"The Moment of Truth"
Understanding Consumers' Conduct at the PoS to Explain Purchase Termination and to Gain a Competitive Advantage

by

Shyda Valizade-Funder*

Oliver P. Heil **

*Doctoral Candidate, University of Mainz

**Chaired Professor of Marketing, University of Mainz

Lehrstuhl für Marketing und BWL · Univ.-Prof.
Dr. Oliver P. Heil (Ph.D.)
Johannes Gutenberg-Universität Mainz
Jakob Welder Weg 9 · D-55099 Mainz
Tel: +49 (0) 6131 / 39 25549
Fax:+49 (0) 6131 39 23764
valizade@marketing-science.de

Abstract

The "Moment of Truth" refers to the point in time when a customer standing in a shopping-aisle decides what to buy and then reach for it (The Economist 2009). That is, purchasing decisions are often made when a shopper is right at the Point of Sale (PoS). Generally, it is crucial that consumers' conduct and behavior at the PoS is being closely monitored, recorded in detail and thoroughly understood. To do so, data should reflect precisely what consumers did at the PoS and if they purchased or not. Ideally, one would assess consumers' conduct at the PoS continuously, consistently and in real time. However, at this point in time, there is a relatively poor understanding of consumer's behavior within real-life retail settings. This lack of understanding exists, at least in part, since current technology does not yet allow to precisely and objectively observe shopping behavior. Thus, this paper outlines a new approach allowing in-store observation of shopping behavior in a real live marketing setting. Using a newly developed video-based technology enables us to track many activities that shoppers carry out during their shopping process at the PoS. Such behavior can be described in remarkable detail by subdividing the in-store consumer conduct into individual stages. These stages are then observed at various pre-defined areas of the store. The detail per area goes down to a single product level. As a result, the new technology allows for fundamentally new insights into customers' shopping behavior shortly before and at the time of purchase or non purchase. It should be noted that the observations are obtained automatically, continuously, in real time and, thus, at a level of detail that was previously concealed to traditional retailers. Our paper describes the new technology, offers several propositions, presents initial, preliminary empirical evidence and points out some managerial and marketing implications.

Key Words: Retail, In-store Shopping, Purchase Termination, Video Technology

1. Introduction

Research suggests that 40-70% of customer purchase decisions in retail outlets are made at the PoS (Liebmann/Zentes 2001). The PoS affects whether shoppers notice a new product or promotion and influences the framing of the purchase decision. The PoS, therefore should be viewed as a most crucial unit of analysis i.e., at which a shopper decides whether or not to buy a product (Decker/Kubach/Beigl 2002). The more detailed the available information about visitors' in-store purchasing behavior, the better retailers can understand the relevant parameters to improve customer experience in offline settings.

We know much about people that entered a store and bought something, but know hardly anything about the vast majority who left without making a purchase. Typical field data tend to capture only purchasing events like the conventional measures of store performance (e.g. sales per square meter) does. These measures have the inherent limitation of being based on sales that have already occurred (Burke 2006).

Non-purchase data is either ignored or gathered through self-reports or controlled experiments, which tend to be inaccurate and not easily generalizable. To our knowledge, no objective instrument exists to capture the search and shopping behaviors in 'real' retailing environments and give purchase and non-purchase information in a complete, timely, and accurate manner (Fader/Moe 2004). Accordingly, there is thus a need to develop more appropriate methods of examining behavior of consumers in real-life retail settings.

Within the consumer conduct literature there is no unified view on non-purchase at the point of sale (Blackwell et al. 2006; Greenleaf/Lehmann 1995; Kroeber-Riel/Weinberg 2003). This research gap may be caused by the lack of a technology allowing to precisely and objectively observe shopping behavior at the PoS. Therefore, this article explores the key question whether there is a technology allowing retailers to gather objective shopping information. We point out that our study has truly broad implications:

> *Theoretically, the study sheds light on the shopping process at the PoS – especially by focusing on non-purchasing behavior.*
> *Methodologically, it applies intelligent video tracking technique to collect and analyze shopping data, which offers several benefits over other techniques.*
> *Empirically, this research helps retailers to understand shopper's behavior at the PoS to improve the conversation rate, respectively reducing the purchase termination rate.*

The paper is structured as follows: After the introduction, a second and third section define the concept of purchase termination and links it to the existing research of consumer behavior. Based on a conceptual framework a fourth section identifies termination points and formulates propositions for empirical testing. In a fifth section current techniques to observe customer behavior in retail settings are reviewed and benefits on intelligent video-based technology (IVT) are outlined. The field study and the primary data are described next. The article concludes with managerial implications, suggestions for future research and limitations.

2. Purchase Termination

Existing research on consumer behavior distinguishes "hedonic browsers" and "goal-directed" visitors by their different shopping behaviors (Janiszewski 1998). Browsing is motivated by visitors' need for diversion, information, recreation and sensory stimulation (Tauber 1972) and can lead to spontaneous purchase. On the other hand, goal-directed behavior is characterized by the search for specific information relating to immediate or postponed execution of a planned purchase (Moe 2003).

Whereas this widespread distinction can serve to identify different intentions and shopping patterns, its explanatory power for visitors terminating their shopping is limited - as neither browsing nor goal-directed behavior necessarily leads to a purchase. Negative store atmosphere, e.g. caused by a crowded store, might prevent people from buying spontaneously (Beatty/Ferrell 1998). Even 'goal-directed' visitors might be confronted with a "out of stock" situation forcing them to terminate their purchase (Büschken 2007). It thus seems essential to classify under which circumstances one can speak of a terminated shopping process. This is of particular importance as there is no unified view on the key characteristics of purchase termination at the point of sale.

Industry experts have proposed a number of different frameworks and heuristic guidelines to improve shopping processes and increase shoppers' conversion rates. Also in the related literature of customer behavior there is no general definition of purchase termination (Backwell et al. 2006; Greenleaf/Lehmann 1995; Kroeber-Riel/Weinberg 2003). The extant literature contains terms like (1) purchase deferral,, (2) purchase abandoning or, (3) purchase defection to describe what in this paper is referred to as 'purchase termination'.

(1) Dhar uses in a variety of articles the term purchase deferral (Dhar/ Nowlis 2004), while others apply the term purchase postponement (Chang/Burke 2007). Both terms denote a temporary interruption of the purchasing process. Customers defer or postpone their shopping act to clarify the purpose of the purchase, to compare alternatives and evaluate information (Mitchell/Papavassiliou 1999). However, deferral often results in a complete shift to an alternative, more familiar product or product category (Rudolph/Schweizer 2004b).

