Carl-Philip Ahlbom

HOW TECHNOLOGY IS EVOLVING IN-STORE SHOPPING BEHAVIORS

EVIDENCE FROM THE FIELD

STOCKHOLM SCHOOL OF ECONOMICS

HOW TECHNOLOGY IS EVOLVING IN-STORE SHOPPING BEHAVIORS

Walking into a bricks-and-mortar store today is anything but offline. Technological marketing devices greet shoppers in practically every step of their shopping trip, wherever they go. The idea of these types of shopper-facing retail technologies is to add value to the shopper in different ways. The question, though, is what impact these in-store technological elements have on shoppers and their actual shopping behaviors. The effect of shopper-facing retail technologies on shopping behaviors is the focus of this dissertation.

In this dissertation, I present five research papers that aim to shed light on the question of how, and why shopper-facing retail technologies affect shopping behaviors and, in particular, purchase behaviors. The shopper-facing retail technologies that are empirically examined in the dissertation include mobile phones, in-store kiosks, music, multi-sensory displays, and virtual reality store experiences. These technologies are shown to all impact shopping behaviors, but the reason why they do differ.

The studies all employ a field experiment approach and uses different types of data sources such as real sales data, shopper observations, surveys, and eye tracking; hence the subtitle "evidence from the field." The results offer evidence on both how and why shoppers react to these types of shopper-facing retail technologies, and a number of conceptual, practical, and methodological insights are presented. For example, contrary to popular belief, retailers that wish to encourage purchases may want to encourage shoppers using their smartphones while they are shopping, as that leads to shoppers spending more time in the store and get exposed to more products.

CARL-PHILIP AHLBOM is a researcher affiliated with the Center for Retailing. His research interest involves different dimensions of in-store marketing, with a particular emphasis on store atmospherics, sensory marketing, and shopper-facing retail technologies.

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Akademisk avhandling

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Carl-Philip Ahlbom

How Technology is Evolving In-Store Shopping Behaviors:
Evidence from the Field

To

my family

and all educators in my life
past, present, and future

Foreword

This volume is the result of research projects carried out at the Department of Marketing and Strategy at the Stockholm School of Economics (SSE).

This volume is submitted as a doctoral thesis at SSE. In keeping with the policies of SSE, the author has been entirely free to conduct and present his research in the manner of his choosing as an expression of his own ideas.

SSE is grateful for the financial support provided by The Swedish Retail and Wholesale Foundation which has made it possible to carry out the projects.

Göran Lindqvist

Director of Research
Stockholm School of Economics

Hans Kjellberg

Professor and Head of the
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Second, I would like to thank the Swedish Retail and Wholesale Foundation for providing generous financial support for the second half of my PhD program. The existence of this scholarship is just one example of how engaged Swedish retailers are in scholarly research. To all retailers in our country, thank you for being so good at what you do, and for trying to get better at what you do continuously. Doing research with you is fun, rewarding, and inspiring.

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Stockholm, February 2019

Carl-Philip Ahlbom

Contents

Chapter 1

Introduction

Walking into a bricks-and-mortar store today is anything but offline. Shoppers are met with technological devices in practically every step of their shopping trip. They are greeted with digital displays inside and outside the store, they use self-checkouts, and they get the help that they need from in-store kiosks and through their own phones. Different technological elements face shoppers wherever they go. The question is what role these in-store technological elements have on shoppers and their shopping behaviors. The effect of shopper-facing retail technologies on shopping behaviors is the focus of this dissertation.

Judging solely by the popular media and their headlines on the death of traditional physical retailers (e.g., Peterson, 2018), it may be easy to assume that every retailer should emphasize conquering online retailing and focus on omnichannel retail offerings. However, such a mindset may be problematic if it takes away too much focus from physical store issues. The fact is that sales in physical stores still accounted for more than 88% of total retail sales worldwide in 2018 (McNair, 2018). While technological improvements have boosted the growth in e-commerce over the past couple of decades, it is easy to forget that technological improvements also provide opportunities for the physical store (Grewal, Roggeveen, & Nordfält, 2017; Hagberg, Sundström, & Egels-Zandén, 2016; Piotrowicz & Cuthbertson, 2014).

To an increasing extent, the retailing industry is acknowledging this fact. In a recent report interviewing American grocers on the main business opportunities for their technology and IT investments, 46% stated that in-store upgrades are among their key focus areas (RIS, 2018). This includes technological improvements to aid service employees to provide good service, such as updated point-of-sales terminals at checkout. However, to a growing extent, it also includes technological investments that shoppers will use and with which they will interact, such as self-service technologies (SSTs), digital in-store marketing elements, or mobile phone apps (Witcher, 2018). The latter, shopper-facing retail technologies, and the way they affect shopping behaviors such as actual purchases, is the primary focus of this dissertation.

Shopper-facing retail technologies

The concept of shopper-facing retail technologies refers to different types of technologies that directly face shoppers in a physical store (cf. Inman & Nikolova, 2017). In this dissertation, the concept of shopper-facing retail technologies refers to technologies that face shopper directly, with a marketing purpose. This can include SSTs and marketing stimuli such as digital signage, scents, music, and lighting that stems from technological devices, or the use of mobile phones for in-store marketing (Grewal et al., 2017; Inman & Nikolova, 2017). However, this view excludes technologies that have a *solely* different purpose, such as operational. This includes, for example, bar code systems or check-out terminals that are only used by sales clerks. While those may affect the shopping experience indirectly by providing efficiency or making sure the store is well-stocked, they do not directly affect the shopper. As such, I suggest that shopper-facing retail technologies need to fulfill two criteria:

1. It must face the shopper directly
2. The technology must operate inside or in near proximity of a store

The introduction of new technologies as they become available is not new to retailing. However, the availability of technological elements to retail envi-

ronments has intensified dramatically over the past couple of decades, making it tough for retailers to separate what is "hot from hype" (Witcher, 2018, p. 1). Inman and Nikolova (2017) discussed technologies that have come (and sometimes gone), such as in-store coupon dispensers and DVD rental kiosks. Surprisingly little academic research has focused on how these technologies affected sales and the bottom line for the retailer (Inman & Nikolova, 2017). This is problematic, as retailers invest heavily in these elements. For example, Progressive Grocers' 2018 report on the status of in-store technology investments showed that 23% of retailers will upgrade their stores with new or better self-checkout terminals within 12 months and that 16% will upgrade their point-of-sales materials, adding new technologies (RIS, 2018). This amounts to billions of dollars.

Accordingly, this calls for research into different types of technologies and how they affect shoppers' shopping behaviors (Grewal et al., 2017; Hagberg, Jonsson, & Egels-Zandén, 2017; Shankar, Inman, Mantrala, Kelley, & Rizley, 2011), which will provide both benefits for managers and academically interesting research. This type of research is the focus of this dissertation.

Purpose of the dissertation

The overall purpose of the dissertation is to add empirical evidence and a conceptual understanding of how shopper-facing retail technologies impact shopping behaviors and, in particular, purchase behaviors. Specifically, the overarching research question for this dissertation is

> ***RQ:*** *How, and why, do shopper-facing retail technologies affect shopping behaviors?*

This research question poses both the question "how" shopper-facing retail technologies affect shopping behaviors and "why" it does so. Thus, it does not only focus on main effects on shopping behaviors. It also examines underlying process mechanisms that can explain why certain shopping behaviors are evoked by the encounter with these technologies. Further, it examines potential boundary conditions that explain under which circumstances a shopper-facing retail technology affects shopping behaviors.

An important distinction is found in the research question's dependent variable: shopping behaviors. While sales may be a more suitable dependent variable from a retailer point of view, it is a result of shopping behaviors among shoppers. The aim in this dissertation is not to *just* have a focus on the end-results (more sales due to the effects of shopper-facing retail technologies on shopping behaviors), but also the underlying mechanism. Thus, the variable *shopping behaviors* is used as the overall dependent variable in the research question. In addition, while purchasing behaviors are a type of shopping behavior, shopper-facing retail technologies may have an impact also on other behaviors. These include, for example, the way shoppers move in the store, what products they put attention to, or the product choices shoppers make in the store.

Structure of the dissertation

The dissertation is divided up into a number of chapters. First, there is a review of previous research on shopper-facing retail technologies (Chapter 2). The overall literature review includes a conceptual framework for research on shopper-facing retail technologies that then forms a basis for the empirical studies conducted as part of this dissertation.

The literature review leads to a conceptual framework that includes the methodological considerations necessary to answer the research question (Chapter 3). Five research papers that focus on different types of shopper-facing technologies follow. All these studies utilize field experiments to measure how shoppers' actual shopping behaviors change as a result of their interactions or encounters with shopper-facing technologies. The field experiments, complemented by four lab studies, one meta-analysis, and a number of pretests, go deeper in describing cognitive, attitudinal, and behavioral process mechanisms that explain why certain shopper-facing retail technologies affect shopping purchase behaviors. They also assess potential boundary conditions to these effects. The majority of the studies are conducted in a grocery retail setting.

While there is a detailed description of the actual papers in Chapter 4, the following summary makes it easier to follow the discussions and considerations the next chapters put forward:

- Paper 1 deals with *in-store music* and how music mainly affects sales positively when shoppers' mindsets are congruent with the store environment.
- Paper 2 deals with *multisensory projections* on end caps in grocery stores, how they can attract attention and spur cognitive thought processes that lead to higher sales of the products on display.
- Paper 3 deals with the difference between a *virtual reality* (VR) depiction of a physical store and the actual physical store, showing that VR simulations can be usable in market research for store environments with products that require fewer sensory inputs.
- Paper 4 deals with the use of *in-store kiosks* and how different types of content with which the shopper interacts lead to different effects on sales.
- Paper 5 deals with shoppers using their *mobile phones* while shopping for groceries, how that increases shoppers' distraction, and how it subsequently increases sales.

Intended contributions

Through the five research papers, and the literature review, this dissertation provides contributions to both the industry and the scientific community in different ways. A popular model that conceptualizes the research approaches for this dissertation and how they contribute to the knowledge of in-store technological enablers is the Brinberg and McGrath domains of research validity (Brinberg & McGrath, 1985; McGrath & Brinberg, 1983): the substantive, methodological, and conceptual domains.

The substantive domain relates to the events and phenomena under investigation, how they work, and their results. In retailing and shopper marketing research, this has close links to fairly practical business issues that researchers can observe in real-life organizations and situations (Grewal, Roggeveen, & Nordfält, 2016). According to Brinberg and McGrath (1985), research in this domain has enhanced validity, because it is also relevant for people outside academia. For this dissertation, the intended contributions in the substantive domain relate to the understanding of how and why shopper-

facing retail technologies affect shopping behaviors. Understanding the causal mechanisms for certain types of shopper-facing retail technologies also provides opportunities to extend the findings to other types of investments for the physical store that may work with similar mechanisms. Considering the enormous investments in shopper-facing retail technologies, the substantive contributions could be significant.

The methodological domain relates to how the research took place from a technical viewpoint, i.e., methods. While all scholars should use the correct methods in any research study, research that provides a contribution in this domain uses innovative techniques to shed light on different research issues. Research focused on contributions in the methodological domain often involves new approaches to examining phenomena that may lead to new insights. This dissertation contributes to the methodological domain in two ways. First, it used field experiment data from actual shoppers in all papers, something that is surprisingly rare in marketing research. For example, in a review of field experiments among four of the top marketing journals, I found that only 20% of accepted publications between 1995 and 2014 included at least one field experiment (Simester, 2017). For research that has the aim to explain how shoppers will react and hot their shopping process may change, realism is key to, as Morales, Amir, and Lee (2017) calls it, provide "insight into real consumer behavior." This, in turn, leads to greater robustness and generalizability in the results.

An additional methodological contribution comes through new combinations of methods for the same phenomena. The distinct combination of different methods, such as combining behavioral and quantitative eye-tracking data with receipt data and surveys could make an important contribution to the methodological domain. The same goes for combining other types of data, such as field experimental data with lab data through new types of lab simulations. The new ways of combining data and methods may be useful both for academia and industry studies on shopping behaviors.

Finally, the conceptual domain adds to the conceptual elements of research. Research focusing on this dimension not only adds empirical findings to the literature but also actively extends the theorizing of different phenomena. Research projects often step up on the abstraction level to explain what the underlying mechanisms for phenomena are, and how they interrelate.

This can, however, be the result of experiment and/or extensive reviews or meta-analyses. In this dissertation, each paper extends the existing literature on the different theoretical lenses of each distinct paper. This study also contributes to the conceptual domain through the literature review in Chapter 2, which synthesizes the research on shopper-facing retail technologies to showcase what researchers already know in a broad sense, to showcase the existing consistency of the research, and to unveil research opportunities.

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This first chapter has served as an introduction to the dissertation, and it has provided a short background to the subject. The following chapter presents a literature review of the papers detailing the existing empirical literature on shopper-facing retail technologies. Following this, a methodology section discusses the different methodological decisions that have led to the choice of methods. Then the papers follow, along with a discussion of their joint contribution to academia and the industry viewed through the three different research domain viewpoints: substantive, methodological, and conceptual. A discussion of the future research journey that awaits concludes this dissertation.

Chapter 2

Background and Literature Review

In this chapter, the aim is to provide an overview of why shopper-facing retail technologies should be able to affect shopping behaviors. A brief introduction on why in-store marketing elements work in general on a conceptual level introduces these concerns, while the subsequent literature review of shopper-facing retail technologies acts as the foundation for the conceptual framework of the dissertation.

