abundant research question.

RQ2. Which regulatory framework determines the process of sensing, storing and exploiting personal data in retail premises, and what attitudes have consumers towards data collection and exploiting it for displays in public space, which may be different across countries or cultures? Considering consumer concerns and resistance, we distinguish two different major settings of embarrassment and deprecatory mutual reactions: (i) Some consumers will interpret person-related content as an invasive act as encroachment, or inappropriate haggle. They may react with denial, anger, or even aggression, as they might not want to be addressed at all in public areas; they refuse to feed any system or a system they cannot control with data on personal details. (ii) Some customers might be embarrassed on displayed content that refers to them, and that can be observed by others in their presence; for example, people with eating disorders, avowed vegetarians/vegans, smokers/non-smokers; references on a person with pharmaceuticals or sanitary products might be perceived as embarrassment. While the perceived intrusiveness of personalization in the online setting is well explored in scientific literature [19, 20], issues of personalization in physical spaces are less elaborated [21].

4. Conclusion

Most developments in DS were technology-driven, impulses for new ideas originated from a technical domain (e.g., to use various sensors for context-adaptive functionality), and technology was the enabler in the first place. Even though the technological "push" was an important driver for initial implementations, it seems the right point in time, to involve those disciplines that may either contribute with their application-related content or that may deploy the technological attainment to perform empirical research in their fields. Interdisciplinary research approaches may

bring DS forward. For instance, the design and implementation of advanced DS for retail scenarios in retail requires profound knowledge about technical capabilities of integrated DS systems as well as thorough understanding in retailing. Further requirements are the skills in implementing them in form of prototypes or mockups to be used in empirical (laboratory or field) studies. While for example psychology may deliver the methods and results to investigate the consumer's perception and opportunities for priming and nudging, film science may be a further source of knowledge for designing and editing well-defined content for studies. Knowledge from all these fields may contribute for being able to design, implement, and evaluate significant field studies. And lastly, field studies are lowering application barriers, are fostering decisions to invest into novel technology-based equipment, and are providing an important attraction for retailers in practice.

References

- [1] Davies, Nigel, Sarah Clinch, and Florian Alt (2014) "Pervasive displays: understanding the future of digital signage." *Synthesis Lectures on Mobile and Pervasive Computing* **8** (1): 1–128.
- [2] Bauer, Christine, Paul Dohmen, and Christine Strauss (2011) "Interactive Digital Signage: an Innovative Service and its Future Strategies." *Proceedings of the 1st International Workshop on Frontiers in Service Transformations and Innovations (FSTI 2011), in conjunction with the 2nd International Conference on Emerging Intelligent Data and Web Technologies (EIDWT 2011)*, 137–142.
- [3] Bauer, Christine, Paul Dohmen, and Christine Strauss (2012) "A Conceptual Framework for Backend Services of Contextual Digital Signage." *Journal of Service Science Research*, **4** (2): 271–297.
- [4] Dennis, Charles, J. Joško Brakus, Suraksha Gupta, and Eleftherios Alamanos (2014) "The effect of digital signage on shoppers' behavior: The role of the evoked experience." *Journal of Business Research* **67** (11): 2250–2257.
- [5] Garaus, Marion and Udo Wagner (2018) "The influence of digital signage on the waiting experience and store satisfaction." *Proceedings of the 2018 Winter Marketing Educator's Conference*: E9–E10.
- [6] Garaus, Marion and Udo Wagner (2018) "Let me entertain you – Reducing perceived waiting time through digital signage." *Proceedings of the 47th EMAC Annual Conference (EMAC 2018)*.
- [7] Pruyn, Ad and Ale Smidts (1998) "Effects of waiting on the satisfaction with the service: Beyond objective time measures." *International Journal of Research in Marketing*, **15** (4): 321–334.
- [8] Tom, Gail and Lucey Scott (1995) "Waiting time delays and customer satisfaction in supermarkets." *Journal of Services Marketing*, **9** (5): 20–29.
- [9] Hui, Michael K. and David K. Tse (1996) "What to tell consumers in waits of different lengths: An integrative model of service evaluation." *Journal of Marketing*, **60** (2): 81–90.
- [10] Bielen, Frédéric and Nathalie Demoulin (2007) "Waiting time influence on the satisfaction?: Loyalty relationship in services." *Managing Service Quality: An International Journal*, **17** (2): 174–193.
- [11] Grewal, Dhruv, Julie Baker, Michael Levy, and Glenn B. Voss (2003) "The effects of wait expectations and store atmosphere evaluations on patronage intentions in service-intensive retail stores" *Journal of Retailing*, **79** (4): 259–268.
- [12] Garaus, Marion, Udo Wagner, and Sandra Manzinger (2017). "Happy grocery shopper: The creation of positive emotions through affective digital signage content." *Technological Forecasting and Social Change*, **124** (1): 295–305.
- [13] Gollan, Benedikt, Bernhard Wally, and Alois Ferscha (2011) "Automatic Human Attention Estimation in an Interactive System based on Behavior Analysis", in *Proceedings of the 15th Portuguese Conference on Artificial Intelligence (EPIA 2011)*: 40–54.
- [14] Bauer, Christine and Sarah Spiekermann (2011) "Conceptualizing Context for Pervasive Advertising", in Jörg Müller, Florian Alt, and Daniel Michelis (eds) *Pervasive Advertising*, Springer, London: 159–183.
- [15] Bauer, Christine and Alexander Novotny (2017) "A consolidated view of context for intelligent systems." *Journal of Ambient Intelligence and Smart Environments*, **9** (4): 377–393.
- [16] Tkalčič, Marko, Nima Maleki, Matevž Pesek, Mehdi Elahi, Francesco Ricci, and Matija Marolt (2017) "A Research Tool for User Preferences Elicitation with Facial Expressions", in *Proceedings of the 11th ACM Conference on Recommender Systems (RecSys 2017)*: 353–354.
- [17] Bauer, Christine and Peter Lasinger (2014) "Adaptation strategies to increase advertisement effectiveness in digital media." *Management Review Quarterly*, **64** (2): 101–124.
- [18] Novotny, Alexander and Christine Bauer (2017) "What Do We Really Talk About When We Talk About Context in Pervasive Computing: A Review and Exploratory Analysis", in *Proceedings of the 19th International Conference on Information Integration and Web-based Applications & Services (iiWAS 2017)*: 301–310.
- [19] Tucker, Catherine E. (2014) "Social networks, personalized advertising, and privacy controls." *Journal of Marketing Research*, **51** (5): 546–562.
- [20] Malheiros, Miguel, Charlene Jennett, Sneha Patel, Sacha Brostoff, and M. Angela Sasse (2012) "Too Close for Comfort: A Study of the Effectiveness and Acceptability of Rich-Media Personalized Advertising", in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2012)*: 579–588.
- [21] Müller, Jörg, Florian Alt, and Daniel Michelis (2011). *Pervasive Advertising*. Springer, London.