(2) The term abandoning the purchase, which is the final termination of the purchase process, is frequently used. Often, a termination of the purchase is triggered by cognitive dissonance diminished the importance of acquiring a product (Mitchell/Papavassiliou 1999).

(3) In addition, shoppers can also drop the loyalty to the entire shopping place (Schweizer 2005) which here is referred to as purchase defection.

Some authors apply the term 'no-buy' or 'no-choice decision' (Dhar 1997a; Huber/Czajka 1982), to express the termination of the purchasing process (Walsh et al. 2007). Barnes et al. (2004) similarly speak of the '*almost customer'* phenomenon when examining the defection before a customer becomes a buyer.

Conceptual definition: As a result, it can be argued that no precise definition of purchase termination has been developed so far. Based on the aforementioned body of knowledge and our own reflections, we, thus, define **purchase termination** as follows:

> ***By purchase termination, we mean the conscious act of not completing the purchase process at the PoS. That is, the potential customer leaves a store without buying.***

This definition implies the assumption that shoppers enter a store with an intention to buy as they are clearly signaling this by looking at, touching, checking, seemingly evaluating the product.

Studies about offline shopping behavior support this assumption: A key component of modelling a customer's store choice and purchasing decision employs so-called tangible and

psychological costs to physically go to a store. For instance, by shopping in grocery store it is very unlikely for a customer to enter the store without having the intention to buy. But on the other hand, it is very likely for a shopper to enter and exit without buying (Fader/Moe 2004). Accordingly, we posit a consumer's salient general need or purchase goal at the moment of him entering the store. We therefore do not distinguish between a temporary interruption or a final termination of purchasing.

3. Literature Review

Researchers accumulated an extensive body of knowledge about why and how people that entered a store carried out a purchase. The rate of those 'successful transactions' varies largely by store format. The conversion rate in grocery stores could seemingly reach up to 100% as conversion rates linger around 20% in department stores (Economist 2009). It thus becomes evident, that retailers do not possess a deep and precise understanding about the vast majority (e.g. 80% of potential customers in a department store) who left without making a purchase.

Also, retailers' knowledge about demand that has not been converted into sales therefore remains largely incomplete and represents a large improvement potential for them (Burke 2006). For many consumer goods the in-store purchase activities are more important than visitors' preparation before entering the store (Dhar 1992).

The reason that this potential has not yet been exploited rests in a lack of technology (Schröder 2007) and procedures to capture shopping behavior in traditional retailing environments - either by (1) conventional measures of store performance or (2) existing typologies of shopping termination.

(1) Conventional measures of store performance such as gross margin, direct product profit, sales per square feet or return on inventory only partly provide insight to improve customer experience. These measures have the inherent limitation of being based on sales that have already occurred and accordingly have no predictive or explanatory value for non-shopping behavior. Sales data alone therefore does not reveal the purchase obstacles or the potential level of "unrealized demand" (Burke 2006).

(2) Existing typologies of purchase termination reasons demonstrate a fairly comprehensive inventory of why people delay or terminate their purchase (Greenleaf/ Lehmann 1995). Table 1 presents a selection of such reasons and clarifies that there is no shared understanding on the key reasons of non-purchasing behavior at the point of sale (Blackwell et al. 2006; Greenleaf/Lehmann 1995).

On a more general level, the reasons for purchase termination can be distinguished in observable (e.g. store environment, store layout, marketing measures such as price, product, packaging and brand) and non-observable (e.g. perceived risk or time pressure precipitated by the organism) reasons. Both can be stimulate purchase termination.

Reasons	Literature
Shopping Environment	Greenlaf & Lehmann 1991, 1995
Out of Stock	Chang & Burke 2007, Stölzle et.al. 2007)
Price	Dhar 1997, 1997b
Attribute Choice	Luce 1998, Dhar & Simonsen 2003
Customer Confusion	Mitchell at. Al. 2005, 1999, Schweizer 2005, Walsh et.al. 2007
(Perceived) Risk	Corbin 1980, Greenlaf & Lehmann 1995
Density/ Crowding	Eroglu and Harrell, 1986.
Time Pressure	Chien-Hunag, Pei-Hsu 2005, Payne et. Al. 1996

Figure 1: Research concepts applied to study shopping termination

Purchase termination can occur at various stages of the shopping process (Chang/Burke 2007). We therefore argue, that the analysis of purchase termination should be stage-specific. Reasons for purchase termination need to be studied to identify reasons at each stage during the in-store shopping process from entering the store until leaving it.

The next chapter introduces a framework to study purchase termination, based on a generic shopping process.

4. A Framework to Study Purchase Termination

Need recognition, information gathering and pre-shopping evaluation of alternatives may influence factors for shopping behavior. Often expressed in general terms early in the shopping process, these factors are developing to be more specific as the shopper moves

closer to making a purchase (Chang/Burke 2007). More precisely, Dhar (1992) points out, that shoppers choose products with respect to a specific in-store situation. Unfortunately, most existing research tends to underplay PoS importance and therefore misses an overall picture of shopper's behavior at the PoS.

Typically, research focuses on the first three steps of the generic process of need recognition, information search, alternative evaluation, purchase and post purchase (Cox et al. 1983; Harrel 1990). Models and frameworks of consumer behavior are often impressive in scope, but lack in specificity and are often critized for their operationalization difficulties (Rau/Samiee 1981). This limits their potential to assist marketing practitioners when trying to reduce purchase termination.

Therefore, we refocus on the PoS and acknowledge its dominant influence on purchase termination. Furthermore we suggest that *Peter & Olsen's* (1990) conceptualization of the in-store shopping process is a promising starting point. It represents the shopping process as flow of observable interactions following three successive steps of store contact, product contact and purchase transaction. The simplicity of *Peter & Olsen's* conceptualization yields several benefits, especially as its abstracts from individualistic feelings, attitudes and intentions to allow identification and optimizations of typical shopping patterns (Figure 2).