General shopping behaviors

Not all human decisions have equal precision or rationality. Previous research has suggested that humans generally use one of two main modes of processing when they make decisions. These types of theories are usually variations of what researchers call dual-process theories, that is, they deal with two modes of processing among human beings. Researcher sometimes call these modes of processing System 1 and System 2 (Kahneman, 2011; Stanovich & West, 2003) or the peripheral route and the central route (Petty & Cacioppo, 1986; Petty, Cacioppo, & Schumann, 1983), although they occasionally have different labels depending on their exact application and theoretical discipline. In the first type of processing, humans are more automatic in thought, and they make quick inferences based on simple heuristic cues (cognitive shortcuts) in their surroundings. In retailing, this could be a scent

of baked goods making shoppers think about eating, or the color red on a price sign signaling cheap (System 1). These heuristics are not necessarily rational, and they often result in decision bias, but they do speed up and simplify the decision process drastically. In the second mode (System 2), individuals take time to reason more about their decisions. A shopper who compares many different variations of flour, or who searches for a recipe inside the store, is using this type of processing.

A complementary explanation of why in-store marketing works come from attention research. While dual-processing theories assume that attention follows heuristics, other research suggests that mere attention is sometimes a prerequisite to heuristics (Orquin & Mueller Loose, 2013). Work on shelf elasticity has articulated one of the most obvious examples of the "what you see is what you buy" argument. It has shown that items in sections of the shelf at eye level always sell more, due to their higher visibility to shoppers (e.g., Frank & Massy, 1970). Other research has shown a physical bias of eye movements, in that their focus is on the center of what shoppers are seeing (Atalay, Bodur, & Rasolofoarison, 2012)

Dual-process theories and attention research, combined, align well with what researchers know about the in-store shopping process. It is empirically well established that humans have a limited attentional scope when they make decisions and carry on tasks, and this applies in in-store contexts (Cohen & Chakravarti, 1990; Hoyer, 1984; Nordfält, Grewal, Roggeveen, & Hill, 2014; Park, Smith, Dudley, & Lafronza, 1989). As a shopper walks into a grocery store, for example, the store offers anywhere from 20,000 to 60,000 unique stock-keeping units (SKUs). At the same time, the average grocery shopper buys about 143 unique items during an entire year, amounting to just 0.7% of the products on offer (Catalina, 2013). This would suggest that shoppers are mostly in a habitual shopping mode (System 1).

Extensive retailing research has also shown that when shoppers pay enough attention to particular items, such as end-cap displays, the likelihood that shoppers will purchase items they had not planned to buy dramatically increases (Chevalier, 1975; Inman, Winer, & Ferraro, 2009; Nordfält, 2011a), that simple cues can affect shoppers' decision making as they use heuristics (cf. Tversky & Kahneman, 1974) when they are in their System 1 mode to govern their actions.

There are many different types of in-store marketing cues and elements that affect the way shoppers behave, such as atmospherics, promotions, and placements of products (Nordfält, 2009; Nordfält & Ahlbom, 2018; Nordfält et al., 2014). However, this dissertation focuses specifically on shopper-facing retail technologies and how they affect shopping behaviors. A more detailed discussion of these effects follows.

Literature review: The effects of shopper-facing retail technologies

Over the past couple of decades, retailers have increasingly introduced different shopper-facing technologies to their physical retail store environments, such as self-checkouts, smart shelves, proximity marketing, mobile app marketing, scan and go solutions, and more (cf. Inman & Nikolova, 2017). The introduction of these elements to the physical shopping environment has led to increased interest from researchers over areas such as what they are, what role they play in the shopping process, and how to make shoppers utilize them. Some research has also been done on how they affect the way shoppers behave as a result of encountering different types of shopper-facing retail technologies. The aim of this section is to synthesize the existing literature to provide an overview of what we know about these technologies, and, equally importantly, what we do not know about them.

Literature search approach

The focus of this literature review is on empirical studies of any kind of shopper-facing retail technology in, or very close to, an in-store environment. That includes studies of technological marketing elements with which the shopper may come into direct contact.[1] Thus, it does not include studies on more general retail-relevant IT, stock management, supply chain technologies, etc. The focus is on the direct experience of the shopper, with an aim

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[1] This review does not include studies on in-store music and scent machines, as they generally focus on the sensory aspect of the marketing stimuli, rather than the actual technological enabler and its impact on the shopping trip. However, there are reviews on music and scents in in-store environments in Research Papers 1 and 2, respectively.

to understand how these technologies add value to the shopping process for the shopper and retailer.

The literature review was conducted utilizing a search through Scopus, Business Source Complete and through the Journal of Retailing, Journal of Marketing, Journal of Interactive Marketing, Journal of Marketing Research, Journal of Consumer Research, Journal of the Academy of Marketing Science, and Journal of Retailing and Consumer Services. The journals were chosen based on their standing in the academic community, and for their relevance to the research topic. Initially, the search items "technology" and "tech" was combined with "retail," "retailing," or "marketing." This resulted in large numbers of research articles. Using these broad searches for references, a handful of newer core references were identified (including Inman and Nikolova, 2017; and Grewal et al., 2017). Using the reference lists and papers referencing these initial papers, a larger set of articles was identified. Working through each paper that was deemed relevant in the initial screening, they were classified as relevant or not. If the paper was relevant to the research question, its references were also screened, resulting in more papers. As such, the process started off structured and had many iterations to get a good overview of the existing literature.

The literature was then coded using a coding sheet that captured a number of key variables: independent variables, dependent variables, process mechanisms, and main results. Identified mechanisms were categorized as either cognitive, affective, or behavioral. Perceptions based on sensory inputs were coded as cognitive processes, as cognitive processes follow most type of perception. Attentional process mechanism were coded as behavioral responses. Possible subsequent cognitive processes where captured using other methods than observations. .

Finally, the papers were organized into groups based on the shopper-facing retail technology examined in each respective article. After some iterations, this resulted in three major streams of research, described below. Finally, common themes and differences in terms of the results within these distinct research streams were contrasted and synthesized. These syntheses are presented below.

The emergence of research in shopper-facing retail technologies

While retailers have introduced different shopper-facing technological inventions for many years, such as vending machines (Andreasen, 1961), research on shopper-facing retail technologies started flourishing primarily in the 2000s. Though a systematic review of the empirical studies, three main themes emerge that act as subsets of the total research body of shopper-facing retail technologies.

The first stream of shopper-facing retail technologies in the late 90s and early 00s focused on the increased use of automation in certain tasks that service employees had previously done, namely SSTs. This line of research dominated the first decade of the 21st century, and is heavily focused on how to get shoppers to use SSTs, and to assess what happens when they do.

In the late 00s and early 10s, empirical shopper-facing technology research shifted into a second research stream: technological in-store marketing stimuli. Retailers used these types of technologies as ways to create a more entertaining or experiential shopping environment, rather than to add functional elements, and they focused more on driving incremental sales than on cost savings. Most commonly, they relied on attention-grabbing elements that captured shoppers' interest. Perhaps the inspiration for this line of research was not only the lower cost of technologies such as digital displays and responsive lighting but also an ongoing industry discussion over how retail spaces were transforming towards more experiential environments (Pine & Gilmore, 1998; Verhoef et al., 2009).

Finally, the third stream of shopper-facing retail technology research emerged around the same time, but it has intensified in recent years, namely mobile and augmented reality (AR) research in physical retail settings. The observant reader may note that this research stream followed closely behind the introduction of the Apple iPhone in 2007, which provides anecdotal evidence that new streams of research can break out whenever new shopper-facing technologies become readily available. A summary of the papers in the literature review is in Table 1.

Table 1. Summary of Shopper-Focused Retail Technologies

Source	Technology	Conceptual Focus	Setting	Method	Shopper reactions	Shopping outcomes	Summary of Results
Andreasen (1961)	Self-service Vending machines	N/A	Grocery	Field survey	N/A	Sales, (SST) usage intentions	The introduction of new technology (vending machines) may take a little time to become popular; then it reaches a peak before it reaches its natural level. Males were more intrigued by the new technology, and they were overrepresented among shoppers. While the new technology had a favorable reception, repatronage intentions were limited.
Dabholkar (1996)	Self-service Ordering touch screen	Attribute-based model, affect model	Restaurant	Survey	Cognitive	Usage Intentions	The study tested two potential models that led to SST usage intentions: Dabholkar proposed an affective model that uses attitudes to technological products and the need for interaction against a cognitive model. Another attribute-based cognitive model used characteristics with associations with the SST option, such as ease of use, enjoyment, and control. The antecedents affected expected service quality that led to usage intentions. The cognitive model was better at predicting intentions.

Source	Technology	Conceptual Focus	Setting	Method	Shopper reactions	Shopping outcomes	Summary of Results
Meuter, Ostrom, Roundtree, and Bitner (2000)	Self-service Various	Service encounters	Various	Survey	Cognitive	N/A	The incidents that made customers satisfied included when the SST solved intensified needs (11%), when the SST was better than the alternative (68%) and when it just did what it was supposed to do (21%). The incidents that made customers dissatisfied included technology problems (49%), process failure (17%), poor design/interface (36%), and customer-driven failures such as when the customer had forgotten the PIN for an ATM (4%).
Dabholkar & Bagozzi (2002)	Self-service Ordering touch screen	Technology acceptance model	Restaurant	Student experiment	Cognitive Affective	Usage intentions	The use of SSTs is dependent on (a function of) consumer traits and situational factors. As waiting time and crowdedness increase, so do intentions to use SSTs.
Meuter Ostrom, Bitner, and Roundtree (2003)	Self-service Various	Technology anxiety	Various	Survey	Cognitive	Usage rate	Technology anxiety is an issue for getting shoppers both to use SSTs and to perceive their interactions with SSTs in a positive fashion. Technology anxiety is a stronger predictor of SST usage and evaluation than demographic variables.
Weijters, Rangarajan, Falk, and Schillewaert (2007)	Self-service Self-scan	Technology acceptance model, usefulness	Grocery	Field survey	Cognitive	SST use, Satisfaction, time in store	Perceptions of usefulness, ease of use, reliability, and fun determine attitudes towards SSTs. Better attitudes increase the likelihood of scanner use. Age, gender, and education moderate various effects of the antecedents on the attitude.
Lee, Cho, Xu, and Fairhurst (2010)	Self-service Self-checkout	Control, risk	Not defined	Survey	N/A	Usage intentions	Demographic factors indirectly affect intentions to use SSTs through consumer traits. Gender, age, education, and income affect technology anxiety, need for interaction, and technology innovativeness, which in turn impact intentions to use SSTs.

Source	Technology	Conceptual Focus	Setting	Method	Shopper reactions	Shopping outcomes	Summary of Results
Jia, Wang, Ge, Shi, and Yao (2012)	Self-service Self-checkout	Regulatory focus theory, anxiety	Grocery	Survey	Cognitive	Usage intentions	Promotion-focused shoppers experience perceptions of desirability and feasibility to use SSTs, which in turn positively impacts usage intentions. The reverse holds for prevention-focused shoppers. High technology anxiety reduces the use of SSTs.
Lee and Yang (2013)	Self-service Self-checkout	Service quality, anxiety	Grocery	Survey	Cognitive	Patronage behaviors	Both actual interpersonal service interactions and SST interactions impact patronage intentions. Intentions have a moderate but positive correlation with actual retail patronage.
Van Ittersum, Wansink, Pennings, and Sheehan (2013)	Self-service Smart shopping carts	Shopping budgets	Grocery	Field experiment	Cognitive	Sales	Shoppers using smart shopping carts (with a tablet acting as a calculator on the cart) bought more when they had budget constraints than those who did not use the smart shopping cart. Shoppers using the smart shopping cart who did not have budget constraints bought less. Increased spending uncertainty when not getting real-time spending feedback mediates the effect for shoppers who shop under a budget.
Wang, Harris, and Patterson (2013)	Self-service Self-checkout	Self-efficiency, satisfaction	Grocery	Longitudinal survey	Cognitive Behavioral	SST use	Three-wave longitudinal study. As shoppers get used to using SSTs, the drivers for usage shift over time from self-efficacy to satisfaction, and finally to habit.
Giebelhausen, Robinson, Sirianni, and Brady (2014)	Self-service Payment terminal	Service encounters, script theory	Restaurant, hotel	Survey, Lab	Cognitive	Service encounter evaluation	When service employees can build rapport with shoppers, the use of technology decreases the service encounter evaluation. If they do not build rapport, the use of technology increases the service encounter evaluation. Psychological discomfort mediates the effect.

Source	Technology	Conceptual Focus	Setting	Method	Shopper reactions	Shopping outcomes	Summary of Results
Blut, Wang, and Schoefer (2016)	Self-service Various	Technology acceptance	Various	Metaanalysis	Cognitive	SST use	Through a metaanalysis, a number of customer characteristics form the initial driver, among them anxiety. Perceptions of usefulness and ease of use that lead to attitudes and usage intentions are key mediators.
Dominici, Matić, Abbate, and di Fatta (2016)	Self-service Smart shopping carts	Shopping budgets	Grocery	Survey	N/A	Usage intentions	Dominici et al. examined attitudes towards smart shopping carts with a built-in display to help shoppers to track their spending and offer promotions. Shoppers with functional needs and shoppers valuing convenience were more positive towards smart shopping carts.
Burke (2009)	Technological marketing stimuli Digital signage	Content and context of exposure	Grocery, apparel, mall	Field data	N/A	Sales	The effectiveness of in-store digital display advertising depends on both the content of the message and the context of the exposure. Shoppers are most responsive to messages that convey news, and to messages regarding more hedonic items. The time of day and week, sign visibility, and complexity (length) of the message further moderate the effectiveness. Successful digital advertising effects extend beyond the focal product to the entire category and brand.
Dennis, Newman, Michon, Joško Brakus, and Tiu Wright (2010)	Technological marketing stimuli Digital signage	Store atmospherics	Mall	Field survey	Affective	Approach behaviors	Digital signage has a positive effect on approach behaviors (frequency of visits, revisit intentions, and spending). Positive affect and perception of the mall environment mediate this effect.