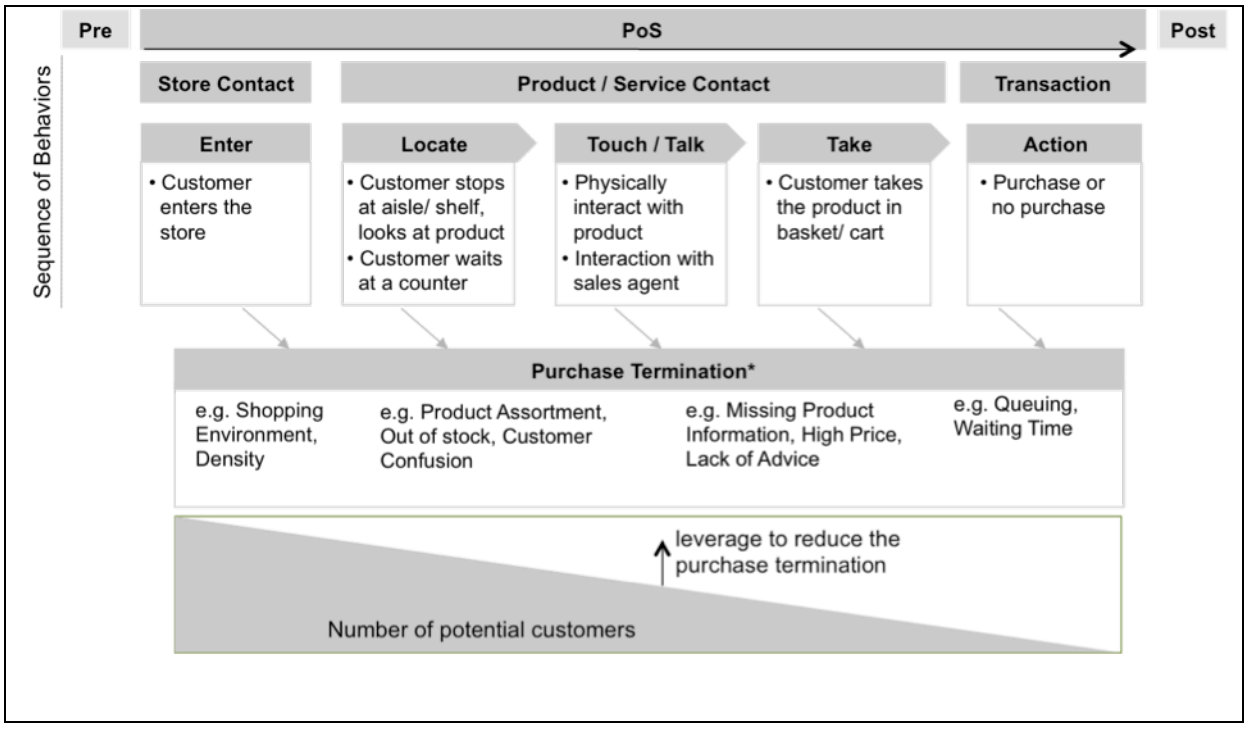


Figure 2: Sequences of Shopper Behavior

Every shopper who enters a store usually undergoes a sequential shopping process. Along the different steps of the shopping process the number of potential customers reduces as customers terminate their purchases in different sections of the store for different products. Ideally, the shopper enters the store, locates a product category or product, picks it up, and buys the product before leaving the store.

Others will either not be able to locate a product category and a product or to terminate the shopping process after looking at respective products without buying. Shoppers may encounter obstacles in various stages of the shopping process, including crowded shopping areas, difficult to locate products (navigation) and long queues or waiting times (fulfillment) (Chang/Burke 2007). In all of these instances, retailers may loose the opportunity to transform in-store consumer demand into sales. The observation of no purchasing shoppers allows assigning termination rates for each process step, then serving as the central indicator to inform and measure the impact of managerial interventions.

4.1 Purchase Termination Points in the Shopping Process

We described the in-store shopping process as a three-step process and sequence of behaviors of store contact, product contact and transaction. As visitors can step out of the shopping process at each sequence, it is required to further shed light on purchase termination points by process step. The following chapter will focus on a single criterion for purchase termination by process step. The following sections on crowding (store contact), customer confusion (product/ service contact) and waiting time (transaction) are set up by following the key logic of why the criteria is important, how each criteria is defined, what the effect of each criteria on purchase termination is.

4.1.1 Crowding and Density

Crowding is defined as the evaluation of the perceived density (Eroglu /Machleit 1990; Stokols 1972). Crowding explains a subjective perception of an individual in a special environment and therefore is difficult to observe.

Density describes the number of people and/or objects in a given space. Whereas density not necessarily creates adaption behavior, perceived crowding does (Pons 2006). Even consumers' perception of visitor density is relative to their expectations, past experiences, and personality traits, it emerges as the most important component of crowding. *Harrell et al.*

*(*1980) report a correlation coefficient of .58 between density and crowding. It is therefore suggested to use density as a proxy for crowding, as it is objectively measurable and observable.

Eroglu and Harrell (1986) conclude that density in retail settings may lead to (1) dysfunctional density (crowding) or (2) functional density:

(1) Studies on crowding revealed that it is perceived as an unpleasant experience in shopping situations (Hui/Bateson 1991), as it is likely to create some psychological stress on consumers (Stokols 1972). Therefore human density and perceived crowding do influence shopping behavior (Eroglu/Machleit 1990; Machleit et al. 2000). Shoppers typically avoid walking into crowded areas (Harrell et al. 1980). They adjust to higher retail densities by reducing their shopping time or even deviating from their shopping plans and escape from the scene (Hui/Fader/Bradlow 2009).

(2) Crowding can also have a positive effect. Consumers may move toward crowded areas, because shoppers may infer the attractiveness of a location (Becker 1991). For instance, *Becker* (1991) document that people usually choose the restaurant with a longer line. While higher crowding levels can produce higher shopping satisfaction - which might seem counter-intuitive at first - it is supported by research findings in the field of environmental psychological. The arousal theory (Berlyne 1960) contends that under certain circumstances and certain settings individuals desire a certain level of arousal (Eroglu/Machleit/Barr 2005). Accordingly, extremely under-crowded conditions tend to generate the undesirable states of isolation, which can cause purchases to be terminated (Altman 1975). Based on these notions, we formulate the following proposition:

P1: The relationship between total store crowding and the probability of PT follows a U-Shape.

4.1.2 Customer Confusion

The increasing rate of technological change, together with changing socio-economic factors and increased competitive dynamics tend to produce high levels of customer confusion (Turnbull/Leek/Ying 2000). Confusion is a conscious state of mind. As a consequence of imperfect information processing - caused by information overload or conflicting, ambiguous

or inadequate information (Mitchell/Papavassiliou 1999; Soloman 1994) – it effects shopper behavior (Mitchell/Walsh/Yamin 2005).

In today's markets, customers in purchase situations are provided with increasing amounts of information from different channels and about more products. Thus, it becomes a major challenge in today's markets to reduce customer confusion (Mitchell/Walsh/Yamin 2005). Extant literature of customer confusion has found an impact of confusion at PoS on purchase termination.

Traditional marketing research suggests that shoppers prefer to have choices between products, channels or shopping locations. While having choices is valued beneficial from customers it comes with the downside of an increase in the amount and diversity of information making shoppers purchase act more complex. To cope with increased complexity, shoppers develop simplifying decision heuristics (Duncan/Olshavsky 1982). E.g. they tend to consider only few criteria when making their purchase. Nevertheless, providing shoppers with too many choices and in consequence information of diverse nature, can produce negative effects (Iyengar/Lepper 2000).

Information overload increases customer perceived uncertainty as shoppers' confidence in their own choices decreases (Walsh et al. 2007). Thus, simplifying heuristics only work until a certain level of perceived uncertainty about potential negative outcomes of choices made (Cox 1967). This, in turn can lead to an affective action of frustration of customers (Mitchell et al. 2005) which, to reduce confusion, may either delay their purchase (Chernev 2003) or inhibit it at all (Schweitzer 2005).

In short, if product's attributes are ambiguous and the store or categories offers many choices, then information overload is more likely to occur and shoppers will touch an increasing number of products, walk around and, as one result, are more likely to postpone their purchase decision. Confusion might therefore be understood as a cause for customers' a difficulty to navigate through or orientate within the store, the category or infront of shelf.

Esch/ Thelen (1997) found that store characteristics (e.g. assortment breath, organization of ailes) influence the rate of information to which customers are exposed and which influences their in-store shopping behavior. Confused or disorientated shopping is often becoming manifest in a customers shopping pattern characterized by often direction shifts. While

divagating around in the store, customers search for their way to the find a product. The more difficult it is for customers to navigate through the store (operationalized by the number of direction shifts) the more likely is it, that they terminate their purchase. We, thus, propose

P2: The higher the number of direction shifts in a given area/aile, the higher the probability of PT.

Furthermore, on the store level, the time it takes customers to evaluate whether they have found their category of interest and whether it carries demanded products might be another indicator of customer confusion. We therefore make the proposition that

P3: The higher the stop-to-pick-time for the first product, the higher the probability of a PT.

Numerous articles that investigate search and orientation of in-store behavior focus on shelf situation. Wells and LoSciuto (1966) observed that 44% of the shoppers in certain categories examined products did not buy them. Other studies based on observation coupled with interviews deal with dwell time, the average time to product removal and the number of touched products (Coob/Hoyer 1985; D´Astous/Bensouda/Guindon 1989).

The results suggest that high involvement products have a much higher retention time with a mean of 47 seconds than low involvement products with 21 seconds. Therefore, it is necessary to observe if the retention time in a product category has non-purchase effects. Based on the aforementioned, we propose

P4: The higher the retention time with one product, the lower the likelihood that a PT will be observed.

P5: The higher the pick-and-replace rate in a product category, the higher the probability of a PT.

4.1.3 Waiting Time

A substantial amount of visitors' time in retail outlets is spent waiting (Tom/Lucy 1995). While this mostly happens in checkout lines to complete purchases, waiting times also occur at pre-purchase stages of retail service delivery. Waiting time is defined as the elapsed time starting with a visitor being ready to receive retailers' service and ending when the service starts (Taylor 1994). Waiting time is one of the most critical factors to influence customers shopping experience and purchase termination rate (Peritz 1993) and more generally of visitor perceptions of retailer service offerings.

When evaluating the effect of waiting time to purchase termination, one needs to specify the term 'waiting time' and distinguish real vs. perceived and expected vs. "tolerated" waiting time. Customers' perception of time may differ from the objective time (Tom/Lucy 1995). Whereas 'real' waiting time reflects the linear evolving clock time, perceived waiting time is based on visitors' individual perception of time. Expected waiting time is the duration of waiting time as anticipated by the shopper at the moment of his decision whether to wait or not.

The tolerable waiting time is the maximum duration of a wait that a shopper is willing to accept. Kostecki (1996) points out, that the tolerable waiting time depends on a number of variables such as the value of shopper time, the value of service or product to be purchased, the intensity of a need, accessibility of a service from an alternative source, discomfort of wait or shoppers' general pace of life.

It is important to note that only perceived waiting time results in an adaption of the shopping behavior, and in order of purchases not to be terminated, expected waiting time must be less than the tolerating waiting time. Despite that Durrandes-Morreau (1999) summarizes findings of empirical research on the impact of waiting time and concludes, that after all real-time is the central driver for perceived time. For that reason measuring real-time by means of observing customers conduct and waiting time at the POS allows to draw conclusions on purchase termination.

Research has found two effects of waiting time on purchase termination. Whereas some have found (1) a negative relationship, others have identified (2) a positive impact of purchases not being terminated with increased waiting time.

(1) As waiting time is associated with economic and psychological costs (Chebat/ Filiatrualt 1993; Katz et al. 1991) a positive correlation between waiting time and purchase termination has been found. Waiting in a line can reduce purchase intention and thus foster non-purchasing behavior. Zhou and Somas (2003) for instance describe shopper reneging strategies of leaving a waiting line after a certain time. It is reasonable to argue that shoppers consider time as units of value and to be strongly affected by what might be perceived as waste of it.

(2) Others have found, that the more valuable the service for the shopper, the longer he or she will wait (Maister 2005). As a consequence, shoppers will avoid terminating their waiting after a certain waiting time due to so-called sunk costs. Understood as "waiting costs already occurred" (Nie 2000), sunk-cost can increase adherence to the decision to wait. Moreover, the concept of social comparison – own position compared with people in front and behind (Wiswede 1997) can yield to the decision to wait, when the own position in the waiting line is perceived being 'better' than that of most other waiting shoppers.

As research has found both positive and negative relations between waiting time (WT) and purchase termination (PT), questions about the external validity of this stream of research prevail (Maister 2005; Zhou/Thomas 2003). Taking into consideration, that the findings indicate a possible duality between WT and PT, further reasoning seems appropriate. It may in fact be that the seemingly contradictory findings reflect that the relationship between WT and PT is s-shaped. Following this conceptualization, the impact of the length of WT on PT can be separated in three areas: In the first area, there is only a weak relationship between WT and PT as customers expect and tolerate a certain waiting time. In a second area PT is rapidly increasing as time spend waiting exceeds customers' tolerated level. In a third area, increasing WT might have a limited impact on PT as a result of sunk cost or social comparison evaluation. For that reason, we offer the following proposition:

P6: The relationship between customers waiting time and the probability of PT is S-shaped.