Source	Technology	Conceptual Focus	Setting	Method	Shopper reactions	Shopping outcomes	Summary of Results
Dennis, Michon, Joško Brakus, Newman, and Alamanos (2012)	Technological marketing stimuli Digital signage	Store atmospherics	Mall	Field experiment	Affective	Approach behaviors	Digital signage leads to a more positive perception of the mall environment, which leads to affect, which in turn (indirectly) leads to higher approach behaviors such as spending, items bought, time shopping and future frequency of visits.
Ravnik and Solina (2013a, 2013b)	Technological marketing stimuli Digital signage	Visual attention	Apparel	Field observations	Behavioral	N/A	Only 35% of shoppers look at the digital display at all. However, there is no benchmark on whether that is good or bad, and it can depend on many factors. Men look longer on average (1.2 s) than women (.4 s), and children are the most responsive to digital signage, which poses an ethical question. Dynamic content increased attention time by about 50% relative to static digital content.
Dennis, Joško Brakus, Gupta, and Alamanos (2014)	Technological marketing stimuli Digital signage	Aesthetics	Department store	Field experiment	Affective	Approach behaviors	Digital signage with affective content (a tropical island and fitting sounds) evoked better attitudes, approach behaviors, and expected spending than ads primarily communicating mostly cognitive (information-oriented text) content. Combining ads rich in information with affective elements mitigated this drop. If retailers wish to use information-rich communication, they may want to add affective elements such as images and sounds to make it more appealing.

Source	Technology	Conceptual Focus	Setting	Method	Shopper reactions	Shopping outcomes	Summary of Results
Roggeveen, Nordfält, and Grewal (2016)	Technological marketing stimuli Digital signage	Retail formats	Grocery	Field experiment	N/A	Sales	Digital displays increase sales in larger stores (hypermarkets), but they have no effect on mid-size stores (supercenters, supermarkets) and a directly negative effect on sales in smaller convenience stores.
Cremonesi, di Rienzo, Garzotto, Oliveto, and Piazzolla (2016)	Technological marketing stimuli Smart Lighting	Store atmospherics	Apparel	Field experiment	Behavioral	Store image	Interactive lighting at a shopping window increases the time passing shoppers spend in front of it. Tailoring the lighting to the presence of a shopper enhances the uniqueness of the window for certain shoppers even when they take photos.
Broeckelmann and Groeppel-Klein (2008)	Mobile Price comparisons	Experience, involvement, reference prices	Electronics store	Field experiment	N/A	Store evaluation Usage intentions	Shoppers who use mobile devices to compare prices with competitors at the point of purchase clearly recognize differences in prices. If shoppers realize that they can get a better deal elsewhere, they are more likely to keep comparing prices inside stores in the future.
Hui, Inman, Huang, and Suher (2013)	Mobile Promotions	In-store travel distance, unplanned spending	Grocery	Simulation	Behavioral	Unplanned spend simulation	A simulation based on RFID tracker data found that shoppers who received targeted in-store mobile promotions that strategically led shoppers to different parts of the store walked longer distances, saw more items in the store, and potentially increased unplanned spending.

Source	Technology	Conceptual Focus	Setting	Method	Shopper reactions	Shopping outcomes	Summary of Results
Fong, Fang, and Luo (2015)	Mobile Promotions	Geotargeting, competitive promotions	Outside of a movie theatre	Field experiment	N/A	Redemption rates	Mobile promotions significantly increase coupon redemption rates when retailers send them to customers who are close to the focal promotional location as compared to customers who are further away. This holds even with small discounts. If customers are close to a competitor, a competitive promotion that has a high value can increase the purchase rate (but not smaller discounts). Geo-targeted coupons thus affect shoppers' behaviors as they become relevant.
Danaher, Smith, Ranasinghe, and Danaher (2015)	Mobile Promotions	Location, promotion characteristics	Mall	Field observation	N/A	Redemption rates	The closer to the focal store, the higher the redemption rates. Coupons that go out early in the day and week have higher redemption rates. Shorter expiry dates signal urgency and increase redemption rates.
Sciandra and Inman (2016)	Mobile Role of phone	Decision quality planned and unplanned purchases	Mass merchandisers	Field panel data, Online experiment	N/A	Omitted planned and unplanned purchases; Decision-making quality	Mobile phone use that is task-related, such as searching for product information, decreases both unplanned spending and omitted planned purchases. Conversely, task-unrelated mobile phone use increases both unplanned spend and the number of omitted planned purchases, thus reducing the shopping decision quality in terms of rationality. The vast majority of in-store mobile phone use is non-task-related use.

Source	Technology	Conceptual Focus	Setting	Method	Shopper reactions	Shopping outcomes	Summary of Results
Bues, Steiner, Stafflage, and Krafft (2017)	Mobile Promotions	Equity theory, value drivers, emotions	Wine store	Panel experiment	Affective	Purchase intentions	Receiving a coupon close to the focal product is the most important driver of redemption. Personalization and price also positively impacted redemption rates. Location and personalization of the promotion had a positive interaction effect on purchase intention. Both emotions and perceived value mediated the location effect, but only perceived value mediated the effect of price promotions and personalization.
Fuentes and Svingstedt (2017)	Mobile Role of phone	Practice theory, social complexity	General shopping	Focus groups	N/A	Different usage of mobile phones	Interviews indicated that young adults use mobiles in stores to help them to find a specific item or to obtain information that would otherwise have required the help of service employees. Some also use it to compare prices. Many also use mobiles inside stores to get social feedback from friends, and they use phones just to connect with friends for purely social and unrelated reasons.
Blom, Hess, and Lange (2019)	Mobile Promotions	Goal congruency, omni-channel	Shopping mall	Panel experiment	N/A	Satisfaction	Shopper receiving promotions that are congruent with their previous search patterns online and contains monetary incentives increase satisfaction with the shopping experience. These effects held for utilitarian products but were attenuated for hedonic products.
Gensler, Neslin, and Verhoef (2017)	Mobile Showrooming	Benefit/cost approach, channel perceptions	Various	Survey	N/A	Decision to showroom	Expected price savings is a key driver to showrooming behaviors. Perceived quality gains online (such as garment fit) and high waiting time for service in the physical store increase showrooming. Online search costs negatively impacted showrooming behaviors.

Source	Technology	Conceptual Focus	Setting	Method	Shopper reactions	Shopping outcomes	Summary of Results
Poncin and Ben Mimoun (2014)	VR/AR AR mirrors, game terminals	Store atmospherics	Toy store	Field survey	Cognitive Affective	Satisfaction, Patronage intentions	An AR mirror increased shoppers' perceived shopping value, improved their emotional states, and improved their evaluations of the store atmosphere. A game terminal also increased the shopping value and atmosphere, although less than the AR mirror. The terminal did not impact shoppers' emotional states. The atmosphere also had an indirect effect on satisfaction through both emotions and perceived shipping value.
Poushneh and Vasquez-Parraga (2017)	VR/AR AR	Interactivity, user experience	Apparel, sunglasses	Lab	Cognitive	Purchase intention, satisfaction	The AR conditions improved the user experience, and, in turn, this affected willingness to buy the focal products and user satisfaction.

Stream 1: Self-Service Technologies

Types of self-service technologies

SSTs are technological enablers that give the shopper the option (or some-times force the shopper) to independently conduct a service task that a service employee has traditionally performed (cf. Meuter et al. 2000). A very early account of an SST described the introduction of vending machines in the late 50s to an American grocery chain (Andreasen, 1961). This account, being purely observational and without any experimental design, showed that the new technology attracted certain people that seemed to think it was an interesting novelty, especially men. However, while people liked to use the vending machines, repatronage intentions were low, and since this was a small study, we will never know what happened with sales from a longer perspective. What is important, though, and what remains important, is the same for all SSTs that will ever exist – who is using them, why are they using them, and above all, why would they want to use them again? After all, even if it saves the retailer money due to lower staff costs, the question is what value it creates for the shopper.

A more contemporary topic on SSTs is that of self-checkouts. Self-checkouts are types of technology where shoppers make payments them-selves through using a machine at the end of the trip or by using hand-held scanners and scanning and bagging groceries as they move through the store. This type of shopping technology has obtained significantly more attention than other types of SSTs in in-store settings (Jia et al., 2012; Lee et al., 2010; Lee & Yang, 2013; Wang et al., 2013; Weijters et al., 2007). Perhaps this has to do with the increased availability of these technical solutions as phenomena, or the fact that they could potentially be clear cost-cutting opportunities for retailers.

Another interesting area of SST research deals with the use of technologies that assist the shopper in different ways during the shopping trip. One example could be an element at the beginning of the shopping process, such as an ordering touchscreen at a restaurant (Dabholkar, 1996; Dabholkar & Bagozzi, 2002). Another could also be a retailer-provided technology that follows a shopper throughout the shopping trip, such as a smart display on the shopping cart that tells the shopper how much he or she is spending

during the trip (Dominici et al., 2016; van Ittersum et al., 2013). In contemporary retailing, this could also be a shopper's own smartphone that is loaded with a retailer app.

There is also an abundance of research on many SSTs at retailers today. There could, for example, be store-provided tablets or computers for shoppers to examine an extended stock of products in other channels (suggested by Verhoef, Kannan, & Inman, 2015, but yet not examined). There could also be an examination of the impact of in-store inspirational kiosks with recipes and deals, which this dissertation examines.

Antecedents of SST usage

Most of the previous literature on SSTs has focused on the antecedents of how to make shoppers use SSTs. Based on the combined literature, there are two major categories of antecedents: situational factors and customer characteristics.

Most situational factors include usefulness, which can stem from different sources, such as crowdedness, waiting times and ease of use. Usefulness consistently positively affects usage intentions. High waiting times in the checkout area also increase positive attitudes towards SST usage (Dabholkar & Bagozzi, 2002). Perceptions of ease of use and reliability also affect willingness to use SSTs (Dabholkar & Bagozzi, 2002; Weijters et al., 2007). At the core of it, to be useful, an SST should either solve a need of urgency or be better than the alternative source of service (Meuter et al., 2000; Weijters et al., 2007). Interestingly, one survey-based study that used a critical incident reporting method found that a staggering 68% of all critical incidents that made shoppers satisfied with an SST service encounter recalled incidents where it solved an issue better than an alternative, such as providing a shorter line. In physical retailing, a need for urgency could, for example, be to finish a transaction quickly. Perception of fun or a sense of positivity before using the SST also impacted usage intentions (Jia et al., 2012; Weijters et al., 2007).

In addition to situational factors, some customer characteristics consistently increased the likelihood of SST usage. The most commonly studied element is technological anxiety. Technological anxiety refers to the fear that arises when one is not sure how to use a technology in the right way and thus risks embarrassing oneself. It has had a consistent negative impact on the

usage of SSTs (Blut et al., 2016; Jia et al., 2012; Lee et al., 2010; Meuter et al., 2003). This requires the retailer to help the shoppers to understand how to use SSTs once the retailer introduces them. Once shoppers are familiar with an SST, any anxiety that may have existed before should logically diminish for most people. Interestingly, one longitudinal study indicated that shoppers do change their primary motivations for using SSTs from self-efficacy (i.e., being efficient in the shopping task) to satisfaction with the SST once they have learned how to use it. After even more time, this lands into the primary motivation of habit, meaning that using the SST is what the shopper is used to do (Wang et al., 2013).

Finally, some customer characteristics also affect the use of SSTs. Several studies have shown differences in demographics, which Table 1 reports in detail. As a summary, customer characteristics such as technological anxiety and perceptions of usefulness seem to impact the usage rates. The location of the SST also moderate these effects. This as shoppers in crowded areas perceive higher usefulness. To make shoppers use these SSTs, retailers should make sure shoppers get a chance to learn how to use the SSTs when they introduce them. The interface should also be consistently reliable, it should be easy to understand, and preferably it should add some positive, fun element.

The effects of SSTs

A few studies have also examined what happens when shoppers use SSTs, rather than just focusing on how to make them use it. One study found that high-quality service encounters with functional self-checkout SSTs had positive correlations with patronage intentions (Lee & Yang, 2013), which in turn had a positive correlation with actual store visits. A limitation here was that it was not an experimental study, so there may be self-selection bias issues in those results.

One of the few studies on SST employing a field experiment approach with actual sales as the dependent variable assessed the effect of adding tablets acting as calculators to a shopping cart (van Ittersum et al., 2013). That study showed that shoppers who have a budget when they enter the store shop more when they can see how they are doing. However, shoppers who

did not have a budget could see how much they had spent, and they shopped less.

Another interesting effect of SST interaction is that interactions with SSTs can enhance customer satisfaction after relatively poor service experiences with human service employees. Giebelhausen et al. (2014) assessed how people evaluated service encounters that were not pleasant or rapport-building, creating a bond though smiling. But participants interacting with an SST kiosk were more satisfied with the service encounters than those interacting with humans. The same results occurred when the participants received a warm welcome or a not so warm welcome. The reason for this is that people do not blame an SST for being cold, while they expect a human to be consistently nice and courteous in a service setting. SSTs may be helpful in retail situations where service employees have a challenging time delivering warm and thoughtful service. This could, for example, be when the store is overwhelmed with the number of shoppers, or when it is understaffed for whatever reason.

Research opportunities based on the existent literature

The effects of SST usage on behavioral elements such as sales, attention, or even behavioral intentions have not received adequate research. The results from Lee and Yang (2013) that positive evaluations of the service encounter with an SST impact patronage intentions are promising. This is, however, not studied using any experimental or longitudinal method, and the causality of those claims remains unsolved. After all, it is plausible that there could be reverse causality going on. Experimental or longitudinal study designs would solve this issue. The phenomenon is very interesting, though, as a store that can provide the best shopping trip could attract more customers from competitors that do not. The question that remains would be how many shoppers would choose a store due to the presence of certain SSTs. Using antecedents such as fun, ease of use, shoppers' experience with SSTs, and so forth, it might be possible to develop new types of SSTs that may create value for the shopper.

In addition, van Ittersum et al.'s (2013) study provides very important findings, in that SST technology that customers use during the actual shopping trip may enhance sales only that one time. While self-checkouts may not

lead to much upsell, as the shopper is by the exit of the store, SSTs inside the store have the potential to add sales. However, apart from this study, the question remains which SSTs could add sales, and under what circumstances. Ideally, retailers would want to add sales to certain customers without decreasing sales from others, which was the case in van Ittersum, et al.'s two-sided results.