5. Methodology

To study the in-store customer behavior various instruments including customer surveys, experiments and shopping observation are available. Whereas those instruments would be

sufficient to research our propositions as a one-off exercise, they do not meet the requirements to assist retailers in managing purchase termination on an ongoing and real-time basis.

This paper aims to contribute to theoretical knowledge but also to offer empirically based insights to enhance managerial practice. For that reason our methodology aims to continuously gather information to ensure transparency and completeness on customer shopping behavior and as it changes. There is a clear trade-off between information richness and budget restrictions to gather those data which only can be offset either by benefits higher than cost and / or automatic data collection accompanied with low cost to set-up, implement and run.

Secondly, our method aims to provide consistent information on shoppers purchase behavior to allow analysis and synthesis across stores and timeframes. For retailers this means application of a replicable methodology while limiting the impact of biases of researchers and observers.

Thirdly, we intend to satisfy retail managers' need for timely available information to experience the impact of their interventions in the shopping process and limit spillover effects of competitive and own actions, ideally allowing a root cause analysis of customer behavior and impact of managerial interventions.

Reflecting the above requirements, the limitations of existing instruments to study in-store behavior become apparent: Surveys suffer from recall problems but have the benefit of high continuity and timely availability of data. Observations on the other hand have a higher explanatory value but are characterized by low frequency and long analysis cycles mainly due to missing technological support. To unlock the potential of observations for retailers and explanation of purchase termination, one should, thus, explore alternative technologies as enablers for observations.

5.1 Video Technology as Enabler

In the past, applications of new technologies have created new, unique and relevant data. This has led to an enhanced understanding of how marketing, customer and environmental factors affect consumer behaviour and store performance (Burke 2006). Nowadays, the technology drivers are digital representation of shopping environments and real-time tracking. Tools like

RFID, GPS and Intelligent Video Analysis provide marketers the possibility to measure consumer's response to the in-store environment and manage the shopping process.

Techniques have progressed from pioneering methods of early consumer research (Barker 1965, Wells/Lo Sciuto 1966), where observed behavior was recorded manually which is inherently subjective and lead to an observer bias. Previous studies employed static video equipment, allied to time-laps photography or RFID to recorded pattern of movements (Phillips/Bradshaw 1993). Especially video tracking of in-store movements has provided effective data concerning patterns of customer movements (Mc Cullagh/Thornton 1995; Philips/Bradshaw 1991) store atmosphere (Donovan 1994) and customer response to store layout (Phillips/Bradshaw 1993). Schröder, Möller and Zimmermann (2007) give an overview of apparatus-supported methods of observation, advice application areas for retailers and compared the different methods (RFID, Shopper Research Box, Video and Eye Tracking Systems) of collecting data in-store.

Even though automated and manual recording techniques to track customers at PoS exist, most tracking systems - despite the RFID technology - are time consuming in terms of data collection, evaluation and analysis or allow for randomized observations only (Schröder, Möller and Zimmermann 2007). RFID has the advantage that once data is tracked, output can be generated automatically. However, the effect of the knowledge of the shopper about the RFID tag is given.

Eye Tracking has similar limitations in respect to the customer data collection; moreover it is rather expensive and difficult to obtain a large sample. The disadvantage of today's applied video tracking is that the images require a manual data reporting. This is not only time consuming but moreover strict regulations and laws exist in respect to video recording to ensure customer and employees privacy rights. Therefore an overall picture of customer's traffic and customer behavior at the PoS is still missing. Because of the limitations with manual observations and tracking surveys the existing methods of retailing research are being supplemented by new research technologies (Hui/Fader/Bradlow 2009).

5.2 Intelligent Video Technology (IVT)

IVT allows moving beyond potentially restrictive experiments and customer recall techniques and explore in detail different aspects of shoppers behavior. Analyses from traffic counting, direction recognition, presence field tracking of areas or products as well as measurement of

queue lengths and waiting time can be tracked with video systems. The intelligent video technique provides accurate and objective insight into customer behavior by disguising data in order to protect identity. IVT is a method of data capture by using an in-store real-time tracking video system with an integrated software tool that generates automatically statistics available at each point of time. IVT is able to track simple information and actions of the customers like e.g. gender, dwell time in the store or retention time for certain product categories. The algorithm is able to transfer all images immediately to binary data without recording pictures. Privacy issues can therefore be avoided.

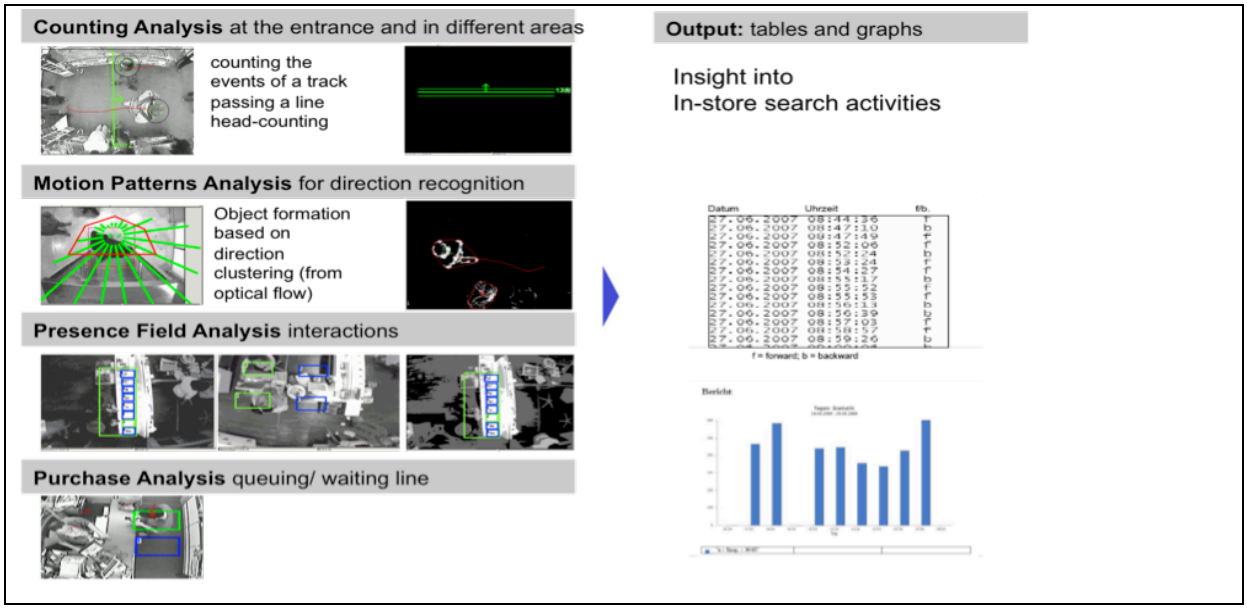


Figure 3: Overview of the Intelligent Video Technology

5.3 Implementation of the Field Study

Store Selection: To get the best possible insights in the non-purchase behavior of visitors the store for the field study has to fulfil specific requirements: A square store with a clear structure and no blind spots, a reasonably large product range with accurate defined product spots, constant lighting conditions and ideally one entry and exit door.

We therefore chose a 115 square meter store without angles that met the above mentioned requirements. It has a common size for this retailer and is located down town. The store is located in a medium-size city (200.000 plus) residents, which is an average city size for Europe. Once these conditions had been defined floor plans and several store inspections were used to determine the optimum type, number and location of the cameras.

Camera Selection: To continuously track the in-store customer behavior normally a high

number of video-cameras and a camera hand-over function were required. As of today, the hand over of camera images is technologically very complex to realize. The main challenge is to have an adequate coverage of the store by overcoming the technical challenge of the camera hand over. As we do not need all movement data to make accurate statements about path-related behaviours we only need images from key locations in the environment to capture the relevant aspects of the path, which could enable significant cost savings (Hui, Fader and Bradlow 2009). To guarantee a continuous data set and to overcome the technological challenge we combined (1) Overhead and (2) Minidom/ Super Color Mini Cameras camera systems.

(1) The **Overhead-System** was installed in defined shop areas to count the number of customers and give information about the dwell time in front of displays and report the total number of shopper-retention time with products and services.

(2) So-called Minidom Cameras fixed at the ceiling as well as Super Color Mini Cameras in displays were covering the entrance, the exit and selected areas. Equipped with biometrical face recognition, the software assigned ID's to shoppers at the entrance (we therefore call the combination of Minidom/ Super Color Mini cameras **ID-System**). A template was generated by calculating characteristic face proportions, which than allowed customer identification in other areas of the store. These customer templates were combined and construct the movements in the store. For data analysis we only used data sets, which had a complete customer tracking from entry to exit.

As the overhead system cannot generate IDs and the ID-System cannot track the dwell time or product handling information, we combined the two camera systems based on the timestamp information (Figure 4). As a result we get a raw data set with key information about the total dwell time and product handling for each ID (customer). [1]

[1] We note that ethical issues associated with an observational methodology in general and the IVT methodology in specific were respected in our implementation (Dodd/Clarke/Kirkup 1998). An exhaustive consultation process involving all: the sample, the retailer (work council, union representatives and staff), the provider of the video-technology and the general public were key to consent the implementation. Notes indicating the presence of video recording equipment were positioned at entrance to the store. Also emloyee's rights were guaranteed and union representatives were informed and involved during each step of the implementation. In short, numerous efforts were made to balance the needs of all parties involved in the study, without detracting from the overall research objectives.

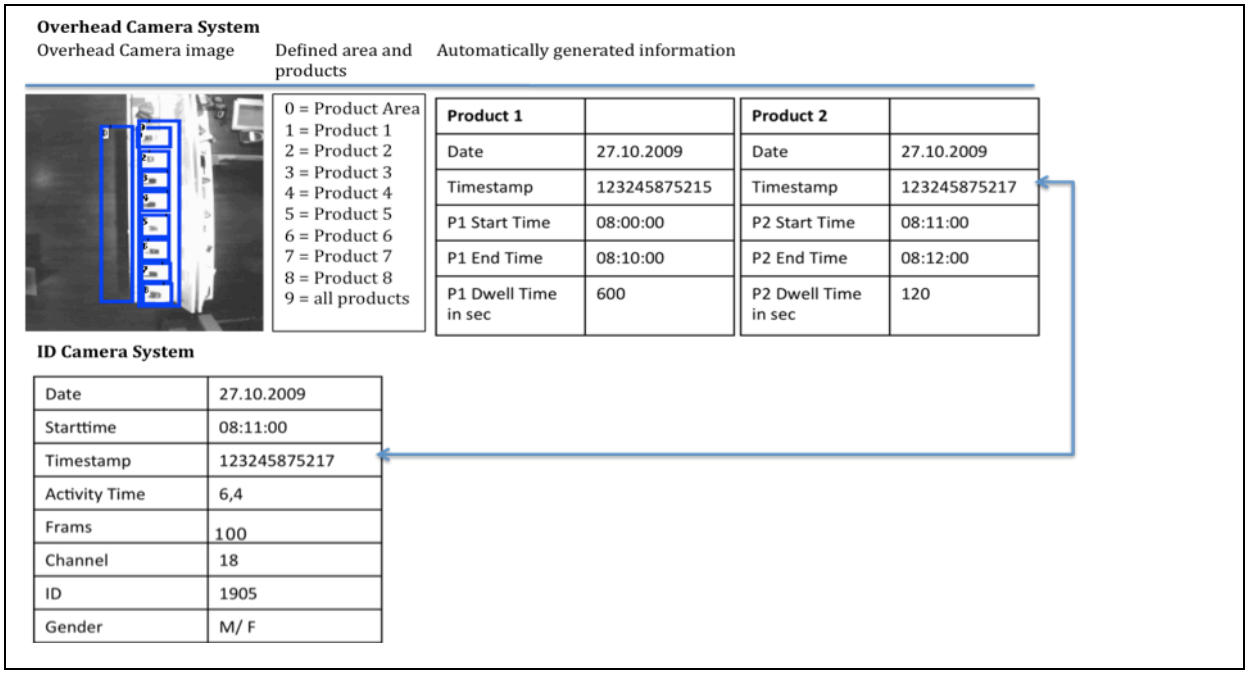


Figure 4: Alignment of camera data sources

The installation of the camera units - 24 ID-Systems and 12 Overhead-Systems - took place during 3 nights to prevent disruption to the retailers existing operations and avoid high customer awareness of the cameras. Figure 5 highlights the positions of the cameras.