Finally, an important substantive research opportunity lies in field experiments that can provide managerially actionable insights — all but one of the reported studies used either survey-based or laboratory studies. To ensure validity in a complex environment such as in a physical retail store, field experiments are most likely necessary to provide the full story.

Stream 2: Technological marketing stimuli

Types of technological in-store marketing stimuli examined

In the second stream of research, the literature focus is on technological enablers that act as incidental marketing stimuli during different stages of the in-store shopping trip. The primary focus from a retailer point-of-view on these types of technological marketing stimuli is to capture the attention of shoppers, to create a more exciting shopping environment, and to boost sales. From the shoppers point-of-view, it is to get inspired, assistance in choosing what products to buy, and to enjoy the shopping experience as a whole.

There is an ongoing and emerging literature on these elements, not the least since calls for research on these types of technologies have appeared recently (Grewal et al., 2017). Due to the nature of these marketing stimuli, most of these studies have taken place in field settings. To date, most research in the topic has involved the use of digital signage (Burke, 2009; Dennis et al., 2014; Dennis et al., 2012; Dennis et al., 2010; Ravnik & Solina, 2013b; Roggeveen et al., 2016). Digital signage is a technology in which retailers connect TV monitors to broadcasts that show different types of content. In the existing empirical literature, the researchers all utilize products in one way or another.

There is also limited literature on a couple of other types of technologies retailers use for marketing stimuli. Smart shopping carts that can act as SSTs for calculating purposes may also be useful for location-based advertising

that has the potential to change depending on where the shopper is located (Dominici et al., 2016). Another one focuses on smart lighting, which may change as shoppers come closer to a focal place, such as a shopping window (Cremonesi et al., 2016).

Effects of in-store marketing stimuli technologies

Since these types of technologies most often rely on incidental approaches by shoppers that happen to stroll by right by them, there is an understandable lack of literature on why shoppers choose to engage with them. Instead, most studies in this stream focus on shopper reactions after exposure. This can include attentional aspects (Cremonesi et al., 2016; Dominici et al., 2016; Ravnik & Solina, 2013a, 2013b), affect (Dennis et al., 2014; Dennis et al., 2010), and/or actual shopping behaviors (Dennis et al., 2010; Roggeveen et al., 2016).

In a survey-based study, the mere presence of positively evaluated digital signage has a positive effect on approach intentions such as sales intentions and repatronage behaviors, as they increase shopper' positive affect and perceptions of the shopping environment (Dennis et al., 2010). Later studies have examined the role digital displays have on emotions (Dennis et al., 2014). However, most studies show that it is more complicated than that, indicating several important boundary conditions.

The type of content the shopper-facing retail technology conveys plays an important role in shopper responses. Dynamic content, versus static, attracts more attention to both digital displays (Ravnik & Solina, 2013a, 2013b) and lighting fixtures (Cremonesi et al., 2016). Sticking out from the clutter surrounding them may be one plausible explanation, although none of these studies offered reliable sales behavior responses as a consequence of the increased attention.

Other field experiments show that in a grocery setting, larger stores are more likely to benefit from digital displays (Roggeveen et al., 2016). Roggeveen et al. (2016) also showed that content that focuses on price communication content is driving more sales than inspirational content. This is somewhat in contrast to what Dennis et al. (2014) found in their study, which they conducted in a department store, where affective content (pictures of a tropical island) evoked more positive attitudes towards a holiday trip digital

ad. Possible explanations for this contrast include the type of product (groceries versus a holiday trip) or the distance to the product (getting it instantly in the store versus buying it later, such as a holiday ad). As a general conclusion, Burke (2009) argued that retailers must tailor digital signage to the state the shopper is in, which may differ between different times of the week, what shoppers need at different stages of shopping trips, and the categories of the signs. Thus, it is clear that contextual factors play a big role in the effectiveness of digital displays, an area that needs additional research. Dynamic content seems to attract more attention, while simplicity seems to be key in terms of content to make shoppers go from attention to buying action.

Research opportunities based on existent literature

There are many research opportunities in technological in-store marketing stimuli. Unlike the SST research stream, this research stream does not necessarily suffer from a lack of knowledge of shopping behaviors, or even field studies. Instead, there is a lack of understanding of how other types of in-store technological marketing stimuli may make shoppers more inspired and drive sales. That is, the underlying mechanisms responsible for the shopping behavior responses. The study from Cremonesi et al. (2016) is a welcome addition, but there are so many other in-store technologies that researchers can examine. For example, can technologies that are a blend of marketing communications and SSTs offer shoppers different types of value than affect and emotions? Examples of this include smart mirrors, which are already available at certain make-up counters and in certain fashion retailers. There could also be interactive kiosks and tablets that aid the shopper in what to cook for dinner, or what accessories go well with a garment.

Another research opportunity comes from understanding whether cognitive or affective reactions drive changes in shopping behaviors and intentions. Affect has mediated the effects of different types of stimuli on approach behaviors (Dennis et al., 2014; Dennis et al., 2010). At the same time, different types of content have directly affected time looking at the focal object (Cremonesi et al., 2016; Ravnik & Solina, 2013a, 2013b). Could it be that there is a causal mechanism that certain stimuli lead to attention, which in turn lead to emotions, and eventually increased sales? Experimental studies that examine both the attention-capturing ability and the thought-

provoking ability of technological marketing stimuli would be able to examine just that.

Stream 3: Mobile and augmented reality technologies

Types of mobile and augmented reality technologies

While the research stream on technological in-store marketing stimuli is still ongoing, a third parallel stream of research in shopper-facing retail technologies has emerged that deals with mobile phones and other types of completely shopper-controlled gadgets. These differ from most of the traditional marketing stimuli, in that they often involve the shoppers' own devices, such as smartphones, while they are moving around in the store.

Most these studies focused on mobile phone coupon redemptions (Bues et al., 2017; Danaher et al., 2015; Fong et al., 2015; Hui et al., 2013) and how different characteristics of coupons and where shoppers are when they receive the coupons has been of particular interest. A few studies have also focused on the different types of usage of mobile phones while shoppers are in the store (Fuentes & Svingstedt, 2017; Gensler et al., 2017; Sciandra & Inman, 2016). As shoppers walk around in a store, they may use their phones for different purposes, such as finding particular items or searching for information about the shopping trip, but they may also use their phones to keep connected with friends for completely non-shopping-related reasons (Fuentes & Svingstedt, 2017). Some studies have also touched on the phenomena of showrooming behaviors (Fuentes & Svingstedt, 2017; Gensler et al., 2017).

Finally, there is also the emergence of AR research, that is, how retailers can add digital elements to the physical retail environment. While this could involve users' own smartphones, research so far has examined how fixed displays with cameras can showcase products as they would look on a shopper's body (Poushneh & Vasquez-Parraga, 2017).

Types of in-store mobile usage

There has been limited research on the reasons why shoppers would be willing to use their mobile phones or other advanced shopper-facing technologies in the store, but a few have touched upon the area. In general, shoppers

use mobile phones in the store for two major groups of reasons: shopping-related and non-shopping-related activities (Fuentes & Svingstedt, 2017; Sciandra & Inman, 2016).

Shopping-related activities, which include activities such as using shopping lists, price searching online, and searching for product information have received at least some attention. One study that used focus group interviews on the role of mobile shopping unveiled some interesting patterns (Fuentes & Svingstedt, 2017). Some shoppers indicated that they could get more unbiased information from a mobile phone search than from a conversation with a service emsployee. When shoppers feel lower trust towards service employees, they may search for information elsewhere. In this sense, the mobile phone starts acting almost as a self-service technology. However, unlike the SSTs, the retailer has little to no control over how consumers use their phones, and what information they can receive from other sources. Other usages related to patterns such as showrooming activities, which means that shoppers visit a physical retailer to look at and try out a product, while later buying it online or at another retailer with a lower price. Undoubtedly, the magnitude of these types of behaviors has received little attention from researchers.

In contrast to shopping-related activities, the most common way of using mobile phones in retail settings seems completely unrelated to the actual shopping task. Sciandra and Inman (2016) found that the vast majority of mobile usage at mass-merchandise retailers is non-task-related (87%). However, this type of usage has received very little attention from researchers. Other types of advanced technologies such as AR usage inside physical stores have not received much attention in terms of antecedents to usage. However, the results from the literature on SSTs show that technology anxiety and usefulness are likely drivers of the usage of these types of shopper-facing retail technologies.

Antecedents and effects of mobile phone use

Researchers have studied the effects of the usage of these types of technologies in more detail, however. The literature on mobile coupons and advertising has shown that the redemption rates of coupons (Danaher et al., 2015; Fong et al., 2015), unplanned spend (Hui et al., 2013), shopping experience

satisfaction (Blom et al., 2019), and purchase intentions (Bues et al., 2017) are all functions of different types of relevance-related elements.

The physical proximity of products when shoppers receive their mobile coupon is of increasing relevance. As retailers send coupons close to the focal advertised product or store, redemption rates increase (Bues et al., 2017; Danaher et al., 2015; Fong et al., 2015). Fong et al. (2015) even showed that when shoppers receive really good discounts for products on their mobile phones when they are close to competitors, the redemption rates go up, as the proximity of the competitor makes the competitive coupon more relevant. Coupons close to the focal product also make the shopper feel a higher perceived value and more positive emotions, which explains the increased redemption rates when shoppers receive coupons close to the focal product (Bues et al., 2017). In addition, personalizing the mobile advertisement can increase purchase intentions (Bues et al., 2017). Similarly, Blom et al (2019) found that promotions that are congruent with shopper's earlier behavior in an online channel increased satisfaction with the physical shopping experience. Using shorter timescales (such as "only valid today") also increases the redemption rates, as it signals urgency (Danaher et al., 2015). After all, with the magnitude of marketing communication wherever humans congregate, relevance is important to stand out and to make shoppers react. What the collected mobile promotion literature suggests is that relevance is key to make advertising effective and to make shoppers care.

It is perhaps even more interesting that mobile promotions can enhance sales for more than just single products. Relevant coupons may make shoppers move off their beaten track in the store and visit departments and categories they might not have visited without the coupon. This could, for example, connect to loyalty data or to digital shopping lists. As shoppers move through the store, they also pass unrelated items they see while walking to the focal product on the coupon. This behavioral effect may increase overall sales by over 16%, according to a simulation (Hui et al., 2013). Yet, the basis of this figure is a simulation with an assumed 20% redemption rate. Further experiments would be necessary to assess the actual effect on overall sales.

Another important factor Sciandra and Inman (2016) found is that different types of mobile phone usage affect unplanned and planned purchases.

They found that when shoppers used their phones for non-shopping task-related activities, sales of unplanned items went dramatically up, while shoppers were more likely to forget to buy their planned items. The opposite held when shoppers used their phones for task-related activities, such as information gathering on the phone; then, shoppers bought fewer unplanned purchases. They focused on decision quality, and they used secondary data to show causality, so experimental studies are necessary, but the results suggested that encouraging shoppers to use their phones for other things than shopping-related activities may actually be a good idea for retailers.

Effects of augmented reality

One of the few studies that have examined AR in physical settings showed, in laboratory settings, that AR may shape the shopper's user experience, as it can highlight a product's unique qualities. This in turns increases the willingness to buy and satisfaction (Poushneh & Vasquez-Parraga, 2017). In the field, the only AR study conducted so far focused on the enjoyment aspect of AR in a toy store. Interactions with that type of technology made people feel greater enjoyment and increased their perceptions of the value of the store visit. However, there has been no examination of sales or actual behavioral responses.

Research opportunities based on previous literature

It is clear that there is quite some interest in the role of mobile phones, AR, and most likely other types of shopper-facing retail technologies. However, due to the relative novelty of these types of technologies, the role of these elements is still developing. For example, mobile promotions may work, and the location aspect is important for redemptions. However, it is not clear how researchers can use mobile phones as a marketing tool to boost overall sales. Hui et al. (2013) indicate the potential for large increases in average basket size in a data simulation, where they argue that mobile promotions inside a store could potentially change the way shoppers walk through the store. This would then expose shoppers to more items on the way to focal items. However, since mobile promotions studies show that redemption rates are heavily dependent on receiving mobile coupons in close proximity to the advertised product (Bues et al., 2017; Danaher et al., 2015; Fong et al.,

2015), the question is how retailers can enhance the relevance of mobile promotions in other ways to make shoppers actually change their walking patterns in the store. Future research could potentially utilize experimental studies to unveil precisely what type of content makes shoppers so intrigued with a focal product or department that they are willing to take detours in their in-store walking patterns.

There is also a clear opportunity to look more broadly into general phone use inside stores. If 87% of the time spent on the phone does not relate to the shopping task, the question is how that type of usage affects shoppers' walking patterns. If shoppers are not looking at products, but at their phones, will phone usage hurt sales? Will distracted shoppers spend more time in the store? The results from Sciandra and Inman (2016) suggested the latter, at least in a mass-merchandise setting. This contrasts with what Hu et al.'s (2013) mobile promotion simulation suggested. Which path is the most important remains uncertain. Is it the lowered decision quality (Sciandra & Inman, 2016) that drives the best sales behaviors, or is it the high relevance of mobile promotions that may make the shopper walk around more in the store (Hui et al., 2013)? The research opportunities with regard to these types of factors are endless, and they warrant more attention.

There are also research opportunities in the way retailers can use AR technologies to facilitate shoppers' decision-making. For example, if a shopper could see him- or herself wearing a particular garment on a screen, instead of having to wait in line for a changing room, would that drive more sales? Other interesting elements include how retailers could use AR applications to map additional information of products in the physical store or to create suggested pathways for shoppers who want extra help to find their way in the store. The latter could also be extremely helpful for shoppers with early stages of dementia to help them to remember what to buy, which opens up an additional stream of research opportunities that this dissertation does not discuss – the social responsibility opportunities of new shopper-facing retail technologies.

General conclusions and research opportunities

There are some common factors in the three streams of shopper-facing technology research that warrant a further discussion: three main shopper responses, the lack of field experiments, and the absence of actual sales behaviors. These elements are in Table 1.

Three process mechanisms that explain shopping behaviors

There are three major types of mechanisms that explain how shopper-facing retail technologies affect shopping behaviors: cognitive, affective, and behavioral responses. All three mechanisms showcase plausible explanations of why different types of shopper-facing retail technologies affect behaviors. Cognitive mechanisms in this coding refer to mental mechanisms that spur thought, such as perceptions of how good the interaction is (e.g., Blut et al., 2016) or how easy shoppers perceive an interaction is (e.g., Blut et al., 2016). Affective shopper reactions include emotional responses to shopper-facing retail technologies (e.g., Bues et al., 2017). Finally, behavioral responses include behavioral effects of shopper-facing retail technologies, such as changes in how shoppers move through the store, and attention to marketing stimuli (e.g., Hui et al., 2013).

Based on the literature review, it appears that shopper-facing retail technologies that require a lot of interaction (such as when shoppers are in a System 2 mode) generally lead to cognitive responses that in turn lead to different shopping outcomes. This is especially clear from the literature on SSTs that require shoppers to interact with the technology to work at all. Technological marketing stimuli, mostly digital displays, are there to capture shoppers' attention when they are passing by (most commonly in a System 1 mode, when they are more receptive to heuristic cues). Here, affective shopper responses are mostly what lead to shopper reactions, such as an improved mood. Behavioral shopper responses appeared in different types of shopper-facing retail technologies, such as mobile coupon use (Hui et al., 2013), as well as technological marketing stimuli such as interactive lightning (Cremonesi et al., 2016). However, behavioral responses were not very common in the SST research stream.

Lack of field experiments and objective shopping measures

Second, the literature review indicates that there is a need for field experiments in all three streams. The vast majority of studies have used descriptive surveys that indicate correlation, but that lack causality evidence (Antonakis, Bendahan, Jacquart, & Lalive, 2010), or lab experiments that may lack external validity (Winer, 1999). As becomes apparent in the summary tables, only a handful of these studies have used experimental designs in field settings. This is problematic for a couple of reasons:
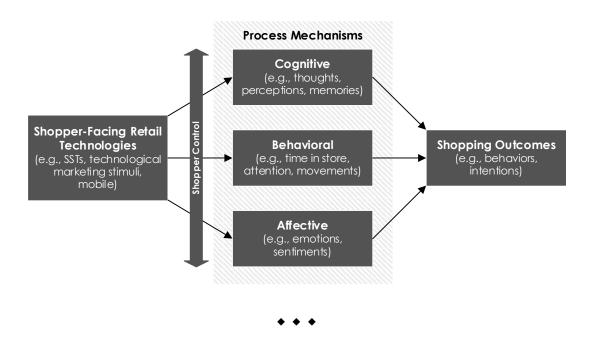
Survey-based studies provide great understanding on what shoppers' perceptions of certain shopper-facing technologies in the field are. However, they have an inherent issue with causality and self-selection bias. For example, it is impossible to show that shoppers' perceptions of an SST's service quality impact the number of uses of SSTs (such as in Lee & Yang, 2013). It could just as well be that shoppers who visit a retailer more often are more used to using the SST, and they thus evaluate it more positively. Experimental designs with enough power deal with that problem, as it is just as likely for all participants to end up in an SST use as a non-SST use condition. Researchers may then be able to confirm any subsequent behaviors and perceptions as causal, as everything else is likely equal.

Lab experimentation is a great way of showing causal mechanisms, as researchers can keep tight control of everything in the study, while just manipulating the use of shopper-facing retail technology. However, as the introduction stated, there is a lot of noise in a physical retail environment that can make an effect that shows as significant in a lab disappear in a real-world setting. The opportunity here is to combine field surveys and lab experiments, for example by conducting field experiments. A deeper discussion on the benefits of field experiments follows in the next chapter

The previous literature also shows an abundance of actual shopping behaviors, and especially sales behaviors. Most studies focus on either how to make shoppers use shopper-facing retail technology (most apparent in the SST research), or the effects on shopping intentions, emotions, attention, or other proxies for actual value-creating behaviors such as sales. However, purchase intentions and actual shopping behavior do not always have strong correlations, which may lead to inflated assumptions (Kalwani & Silk, 1982; Morrison, 1979). Using actual sales behaviors from shoppers would enhance

not only the reliability of the study methods but also their external validity. An overview of the current state of empirical studies on the causal mechanisms of the current literature on shopper-facing retail technologies is in Figure 1. This conceptual overview of the existing literature falls into three steps: (a) the interaction or encounter with different shopper-facing retail technologies, (b) shoppers' reactions to them in terms of cognitive, affective, and behavioral responses, and (c) the outcome on shopping behaviors, intentions, or attitudes.

Figure 1. Conceptual illustration of causal mechanisms in previous shopper-facing retail technology research

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In this dissertation, the primary emphasis has been to utilize actual sales behaviors, to examine sales, and to examine the causal mechanisms for a handful of shopper technologies, such as general mobile phone use, and sensory technologies, such as music, scent, and projection technologies. Overall, the aim is to extend the existing literature with strong and empirical evidence that leads to effects on shopping behaviors and sales.

Chapter 3

Methodology

Relating to the literature review in the previous chapter and the overall research question for this thesis, there are certain essential methodological considerations for the design of the studies and the papers in this dissertation. The research question refers to understanding shopping behaviors when shoppers interact with, or encounter, shopper-facing retail technologies. This means that it is necessary to measure actual shopping behaviors to show causality. It also means that it is necessary to combine several types of data and methods to understand not only whether shopper-facing retail technologies affect shopping behaviors and sales, but also how this process works. That is, what the underlying mechanisms affecting shopping behaviors are in terms of the behavioral, affective, and cognitive shopper responses that the literature review revealed. Thus, this section presents the methodological considerations for the dissertation.

Triangulation of data and methods

Using just one method or source of data has some benefits. For example, it is relatively easy to replicate the study. However, an issue with just using one type of data is that one may not capture different dimensions of a research question. For example, an observation of shoppers in a store may provide great insights on how shoppers react in relation to a focal product display. Similarly, a survey may offer insights in shoppers thoughts with regard to a marketing stimulus. These types of method rely heavily on the measurement

accuracy of the observer/interviewer. One issue with this is that confirmation bias may occur, which is the process in which a researcher or research assistant tend to seek to (unconsciously) confirm a preexisting hypothesis (Nickerson, 1998). Other methods offer more objective data, such as actual sales from a retailer. However, that type of method lacks in explaining causal mechanisms as only the sales behaviors can be observed, but not any human responses to a study treatment such as affect, attention or cognition.

In response to the issues that are caused by single methods, one can combine different types of methods and data sources that seek to replicate the same dependent variable, but assess it in different ways. Thus, a cornerstone of most projects in this dissertation is that they use several sources of data and methods to explain how shopping behaviors change, as well as why. Triangulation is using two or more sources of data to deal with the same research question. This term stems from sailing and the traditional way of finding one's way by using two points of view in the sky to find one's position (Mertens & Hesse-Biber, 2012).

Utilizing various sources of data may shed light on a research question from different angles, allowing for greater validity in the research methodology. For example, take an experimental study looking at what happens with shopping behaviors if a retailer starts making baked goods inside the store that spread a pleasing scent of fresh bread for shoppers to enjoy. A study like that could involve hypotheses derived from the theory on spreading activation, such as shoppers who can smell the freshly baked goods may think about bread, or perhaps other food, and buy more. If everything else is equal in shopper characteristics, store offers, and so forth, and if the retailer experiments with baking items, perhaps looking at sales figures is good enough. If sales go up, this establishes the main effect, and it can support the usefulness of the scent of baked goods.

However, what is lacking from just using one data source – sales – is a deeper understanding of why this sales increase happens. It answers the question of *how* the scent of bread affects sales, but it is more difficult to argue *why* this is, other than from purely theoretical arguments. There are several theoretical and empirical drawbacks to this. First, if the underlying cognitive or affective mechanism among shoppers is unknown, the results are not easily generalizable. Second, we miss examining the role of the shopper and his

or her processing of the new sensorial cue. Clearly, the scent does not magically make shoppers buy more. Rather, the scent triggers something inside the shopper, automatically or not, that results in him or her shopping more. This could be an emotion (it is more satisfying to be in this environment), a cognition (someone thinks of cooking), or something else. Researchers call this view of using the shopper's internal reactions as an underlying explanatory variable to explain shopping the stimuli-organism-response model, where the shopper is the organism (Woodworth, 1929).

So how does this happen? One way to move from the question of main effects (the "how") to understanding the underlying mechanisms (the "why") is to look at various sources of data collected using different methods. In the example above, one could gather more vital information regarding the shoppers' cognitive and/or affective mechanisms by adding a different source of data through a different method, such as a survey. To assess attentional processes, one could observe shoppers. To understand the behavioral consequences that lead to increased sales, one could utilize ethnographic methods, such as eye tracking. An extended discussion of these elements of the research triangulation approach in this dissertation follows.

Behavioral data

Sales data

Actual sales data has the benefit of providing a relatively objective measure of whether there is a main effect or not. Does X lead to Y, such as does the scent of bread in a store lead to more sales? In retailing research, actual sales data would arguably be one of the strongest indicators of this, given that experiments control for store unique effects and calendar effects (Nordfält, 2011b; Nordfält & Ahlbom, 2018). This means that one takes the variation of confounding variables such as different weeks and different stores into account, for example by employing a Latin square design, which counterbalances the different treatments with different stores. An example of such a design is in Table 2. Another example is in Paper 2 (p. 54).

Table 2. An Example of a 2 × 2 Latin Square Study Design

	Test Period 1	Test Period 2
Store 1	Control	Manipulation
Store 2	Manipulation	Control

Sales data derived from the retailer's complete sales database provide among the most objective pieces of evidence for shopping behavior. Sometimes the study design also involves the opportunity to do experiments with the shopper, changing nothing in the store, such as asking shoppers to interact with an in-store terminal (Paper 3, p. 55) or using their mobile phones (paper 5, p. 58). There, records of individual shoppers' final shopping amounts are essential. The easiest way to do this is by taking photos of receipts.
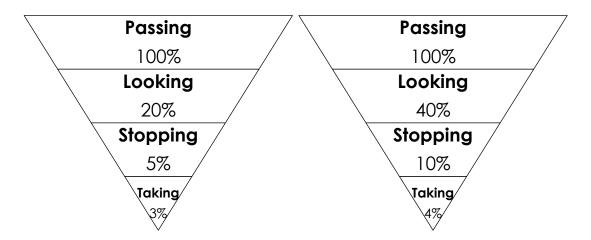
Observations

Another interesting method of understanding how (and why) shoppers react the way they do is to utilize observation. This method, closely attached to ethnographic studies, can be both a qualitative and a quantitative method. If the observation is of a more qualitative fashion, then it usually serves as a source of a very rich understanding of the shoppers' behaviors. Often this occurs on smaller samples to get rich data on shoppers, and there are many examples of successful observational studies in retailing (Fuentes & Fredriksson, 2016; Hynes & Manson, 2016). In this dissertation, I took a more quantifiable approach to the qualitative elements of observations.

One important aspect of in-store marketing is that shoppers who see a product are much more likely to buy it than shoppers who do not. There has been a discussion of the paramount importance of visual elements for years in different streams of retailing research (Baker, Parasuraman, Grewal, & Voss, 2002; Roggeveen et al., 2016). It is of some importance to understand whether an element creates attention. This could, for example, be that people look at baked goods more often when they smell the scent of freshly baked bread and that this attention leads to a higher probability that they will buy it. If you do not have bread on your mind or on a shopping list, and you do not see it, you are very unlikely to buy it on impulse.

One way to do this (e.g., Paper 2, p. 54) is by using a double conversion rate approach, where observers identify the most important behavioral actions (Nordfält, 2011a; Pieters & Wedel, 2008; Sorensen, 2003). Often, this is something like assessing whether shoppers also look at a product display or other focal element they are passing. If they also stop by the product display, they are likely thinking about whether they should buy the product or not. If they then take a product, we get a behavioral sales measure. Using the relative fractions of the conversion rates between two or more experimental treatments, one could find important process mechanisms, explaining that increased attention to the bread display causes the sales effect of the bread scent. A (successful) typical conversion rate tunnel between two treatments could look something like Figure 2.

Figure 2. An example of the double conversion method

Passing	Passing
100%	100%
Looking	Looking
20%	40%
Stopping	Stopping
5%	10%
Taking	Taking
3%	4%

Note. This is an illustrative example of two treatments. At each level of the conversion model, researchers can perform statistical tests to look for any differences.

These insights provide a deeper understanding of whether attention is the underlying mechanism in an in-store experiment. They may also rule out attention as a mechanism if that cannot be the driving factor. For example, there may be cases where attention to a product display is not the driving mechanism for purchase behaviors, but something else, such as

understanding how to use a product through added marketing communication,. If this is likely, some other methods may be more appropriate; a discussion of this follows next.

Eye tracking

An additional way to capture observational data is to utilize recent technologies such as eye tracking. Eye tracking records a person's point of gaze with different technologies to obtain information on the exact point at which a person is looking.