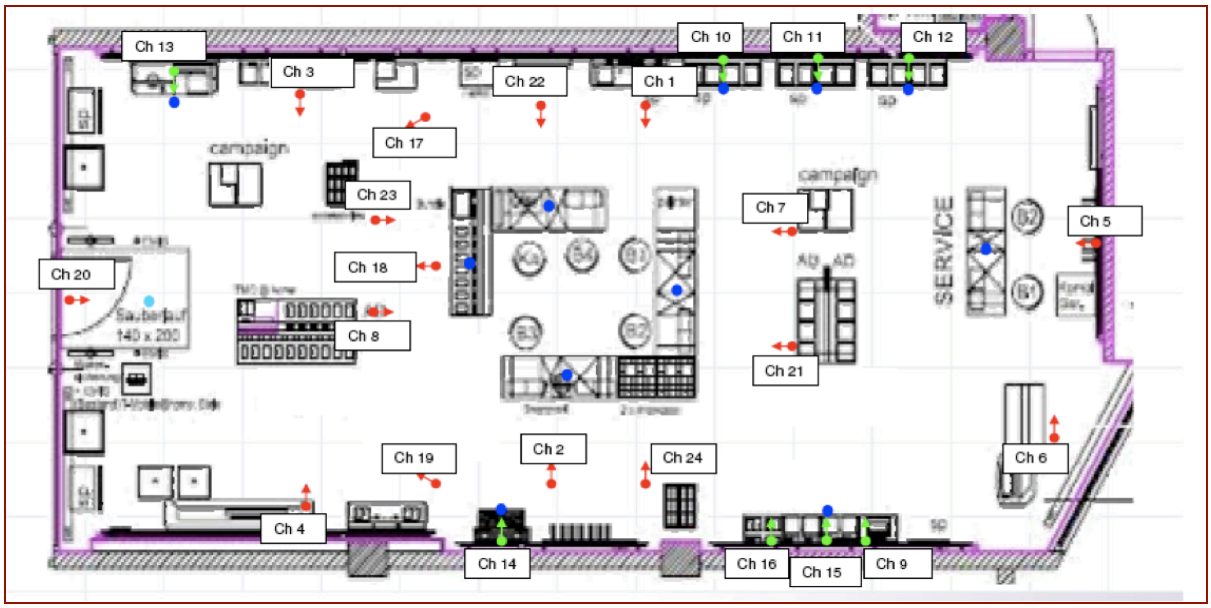


Figure 5: Camera Field Positions

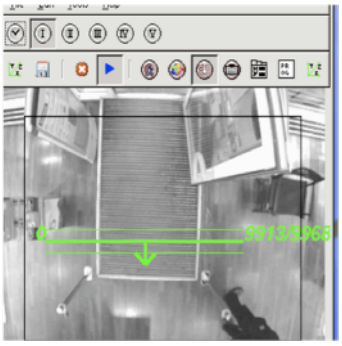
A remote network access was installed and allowed the remote parameterization of the cameras. Camera angles were optimized and adaptations to lighting conditions were made to

optimize customer recognition rates. The installation and parameterization followed a two week pre-testing period. Only within this period video data was recorded to perform quality control checks of the automatic generated binary data. Five research assistants reviewed and compared video and binary stored data sets to feed back to the solution provider, which let to a re-parameterization of cameras and in two cases in an exchange of cameras.

5.4. Data

The observation took place for six months period from May to October during the open hours from 9 a.m. to 7:30 p.m. during the week and on Saturdays from 9 a.m. to 6:00 p.m. During the observational period a total of 63,240 visitors were tracked. The average number of visitors in the store was 38 per hour, 405 per day, 2,439 per week and 10,644 per month. As the number of visitors differed to a large extend during the week and on Saturdays, we separated the data: From Monday to Friday we observed an average of 35 visitors in an hour and 380 visitors per day. On average, 51 customers visited the store on Saturdays in an hour, which results in an average of 526 visitors per day.

One of the installed overhead cameras focused on counting people entering and leaving the store. Thus, we had the customer presence and store density figure for each unit of time. The density as the number of shoppers ranged from 0.01 to 0.22 per sqm. Figure 6 shows an extract of the entering data.



Date	Time	Action	Enter	Exit	Presence	Density
20090921	9:34:01	f	11	4	7	0,076
20090921	9:36:02	b	11	5	6	0,065
20090921	9:40:38	f	12	5	7	0,076
20090921	9:40:40	f	13	5	8	0,087
20090921	9:41:49	f	14	5	9	0,098
20090921	9:41:50	f	15	5	10	0,108
20090921	9:42:04	f	16	5	11	0,119
20090921	9:43:25	f	17	5	12	0,130
20090921	9:43:26	f	18	5	13	0,141
20090921	9:43:33	b	18	6	12	0,130

Figure 6: Extract of the Overhead Camera Data at the Entrance

The other overhead cameras focused on determining the total dwell and retention time by area. These informations were available for the lowest level of time of seconds. The area analysis gave counting information about certain defined and observed product areas (e.g. all cell phones). Moreover, overhead cameras made retention time continuously available for each product (e.g. an individual cell phone).

The overhead systems generate aggregated data of the customers - for the sum of visitors - means not on an individual level. These aggregated data are relatively easy to collect but it is a technical challenge to get data on an individual level. The ID-System delivers disaggregated data for a single visitor. These disaggregated data are characterized by a higher accuracy. Gender, individual dwell time in the store and in certain areas, the individual retention time with products or service time with sales staff are part of this data collection.

6. Initial Findings

To produce valid findings on purchase termination[2] we need to combine our observation data set with transaction data. To start, we used transaction data on an aggregated daily level to analyze if there is a significant effect between the total number of customers and the probability of purchase termination.

The data set covers 144 days of information on the daily number of total customers (customer frequency) and number of products (sales volume). To describe the data set, we group both information into quartiles to evaluate the impact on purchase termination. As a first indication we see support of our proposition P1: First, as expected a lower sales volume implies a higher purchase termination rate. Second, an increasing customer frequency suggests a higher purchase termination rate. Third the combined view on customer frequency and sales volume lead to an even higher termination rate (Figure 7).

Figure 7: Average Termination Rate

[2] [Termination Rate (TR) = 1- Conversion Rate (CR)]

ANOVA analysis shows a significant difference between Q4 of customer frequency and Q1 and Q2, which might be the "Saturday-Effect" of family shopping. But there is also a significant difference between Q3 and Q1, which might indicate a "Crowding-Effect".