Eye tracking has several benefits. Pieters and Wedel (2008) pointed out a few important conclusions from existing research on eye tracking of high relevance to marketers:

- Eye movements reflect information sampling both in the time individuals are spending on a focal object and on where they put attention.
- The awareness of what one is looking at is very much limited. Individuals often do not take just because they are watching something.
- The perceptual field is very narrow, just about 2 degrees of the visual field around a fixation point. This is roughly the size of a thumbnail at arm's length.
- Eye movements have an association with attention, and attention has a strong association with cognitive processing

Eye tracking gives important insights about attention (Duchowski, 2002). What makes the method different from traditional observations is that it gives more detail on what exactly shoppers are observing. Today's technology is so sophisticated that one can gain insights at the level of individual products or even elements of a product. In our bread example, this could give insights into whether certain types of products are gaining more attention due to the bread scents, such as certain types of bread, or perhaps certain types of complementary products, such as cheese and butter (Chandon, Hutchinson, Bradlow, & Young, 2009).

Eye tracking allows the researcher not to predefine what to code up in the dataset as with the double-conversion method. In this way, the researcher may study an initial eye-tracking database with an ethnographic mindset to find interesting elements to code (Harwood & Jones, 2014). The researcher can then code and analyze these elements both qualitatively and quantitatively by translating the observations into statistical units of analysis. Coding can also involve theoretical argumentation with no ethnographic analysis, but that may also result in losing important insights from the rich dataset.

Portable eye-tracking devices are suitable for in-store marketing research, as they capture not only information regarding attention, but also actual behaviors during the entire shopping trip. For example, one can measure the way shoppers move in the store and code this. One can also see if shoppers agree with this and record any conversations they have during the shopping trip. For studies that place individual shoppers in an experimental condition, rather than changing an entire store environment, this method is useful.

A legitimate question is whether shoppers act differently if researchers ask them to wear eye-tracking glasses. From my personal experience, I would say no. Most people forget that they are wearing glasses. This is most clearly exemplified by the frequent need to run up to them at the checkout to ask them to remove the glasses when entering the PINs for their credit cards, which would otherwise be visible to the researchers. One of the papers in the present dissertation uses this method to enrich the understanding of what happens inside the store when shoppers use their mobile phones (Paper 5, p. 58). There, the eye-tracking study started with an entry survey asking shoppers how much they had planned to spend, what they had planned to buy, and so forth. When the shopping trip ended, the researcher took a photo receipt and collected measures on perceived distraction. The next section provides a discussion on the survey and questionnaire data.

Affective, cognitive, and attitudinal data

Surveys

The final data source for the projects here is surveys and structured interviews of shoppers (in the papers in this dissertation, usually with Likert-type

questions or semantic differential scales). The benefits of surveys and questionnaires are that they can capture elements of attitudes, affection, and cognition. By this, I mean what people feel when they encounter a marketing stimulus, what they think about when they are in the treatment, and whether they change their attitudes to a focal element such as the store. These elements can serve as process mechanisms (see the discussion later). They may also measure behaviors occasionally, with questions such as "have you bought Product X?" or similar.

In the example with the scent of baked goods, surveys could, for example, capture attitudes towards the store and its environments, emotions, and demographic variables that could moderate the effect. All the studies in this dissertation used surveys or interviews to gain insights on mechanisms like those.

One can conduct in-store marketing research in different ways, depending on the research questions and hypotheses in every project. Usually, triangulation of methods increases the validity of the research methodology and thus increases the generalizability of the results. This approach is a cornerstone of the approach of the present dissertation, and the aim has been to collect data of distinct types to understand mechanisms in greater detail. An overview of the papers and their data sources is in Table 3.

Table 3. Methods and Data Sources in the Papers

	Type of Data			Data Sources	
	Behavioral	*Affective or Attitudinal*	*Cognitive*	*Field Study*	*Online Study*
Paper 1 In-store music	Store sales data	Surveys	Pretest surveys	Yes	Yes
Paper 2 Sensory projections	Store sales data, observations, surveys	Surveys	Surveys, observations	Yes	No
Paper 3 VR	N/A	Surveys, interviews	Surveys, interviews	Yes	No
Paper 4 In-store kiosks	Shopper sales data	Surveys	Surveys	Yes	Yes
Paper 5 Mobile use	Shopper sales data, eye tracking	Surveys	Eye-tracking, surveys, observations	Yes	No

Note: Store sales data means data the researcher collected from the retailer for all sales during a specified period. Shopper sales data means receipt data the researcher collected from shoppers directly.

Field studies vs. lab studies

As a result of the research question (how and why are shopping behaviors affected), the ability to show causality becomes of paramount importance. Most studies utilize experimental designs as the dominant study design, sometimes paired with some observational data. According to de Vaus (2001), there are two main experimental design implementations: laboratory and field experiments.

Laboratory experiments or controlled experiments have several benefits. First, since the researcher controls them tightly, there is little doubt regarding confounding variables. Given that true randomization between different manipulations occurs, a controlled experiment changes only one predefined element, keeping everything else stable. It allows for easier replication, and it is easier to unveil process mechanisms due to a specific element. Different varieties include a true lab experiment, where one must just do something based on an instruction, or experiments that are scenario-based, where the participants must role-play themselves into a scenario (Söderlund, 2018),

such as "imagine this: you are out shopping.…" The downsides are that the real world is not stable. The surroundings change constantly, and if one considers a physical retail environment, much will differ between two visits: the stock, the cleanliness, the reason the shopper is there, the crowdedness, the time of day, and so on.

Therefore, field experiments are essential to allow for strong ecological validation, i.e., that an effect is replicable despite all possible confounding elements (Söderlund, 2018). At its very core, a field experiment is a robustness check of a mechanism. If it is strong enough to hold, despite the cluttered in-store environment, it is relevant in real life, a concern that has grown within marketing in recent years (Simester, 2017). A downside with field studies is, however, that process mechanisms (i.e., emotions and affections) are more difficult to measure and obtain. Researchers may lose some explanations. There is also an issue with the lack of control over extraneous variables that may change, such as cultures, times of the year, and so on.

Another way of arguing for the need for natural field settings for experiments comes from the fluency literature and the concepts of incidental and forced exposure of a stimulus (Nordfält, 2005). In controlled lab experiments, the researcher forces the stimulus upon the participant, rather than letting participants encounter a stimulus incidentally, which happens in a natural environment. In the bread scent example, this becomes obvious. If one walks into a laboratory room with bread scents, the scent is not only dominant, but it is an obvious stimulus, thus forcing attention to the scent. In a field setting with thousands of other elements fighting for participants' attention, this exposure becomes much less obvious. Since the shopper has no idea of the different treatment groups, and he or she is unlikely to think about this instantly, the exposure becomes incidental, and any measured responses to the stimulus, conscious or unconscious, have much higher validity. The fundamental difference in field studies is that the incidental exposure can capture both conscious and unconscious cognitive mechanisms that result in responses (Nordfält, 2005; Shapiro, 1999; Shapiro, MacInnis, & Heckler, 1997).

In the best of worlds, one combines controller and field experiments to mitigate each other's limitations. In two of the studies in the present disser-

tation (Paper 1 and Paper 4), this occurred. Thankfully, today different software packages allow researchers to make field emulations in computerized settings that get closer and closer to real-life shopping experiences. These two papers present some examples of new methods, and this discussion is in the methodological contributions section. The other projects instead focused on replication of field experiments to prove the robustness of the results.

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As a concluding note, the chosen methods are selected to allow for satisfactory validity and reliability. For the empirical data collections used in the research papers in this dissertation, high validity is achieved by utilizing field experiments that allow for real-world noise, while at the same time combining these experiments with tightly controlled lab studies. The use of triangulation of methods and data sources further enhance the validity of the study designs. While field experiments may be stronger in external validity, that is the generalizability of the findings; the lab studies are strong in the internal validity when they are designed correctly.

High reliability is achieved by utilizing carefully selected and in some cases pre-tested measurement scales from previous research. That way it is more likely that what is intended to be measured is actually measured. An important contributor to high reliability in the field experiments is also that I was personally out in the stores and made sure that any research assistants that were collecting data did it the right way, and understood the questions and methods correctly.

Finally, it is worth pointing out that one of the ways this research provides high validity is by utilizing field experiments, which is not as common as one might think in human behavior research (cf. Baumeister, Vohs, and Funder, 2007). Utilizing survey data and laboratory studies provides important insights into peoples' internal thought process, but as discussed in the previous chapter, behaviors are often dependent on more than just conscious cognitions. Most of the field experiments presented in this dissertation do look at shopping behaviors, not intentions or satisfaction attitudes.

Chapter 4

Research Papers

In response to the research question, five distinct research papers now follow. They all deal with shopper-facing retail technologies and their effects on shopping behaviors. This chapter contains extended summaries. The full versions are in the appendices.

Papers 1, 2, 4, and 5 explain how five distinct shopper-facing retail technologies affect shopper behaviors. The main dependent variable is purchase behaviors or sales. Paper 3 uses the proxy of store evaluation. All papers also include process mechanisms, dealing with explaining why these technologies impact shopper behaviors.

These papers cover a continuum of different types of shopper-facing retail technologies, with shoppers actively using them or shoppers just encountering them. They are thus structured based on how much control and ability to interact with the technology shoppers possess. At one end-point is Paper 1 which deals with in-store music playing in the background for shoppers. Here, shoppers have no control whatsoever over the marketing element (sounds), and they cannot dodge it, other by leaving the store. At the other end is Paper 5, in which shoppers interact with their own technological devices – mobile phones. This project focuses on the effects of mobile phone usage when shoppers choose to use their phones while grocery shopping. In this sense, the shopper-facing retail technology is not under the control of the retailer. The other papers fall somewhere in between. Accordingly, shopper responses (process mechanisms) may explain any shopping outcome. The process mechanisms differ between cognitive, affective, and behavioral

responses, and they align with the conceptual framework in the literature review in Chapter 2 (see Figure 1 on p. 37).

The papers use an array of different methods, with the majority utilizing triangulation of methods and data sources, to assess their effects on shopping behaviors more extensively. Chapter 3 gave an overarching discussion of the methodological choices and tradeoffs. The papers also use theoretical grounds including congruency theory, attentional capability theory, embodied cognition theory, and categorization theory. An extended discussion on these theoretical approaches is in the full manuscripts in the appendices.

Paper 1. When In-Store Music Enhances Sales: The Role of Motivational Congruity

Authors:
Anne L. Roggeveen, Babson College
Dhruv Grewal, Babson College
Carl-Philip Ahlbom, Stockholm School of Economics
Jens Nordfält, University of Bath

Status:
In review. Preparing for 2nd round revision at the *Journal of Marketing*. An early version of the paper was awarded the Stanley C. Hollander award for the best retailing paper at the 2016 AMS Annual Meeting.

Shopper-facing retail technology:
Background music system.

Summary

Does in-store music enhance sales? Investing in a new sound system and paying monthly subscription fees to music providers costs retailers a lot of money. Generally speaking, the mere presence of in-store music seems to have a positive impact on shopping behaviors. However, there are many conflicting results from studies examining the effects of in-store music, as some

studies show great effects of utilizing music as a marketing tool, while others show null effects.

To clarify the conflicting results in prior research, we propose that motivational congruity, which results from a match between the shopper's motivation for shopping (utilitarian/hedonic) and the shopping environment (functional/experiential), can predict whether and when in-store music is effective. In this study, we operationalize this by showing that shoppers show more utilitarian shopping behaviors during weekdays and more hedonic behavior during weekends. We also examine differences in shopping environments from very experiential (as in a high-end store such as a Wholefoods) to functional (a local grocery store).

First, we provide a meta-analysis of extant research on the in-store effects of music. This shows that shoppers with congruent shopping motivations and store environments showed much better in-store behaviors (e.g., sales) when stores played music.

Second, we performed three studies, including a field study. The field study took place at three grocery stores in Sweden, and we used aggregated, objective, sales data as the dependent variable. We conducted lab studies using an innovative screen-based shopping simulation with music (or no music) playing in headsets for the participant, who then had to make a series of shopping decisions based on a scenario.

The studies indicated that in congruent situations, music enhances sales, whereas, in incongruent situations, music detracts from sales. The results are consistent, both in the field and in the lab. Retailers should play music when shoppers' motivations and the store environment are congruent – but not otherwise. For example, non-functional grocery stores should play music during weekdays, when shoppers have a more utilitarian mindset, while high-end experiential stores such as Wholefoods or Eataly should play music during weekends, as their shoppers' mindsets are congruent in those situations.

In response to the review process, two additional studies have been conducted that show that positive affect is a mediating mechanism to the effect of motivational congruity on sales. While they are not reported in the current manuscript (Appendix A), they are mentioned here as they align well with the conceptual framework put forward in Chapter 2.

Paper 2. Multi-Sensory Projections in Stores: A Field Study

Authors:
Dhruv Grewal, Babson College
Elisa B. Schweiger, University of Bath
Anne L. Roggeveen, Babson College
Carl-Philip Ahlbom, Stockholm School of Economics
Jens Nordfält, University of Bath

Status:
To be submitted. Preparing for submission, presented at academic conferences.

Shopper-facing retail technology:
Multi-sensory projection system (visual, auditory, olfactory).

Summary

Many stores use digital signage to enhance the shopper experience and to be flexible to changes in the assortment of goods. However, to date, most stores have focused solely on screens with different messages. In this study, we assessed how retailers can use the store floor and product displays as the scene for visual marketing communications, by utilizing new projection technologies. We also examined the understudied area of multisensorial marketing communications, by examining how retailers can combine visual projections with auditory and olfactory cues to find boosting combination effects. There is also a matter of sensorial thresholds, i.e., whether there is an optimal level of stimulation for a product display, and whether it can become too much. Theoretically, this project utilizes optimal stimulation theory from different angles.

The paper consists of three field studies, which we conducted in three grocery stores in the Stockholm area. The first field study examined whether utilizing visual projections on special displays on two end-cap displays with pasta/tomatoes and nuts respectively had any effect on shoppers. We utilized

a Latin square design with three conditions: a no-projection condition, a static projection condition showing the products and the price on the floor, and a vivid projection showing a short video of how to use the product and items that were visually falling down from the end-cap display.

The results of observations, sales analysis, and shopper interviews indicated that there was a positive effect of the static, product and price, projection relative to the control. The vivid projection did not perform better than the control condition, indicating that it contained too much sensorial information. Increased perceptions of visibility of the special display, as well as an increased mental involvement, mediated this effect. Mental involvement means that the shopper understood the product and how to use it for, e.g., cooking.

In two follow-up studies, we tested the effect of added congruent olfactory and auditory elements to the static projection. The results indicated that scents added to the increased sales effect of the static condition, but auditory elements added even more. However, combining the olfactory, auditory, and visual elements had a null effect against the control condition, indicating overstimulation.

As a general conclusion, from a practical point of view, this paper shows that retailers may utilize their floors more as marketing elements. From a theoretical perspective, it seems that sensory marketing in in-store environments is promising, but that retailers should avoid overstimulation, as shoppers simply cannot take everything in.

Paper 3. Sensory Embodiment in Virtual Reality: Opportunities and Limitations

Author:
Carl-Philip Ahlbom

Status:
To be submitted. Preparing for submission, presented at academic conferences.

Shopper-facing retail technology:
VR glasses using smartphones.

Summary

The rapid development of immersive VR technologies has opened up the retailing field to many new opportunities, including a new market research technology and a potential new shopping channel. However, little is known about the extent to which a VR shopping environment can substitute for a real-life shopping situation. With the limitation that VR provides mainly visual and auditory stimuli, shoppers might feel that they lose out on important sensorial decision-aiding information. This project assesses the question: are VR store simulations good enough for market research use, or do we need to adapt to the lowered sensorial inputs VR technology offers?

Using theory based on the sense of embodiment and information processing, we performed a field experiment in the fashion industry. The study revealed that shoppers in a VR simulation suffer from a lower sense of embodiment, which spills over to evaluations of the store and its products. However, while a lower sense of embodiment negatively influences store evaluations, this is primarily important when the assortment of goods requires extensive sensory information, such as with complex fashion items rather than with items that are easier to understand (e.g., plain t-shirts).

The main conclusion of the study is, thus, that retailers that showcase items that are easy to understand may use VR depictions of stores for marketing research purposes or even as an additional shopping channel. If the shopper wants to touch the items in more detail to understand the products, however, market researchers and retailers should be aware that the store may get a lower evaluation due to the shopper experiencing a lower sense of embodiment.

Paper 4. Mobile Integrated Kiosks: How Communication Content Increases Unplanned Spending

Authors:
Dhruv Grewal, Babson College

Carl-Philip Ahlbom, Stockholm School of Economics
Stephanie M. Noble, University of Tennessee
Venkatesh Shankar, Texas A&M University
Unnati Narang, Texas A&M University
Jens Nordfält, University of Bath

Status:

In review. Reject & Resubmit at the *Journal of Marketing*, revising for resubmission.

Shopper-facing retail technology:

Self-service kiosks with inspirational and promotional content.

Summary

In this paper, we examine mobile integrated kiosks that shoppers often find in retailers. Mobile integrated kiosks in retail settings help information to flow seamlessly across in-store technology, the retailer's website, and mobile apps. These kiosks differ in functionalities between retailers, but they may offer coupons, recipes, shopping lists, shipping options, sales, and more.

A better understanding of their effects on shopper behavior can help retailers to leverage them to encourage unplanned spending and sales, while at the same time offering additional value to the shopper. Noting the theoretical and managerial importance of the relative effects of inspirational (i.e., content that sparks ideas or shows creative product uses) versus promotional (i.e., content that provides customers deals and offers) communications, we predict varied effects of different content.

Specifically, we utilize categorization theory to explain that different types of content may activate thoughts of products when retailers present the content differently. The hypotheses tests involved two field experiments in grocery stores and two follow-up lab studies. The field experiments took place at a grocery retailer, and they utilized the retailer's own kiosks. The lab experiments utilized a simulated shopping experience with an encounter with a kiosk containing deals or a recipe, or a control condition with no kiosk. We then asked shoppers to make a virtual shopping trip.

The results revealed that inspirational communication content increases unplanned spending and sales more than promotional communication content does. In line with categorization theory, the activation of category-related thoughts and purchases of substitute products relating to the inspirational communication content mediated these effects. The effects are also more pronounced for shoppers who spend less on groceries or who process information concretely. Retailers thus might increase sales by offering inspirational ideas to shoppers through mobile integrated kiosks and by targeting low-budget, frequent shoppers by providing inspirational information in a more concrete way.

Paper 5. In-Store Mobile Phone Use and Customer Shopping Behavior: Evidence from the Field

Authors:
Dhruv Grewal, Babson College
Carl-Philip Ahlbom, Stockholm School of Economics
Lauren Beitelspacher, Babson College
Stephanie M. Noble, University of Tennessee
Jens Nordfält, University of Bath

Shopper-facing retail technology:
Mobile phones.

Summary

Ever thought that using your mobile phone may make you a smart shopper? Perhaps you think that you will not encounter any marketing materials if you just look at your screen, or perhaps you remember the time when you did a price search of your phone? In this project, we focus on the general use of

the phone, because, to be honest, most of us look at our phones for messages, social media, calls, or e-mails: not for price comparisons. This research examines just that: consumers' general in-store mobile phone use and shopping behavior. The major driver for this project is that anecdotal evidence has suggested that mobile phone use reduces point-of-purchase sales. However, the results of the current study indicate instead that it can increase purchases overall.

In this paper, we utilized eye-tracking glasses to record shoppers' complete shopping trips, as well as coding data up, frame by frame, on relevant actions, such as looking at products and moving to different parts of the store. Using this eye-tracking technology in both a field study and a field experiment, matched with sales receipts and survey responses, we showed that mobile phone use (vs. nonuse) and actual mobile phone use patterns both lead to increased purchases, because consumers divert from their conventional shopping loops, spend more time in the store, and spend more time examining products and prices on the shelves.

Building on attention capacity theories, we proposed and demonstrated that the underlying mechanism for these effects is distraction. This article also provides some insights into the boundary conditions of the mobile phone use effect. Specifically, mobile phone use has more effect on older shoppers.

Retailers that seek to enhance sales by having shoppers experience more of the store could ensure that the store has adequate mobile phone reception and Wi-Fi, and they could encourage mobile phone use in different other ways, such as marketing communication, and, as some of the retailers in the study did, by installing smartphone holders on their shopping carts. Shoppers who do not want to overspend may want to keep their phones in their pockets until they have exited the store. The human mind just seems too limited to handle both a phone and a shopping task.

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This chapter has introduced a summary of each paper in the dissertation very briefly, in an abstract format. An additional overview, based on the research domains the introduction section discussed, is available in Table 4. Much

more detail is in the appendices, which present the current versions of the manuscripts. Next, Chapter 5 presents an overarching discussion of the contributions of the present dissertation.

Table 4. Domains and Research Paths

| Paper | Research Domain | | |
	Substantive	Methodological	Conceptual
Paper 1 In-store music	In-store music being played during different types of shopping trips	Field quasi-experiment Online experiments with a survey and a new type of in-store simulation	Motivational congruity
Paper 2 Sensory projections	Multiple sensorial cues at special displays (visual, scents, sounds)	Field quasi-experiments	Sensory marketing Optimal Stimulation
Paper 3 VR	The suitability of VR depictions of physical stores	A field experiment in a mall Lab experiment	Sensory marketing Embodied cognition
Paper 4 In-store kiosks	Type of communication	Field experiment	Categorization theory
Paper 5 Mobile use	Mobile phone use when grocery shopping	Observational eye tracking data Field experiment with eye tracking and surveys	Distraction Limited attention capacity

Chapter 5

Discussion

After the presentation of the papers, this section links back to the initial research question, "How, and why, do shopper-facing retail technologies affect shopping behaviors?" Here, a discussion presents and discusses the contributions to both academia and industry through the lens of the three research validity domains: substantive, conceptual, and methodological.

First, there is a discussion on the conceptual domain, i.e., the addition to theory and literature. Then, a discussion on contributions to the methodological domain follows, highlighting some of the innovative methods in the paper. Finally, a discussion on contributions to the substantive domain, i.e., the managerial implications wraps the section up.

Contributions in the conceptual domain

Literature review

One aim of this dissertation was to extend the literature on shopper-facing retail technologies and their effect on shopping behaviors. One important conceptual contribution is the synthesis of existing research on shopper-facing retail technologies that appeared in the literature review. It offered a conceptual framework for the effects of shopper-facing retail technologies with affective, cognitive, and behavioral shopper responses leading to shopping

outcomes. Studies that examined technologies that require lots of interaction tended to have more cognitive mediators, while technologies that rely on attention tended to have more affective mediators. The process mechanisms found in the empirical studies in this dissertation also reflected this. Although they did not explicitly examine the model fit or competing pathway, this summary of the existing research acted as a starting point to provide answers to the research question. It is also worth noting that the three shopper responses that were identified as common process mechanisms indicate that their suitability may be a function of shopper control, or direct interaction with the shopper-facing retail technology. If shoppers can interact directly, cognitive responses appear which may explain results. Conversely, when shoppers are just passing by something, such as a digital display, affective responses may be more interesting for researchers.
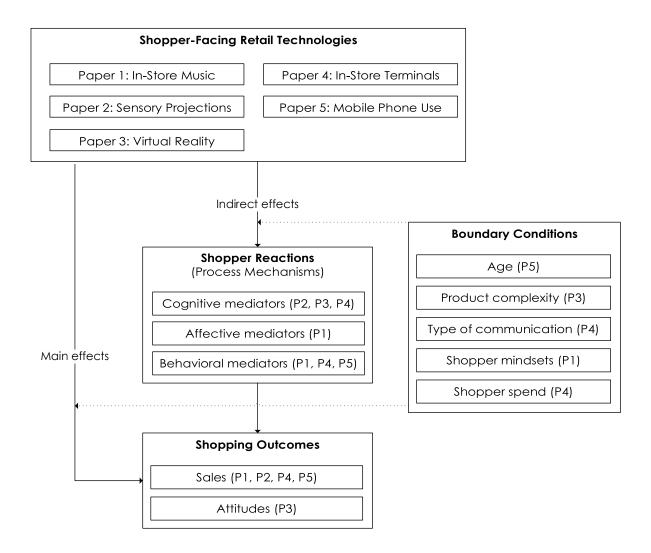
Apart from summarizing and synthesizing the existing literature, the literature review also outlined several research opportunities for future research. One of these related to the need for more experimental and empirical support for the effects on actual shopping behaviors. This is, at least in part, offered in this dissertation. Another highlighted common antecedents to the usage of shopper-facing technologies, such as technology anxiety and usability perceptions. These common elements are important for both academia and industry. Researchers can design studies with technologies that they believe fulfill those requirements. Retail managers can make sure that technologies that require the shopper's direct interaction (such as SSTs) do not fail on those dimensions. For example, any introduction of shopper-facing retail technology should include a careful analysis on how to educate shoppers to use it – whether through instructions on a screen or through service employees.

Papers

The conceptual framework that came out of the literature review, especially with regards to the process mechanisms, was also examined in each of the empirical studies. An overview of the research papers and how they address causes, effects, process mechanisms, and boundary conditions is presented in Figure 3. The mediating process mechanisms have their foundations in the shopper reactions in the literature: cognitive, affective, and behavioral. In

addition, moderating boundary conditions come from theories relating to the specific shopper-facing retail technology.

Figure 3. Overview of the dissertation papers

With regards to the main effects, shopping behaviors change because of the shopper-facing retail technologies we examined in the empirical studies. By utilizing field experiments, this dissertation provides evidence that shopper-

facing retail technologies can affect shopping behaviors by creating inspiration, attracting attention, distracting them, or making them think about other products.

As a general conceptual contribution, the joint dissertation shows that shopper-facing in-store technologies affect shopping behaviors through one of three major ways: First, they may provoke cognitions, such as making shoppers think about how to use an item [Paper 2 (sensory projections)] activating thoughts about other products [Paper 4 (kiosk)], providing a sense of control over sensorial inputs [Paper 3 (VR)], or distracting shoppers during the shopping trip [Paper 5 (mobile)]. Second, they may change shoppers' behaviors, prior to affecting purchasing behaviors (and sales). This can involve attention-capturing in-store elements that result in shoppers looking at products [Paper 2, Paper 5] or it can affect shoppers' movements or time in the store [Paper 5]. Both these shopper responses lead to higher sales. Third, they may affect shoppers' affect, which leads to higher sales [Paper 1 (music)]. Certain shopper-facing retail technologies may work through more than one of those mechanisms, such as Paper 2 on sensory projections. These findings are consistent with the conceptual framework. The shopper-facing retail technology where the shopper has the least personal control [Paper 1] evoked affective shopping responses, while the more interactive [e.g. paper 4] ones worked through cognitive mechanisms. Behavioral effects appeared consistent as we measured them through observations or eye tracking.

Combined, the results from this dissertation go hand in hand with the two major modes of processing information, discussed in Chapter 2. Shopper-facing retail technologies may affect shoppers' behaviors both when they are using cues to make quick, heuristic-based decisions and when they are more in a deliberating decision-making mode (Kahneman, 2011; Petty & Cacioppo, 1986; Petty et al., 1983; Stanovich & West, 2003).

Specific conceptual contributions per paper

With regards to the specific papers, Paper 1 shows that music may change how much shoppers buy in the store when shoppers are in a mindset that is congruent with the store environment. This fits in well with the results of previous meta-analyses (Garlin & Owen, 2006; Roschk, Loureiro, &

Breitsohl, 2016). Yet, this study adds another layer to it – that of the importance of motivational congruency for music to have a positive impact on shopper sales behaviors, a prerequisite researchers have not yet explored. This adds to the conceptual understanding of why in-store music yields different shopping behaviors in studies that are seemingly very similar (e.g., Andersson, Kristensson, Wästlund, & Gustafsson, 2012; Milliman, 1982). In addition, the importance of the role of motivational congruity between shopping motivations and the store environment could potentially be generalizable to many future studies on congruency effects in a broader range of in-store shopper marketing research. For example, future studies could investigate how retailers can use affect-lowering elements when there is motivational incongruity.

The second paper discusses the effect of shopper-facing retail technologies that include multisensorial elements for product displays. It shows, like other papers in the past, that in-store digital visuals can capture attention (Roggeveen et al., 2016). However, Paper 2 also shows that this is because shoppers understand the product and its use much better. It also shows that adding sounds to the special display may provide an additional boost to sales figures. Interestingly, this seems to be a two-sided process in which visual elements increase visual attention, while music further boosts the effect by activating shoppers' cognitive processes on how they could use the product. It also shows boundary conditions in terms of when the multisensorial offer becomes too overwhelming for the shopper, adding insights into whether there can be too many marketing elements for certain product displays in the store.

The third paper shows that physical stores contain many important elements that give shoppers sensorial information. The entire body acts an information source to the shopper, and when products a shopper may want to examine require elaborate examination, VR elements may not be suitable. This is in line with the literature on sensory embodiment that argues that the experience through all senses should be congruent to make sense (Ehrsson, 2007; Kilteni, Groten, & Slater, 2012). However, when the product or store environment does not require much information, such as with plain, white t-shirts, this is not necessarily a problem. The visual information VR glasses

provide is perfectly adequate for shoppers to understand what they are experiencing. This paper also showcases many research opportunities for using VR inside actual stores to extend the offering of the store exponentially, while still offering a physical shopping experience.

The fourth paper discusses the effect of mobile-integrated kiosks as a type of self-service technology, and it explains how different types of content may affect shopping behaviors. In particular, inspirational content drives increased sales through activation of higher level categories. This is because shoppers then activate a broader set of categories – which means that they think of more products. This contrasts with earlier research on SSTs in that it focuses on the use of the SST while the shopper is inside the store, and thus it shows that SSTs may also impact increased revenues, rather than merely providing cost savings in reducing service staff. This result adds to both empirical knowledge and the categorization literature. A recipe, for example, activates more salience hooks than a deal that focuses on a specific SKU.

In the final paper, the discussion relates to whether mobile phone use inside store environments acts as a distractor from shopping for items, or whether it acts as a distraction that makes shoppers buy more. Our results clearly show that, at least in grocery settings, shoppers buy more when they use their mobile phones. A store environment is very complex, and any distraction from the "auto-pilot" may make shoppers look at new items. As our results show, looking at products, moving around in the store more, and staying in the store longer leads to more sales. Mobile phones have just this effect – they distract shoppers because of shoppers' limited attentional capability. This effect seems to grow stronger when shoppers get older. Thus, this paper adds to the literature on mobile phone use in commercial environments (Grewal, Bart, Spann, & Zubcsek, 2016), attentional capability (Baddeley, 2010; Chaiken, 1980; Petty et al., 1983), and general distraction literature.

Future research opportunities

Future research opportunities involve examining the conceptual framework more holistically by specifically testing the three main process mechanisms

against each other. A meta-analysis could be one way to assess if the proposed conceptual framework is valid for a broader set of studies.

Another interesting research opportunity arises from the results from each of the distinct papers. In Paper 4, the shopper-facing retail technology (a kiosk) inspired shopper to buy related products. Paper 5 suggest that distraction may lead shoppers to spend more time in the store and examine more products. An interesting research opportunity here is to examine what is the relationship between distraction and inspiration when shoppers are engaging with shopper-facing retail technologies? Are they opposites, or could distraction be a pathway into shopper inspiration?

Contributions in the methodological domain

Triangulation of data and methods

This dissertation also adds a few methodological contributions. The need for field experiments is already clear, as is the need for triangulation. Throughout the dissertation, the results indicate that researchers can learn much more about shopper-facing retail technologies if they combine methods and data sources. The literature review has also highlighted the lack of crucial data elements, such as actual shopping behaviors rather than intentions, and the lack of complementary method designs, such as experiments.

The research studies in this dissertation have shown that a combination of different methods provides opportunities to understand how shopper-facing retail technologies affect shopping behaviors. Utilizing field experiments in combination with lab studies shows both whether these technologies affect actual shopping behaviors and what the underlying mechanisms are. For example, Paper 4 showed how the interaction with an interactive kiosk impacts actual sales behaviors through field experiments. Shopping simulations in the field further added to this by showing that the increased sales are a result of activation of broader sets of categories.

Combining different methods and sources of data also adds to the understanding of how technology impacts shopping behaviors. Paper 2 utilized different methods such as eye tracking, surveys, and sales to show how the

sensory projectors changed behaviors. Surveys in the field added to the understanding of what shoppers thought when they passed the product display. Here, shoppers understood better how to use the products on display, which in turn led to increased sales behaviors. All in all, this dissertation has provided guidance on how to ensure validity in the research results by studying the field as a starting point (cf. Simester, 2017).

Utilizing new types of research technologies

Another contribution to the methodological domain was utilizing new methods to respond adequately to the research question. In the present dissertation, two new methods added to the methods of in-store marketing research in general: eye-tracking data to record a richer array of shopping behaviors, and virtual shopping simulations.

The suitability of eye tracking as an empirical research method and a data source for understanding shopping behaviors is now clear. When shopping behaviors in physical store environments are the focus, few types of data collection are likely to provide richer behavioral data. This allows researchers not only to unveil any potential sales behaviors but also to see if there are underlying behavioral mechanisms that account for these effects. The fifth paper utilized portable eye-tracking devices in this novel fashion. Importantly, it is different from earlier uses of eye tracking for in-store marketing purposes in that it uses the entire shopping trip to explain what is happening in the store, instead of focusing on a single element, such as a predefined shelf (e.g., Chandon et al., 2009). While this method requires extensive and very time-consuming coding, this approach gives a complete overview of shoppers' behaviors in the store (cf. Wedel & Pieters, 2008).

The second type of method that added rich data and understanding was computer-based shopping simulations. In Papers 1 and 4, I developed a platform for shopping experiences on a screen-based system. These simulations differ from many other studies, in that they provide a behavioral indicator of sales behaviors.

These simulations started out with a scenario that is suitable for the specific treatment group. Then, the participant saw a first-person view of a walk around a store that we recorded and pretested for each project. Then the participant received instructions to choose among a select array of products

from the screen. Depending on the scenario, this could involve anything from a few products to several categories over a number of screens (see Figure 4).

Figure 4. A simulated shopping page example.

Depending on the study design, researchers may add more or fewer items or categories to measure purchase behaviors.

This type of simulation has many benefits: researchers can customize it to add literally any visual or auditory element; they can add survey questions, allowing measurement of both mediating mechanisms and potential moderating variables. It can test a phenomenon in different versions without much tweaking. Researchers can also use it both in physical labs and with online panels.

In addition to web-based shopping scenarios, Paper 3 provides insights that researchers can use VR depictions successfully for market research as long as the product categories under review do not require too much sensory input, i.e., most likely for products that shoppers often buy with little elaboration.

All in all, this dissertation provides important contributions on how to conduct research on shopper-facing retail technologies and on in-store marketing research in general. Researchers may use combinations of the field- and lab methods that have been effective in the present dissertation to add richness to their understanding of certain phenomena. Market researchers in the industry may utilize several of these combinations, but they may also find suggestions on what to measure in a marketing study, such as sale behaviors, other behaviors, attention, and more.

Future research opportunities

One limitation with regards to the methodology used here is that the samples have only been a so-called "WEIRD" sample (Western, Educated, Industrialized, Rich, and Democratic; cf. Henrich, Heine, & Norenzayan, 2010). This poses a question of generalizability in other parts of the world. Future research that search to enhance validity in different contexts may want to use samples from other parts of the world.

There are also other types of methods that could add even further richness to the understanding of the research question. For example, different types of qualitative methods such as ethnographic shadowing could add a deeper understanding of shopper's responses to shopper-facing retail technologies. Combining those qualitative methods with the more quantitative methods used in the research in this dissertation may even further explain the underlying mechanisms, while still being able to show convincing causality between the shopper-facing retail technology and shopper behaviors.

Contributions in the substantive domain

The final contributions relate to the substantive domain or the managerial implications. As the introduction stated, the aim was to assess the increasing

phenomena of shopper-facing retail technologies and to determine how different types affect shopping behaviors and especially sales behaviors. As such, the focus of the dissertation has been to find ways to enhance revenues, rather than to cut costs.

First of all, the empirical results provide clear evidence that shopper-facing retail technologies can already affect shopping behaviors during shopping trips. As the literature review showed, much previous research on shopper-facing technologies focused on checkout technologies, or it focused on driving sales of specific items using mobile coupons. The results of this dissertation show that retail technologies can not only drive sales behaviors of specific items [Paper 2] but also average receipts [Papers 1, 4, and 5]. The results also make an important contribution, in that retailers need not worry too much over in-store mobile use, but rather how to encourage that in any way possible. In sum, the results of this dissertation show that these technologies may provide shoppers with value, in that they reduce their search costs, while retailers that utilize these shopper-facing technologies the right way can get a larger share of pocket.

Specific substantive contributions per paper

Specifically, the studies have several implications that have substantive meaning for retailers, as well as providing a substantive contribution for researchers in terms of interesting phenomena. First, Paper 1 shows that retailers should probably play music during weekdays in more functional environments such as local grocery stores. Retailers with more experiential environments may instead gain by playing music during weekdays when shoppers are in the right mindset or mood.

The second paper shows that multisensory marketing may work well for retailers if they make sure they do not overdo it. We found that it is best to combine visual elements with auditory cues when using end-cap displays in grocery settings. However, this may differ for other types of retailers, and thus, every retailer should find the fine line between good stimulation and too much stimulation. This is especially important to avoid the backlash that retailers such as Abercrombie & Fitch experienced when they overdid their multi-sensory marketing, and some people did not want to enter the stores anymore (Bhasin, 2014).

Third, the VR paper (Paper 3) shows that VR may not provide enough sensorial elements for products that are more difficult to understand. The question is, for which exact categories is it really relevant? If retailers can assess the need for sensory embodiment prior to any marketing research, they may identify whether the category or store is suitable for VR testing. If retailers, for example, want to undertake market research on what happens when they remodel, it may be both cheaper and more convenient for retailers carrying easy-to-understand products to create a VR rendering emulation than to rebuild an entire store.

The fourth paper provides two managerial suggestions: First, retailers should try to drive foot traffic to the in-store terminals, as they can boost sales. Second, retailers should take steps to assure that the content shoppers see on the kiosk is more focused on inspirational content than on coupons. After all, if shoppers have already set foot in the store, they have already committed to making purchases, and giving them in-store coupons through the terminal seems to only boost sales on those items. Essentially, that is giving margins away. Instead, retailers should encourage shoppers to read inspiring content that broadens their minds and makes them think about more items that would complement the inspirational, focal, item.

Finally, the fifth paper on mobile phone use suggests that shoppers who use their phones get distracted, and thus, they shop more. Retailers can use this type of knowledge to offer Wi-Fi and cellular coverage, to offer mobile holders on shopping carts, and perhaps to use geo-targeting to send out messages to get shoppers to use their phones in different ways.

Future research opportunities

As new types of shopper-facing retail technologies, they could be examined using the framework put forward in this dissertation. Understanding if, and if so, how, a technology affects shopper behaviors or not is key for any substantive study in this research domain.

Another very useful substantive issue would be to be able to classify shopper-facing retail technologies that are in use in the industry into more generalizable groups. The literature review and papers in this dissertation indicate that shopper control or shopper interaction with the technology may

play a key role in how they affect shoppers. A categorization of existing technologies into different groups could then be tested empirically. Understanding which mechanisms are responsible for the effects of different types of shopper-facing retail technologies makes the results more generalizable. This, in turn, provides important decision-making aid for retailers, and important knowledge also for consumer groups and legislators that are interested in the ethical side of marketing practices.

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In summary, the contributions of the dissertation are relevant for both academia and industry. As a general conclusion, the empirical field evidence shows that shopper-facing retail technologies have the potential to change the way shoppers behave in the store by affecting what they think about and what they see. This leads to changes in the way shoppers go about their shopping trips and move in the store, and it subsequently increases purchases, which leads to higher sales for the retailer. As such, the dissertation as a whole responds to the research question. However, to identify value-adding shopper-facing retail technologies successfully, retailers and academics also need to understand several boundary effects to these elements such as demographics, type of stores, type of shopper mindset, and more. When retailers adapt shopper-facing retail technologies for specific stores and shoppers, they can affect shopping behaviors, and subsequently, they add value to both shoppers, by helping them in their decision making, and retailers, by helping their bottom line.

Concluding Reflections

These research projects show that shopper-facing retail technologies have a great potential to impact shopping behaviors. This holds true, both in terms of what the shopper buys, how they act in the store, and what gains their attention. On a personal note, I feel that is important to emphasize that they do even more than just push sales. They add to the store environment, aiding the shopper in complex decision making, and this just makes physical stores more fun to visit. How many times have you visited your grocery store to buy dinner without having a clue what you are going to cook? Shopper-facing retail technologies may be an important puzzle piece in that process. Perhaps the 2020s will the decade when physical stores become so full of retail technologies that we consider physical stores to be as digital as an online retailer's website.

As technologies advance and the application of new types of technologies into innovations offers more potential uses for stores, many opportunities will arise (Grewal et al., 2017; Shankar, 2014). Projects on which I already work with colleagues include the role of hand-held scanning devices, mobile phone ordering and its effect on other shoppers, shopper movements, and more. Other related shopper-facing retail technologies that I find of high interest to physical stores include robotics. There are already robots for many tasks. For example, the Swedish retailer ICA has a fully automated warehouse for its pharmaceutical products. Could this be adaptable to physical stores, and what would be the impact on shoppers' perceptions of a store that had visible or non-visible robotics, for example? The research opportunities are endless!

As I said at the beginning of this dissertation, the area of shopper-facing retail technologies is more important and exciting than ever. I look forward

to being part of the research community in that area, and in marketing research in general, for many years to come.

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