Nevertheless, findings are preliminary and initial at this point, as this indication is based on daily data. Further analysis is required, e.g. transactions by ID and by hour. Therefore our next steps will be to combine sales transaction and shopper data by utilizing the time stamp information. This allows to build a disaggregated shopper ID data and sales data per time unit for further analysis. By this combination of data sources we plan to explore the effect of crowding on PT. Moreover we will involve the number of sales staff.

8. Initial Managerial Implications, Future Research and Limitations

(a) Preliminary evidence suggests that retailers and researchers gain much more precise insights into actual visitor shopping patterns, consumer conduct and consumer decision makers through the use of our technique. We reiterate that these insights should be considered pregnant with validity due to the collection effort's unobtrusiveness.

(b) Retailers and researchers benefit from the increasing transparency of the shopping experience as achieved by the new video technology. Objective records of interpersonal interactions of shoppers within the real-world retail environment (how they "really," shop instead of how they "say" they shop) are provided.

(c) Moreover, a broad range of shopping patterns can be identified. Initially, such patterns will include gender-specific and time-related behavioral patterns. Thus, it is reasonable to expect that new und counter-intuitive patterns should emerge.

(d) Naturally, new ways to segment consumers can be expected - possibly involving newly distilled behavioural traits that can be translated into new selling and service approaches.

(e) Managers may optimize store sales by better exploring their sales potential by reducing purchase termination along the shopping process and across store interaction, product interaction and single transaction steps across customer touchpoints. Furthermore, applying IVT might provide the basis for a fact-based retail store management:

(f) As discussed previously, it has been argued, that crowding has a dual effect on purchase termination. Our data may allow new insights into this duality. That is, by having detailed data on the impact of density on shopper dwell time, retail managers can evaluate the 'ideal'

density for their store types and undertake measures to steer shopper frequency (e.g. applying time based pricing).

(g) Managers may also better understand customer confusion. Customer confusion has been argued to have a negative effect on purchase termination, mainly caused by shoppers being overwhelmed by choices and information. When observing 'confused' behavioral patterns retail managers can provide focus and guide customers through the store to support their decision process (e.g. by reducing choices, optimize range & space allocations by category or providing more precise in-store navigation). Retailers entail knowledge about precise movements of individual consumers in a retail outlet. This provides retailers to manage customer experience and to reduce the rate of purchase termination.

(h) Furthermore, we maintain, that waiting time could have a positive or negative effect on purchase termination. By applying IVT, retail managers can explore the cost/benefit trade-off of customer waiting time and can either try to shorten perceived waiting times or redistribute sales agent resources more effectively within the store.

(i) Next, we expect that our method can thoroughly enhance manager's abilities to exploit existing data mining methods. In addition, personal management at the store level should become more effective.

(j) Similarly, managers can assess the effectiveness of any PoS at a faster rate and with higher precision. Thus, IVT will provide a more engaging, convenient and enjoyable shopping experience in the future.

(k) It has been argued that retailing is undergoing an unprecedented change due to the internet and that certain channels, such as traditional bookstores, pharmacies, or travel agents may vanish completely. Other channels, such as car retailers may evolve into some kind of a hybrid. Thus, the channel may keep some of the traditional attributes like a test drive but add new detail of pre-purchase search due to the web's wide ranging opportunities to collect information on product performance, safety, resale values and the like. Obviously, purchase termination may depend on different variables or factors once retail environments develop a completely new configuration or mix old and new attributes.

(l) Whereas IVT takes shoppers gender characteristics, their movements and context interactions into account, our technology is limited as feelings, attitudes and motives cannot

be simply observed and are therefore out of range for a video-based technology. The observable data should ideally be complemented by surveys.

(m) Another limitation pertains to the generalizability of our findings. All data are collected in a specific sales environment, i.e. a rather small store, selling a rather narrow range of high-tech products. Naturally, future research would need to address the question to which findings would apply to other retail setting ranging from a focus on groceries, durables, clothing, luxuries and so on.

(n) Finally, a most interesting direction of future research seems to entail our technique's potential to track consumers over time. More precisely, we expect that the technique can recognize shoppers over time and, thus, offer data with fundamentally improved precision on repeat-purchases. Subsequently, new measures of consumer loyalty could offer more breadth and depth.

In summary, we would like to argue that our technology carries the potential to better understand consumers's shopping behavior, improve the management of retails outlets in numerous markets and offers a wide variety of marketing research in form of methodolical and empirical work.

References

Altman, I. (1975): The environment and social behavior: privacy, personal space, territory and crowding, Brooks and Cole, Monterey,CA.

Barker, R.G. (1965): Explorations in ecological psychology, American Psychologist, 20, pp.1-14.

Bauer, F./Lendrich, M./Markart V. (2005): Buy or bye-bye? Mit Abbrecheranalysen Websiteprozesse optimieren, Planung & Analyse, 5, pp. 26-30.

Beatty, S. E./Ferrell, M. E. (1998): Impulse buying: Modeling its precursors, Journal of Retailing, 74, 2, pp. 169-191.

Becker, G. S. (1991): A note on restaurant pricing and other examples of social influence on price, Journal of Political Economy, 99, 5, pp. 1109-1116.

Berlyne, D.E. (1960): Conflict, arousal and curiosity, McGraw-Hill, New York.

Blackwell, R.D./Miniard, P.W./Engel, J.F. (2006): Consumer behavior, Thomson South-Western, Ohio.

Burke, R.R. (2006): The third wave of marketing intelligence, in: Krafft, M./Mantrala, M. (eds.): Retailing in the 21st century: current and future trends, Berlin, pp. 113-125.

Büschken, J. (2007), 'Conversion of shoppers in brick-and-mortar retailing – an analysis of observational data, Journal of Retailing, revision (working paper on request)

Chang, C.A./Burke, R.R. (2007): Consumer choice of retail shopping aids, Retailing and Consumer Services, 14, 5, pp. 339-346.

Chebat, J.C./ Filiatrault P. (1993): The impact of waiting in line on consumers, International Journal of Marketing, 11, 2, pp. 35-40.

Chernev, Alexander (2003): When more is less and less is more: The role of ideal point availability and assortment in choice, Journal of Consumer Research, 30, pp.170-183.

Cox, D. (1967): Risk taking and information handling in consumer's behavior, Boston division of research, Harvard Business School Press, Boston.

Cox, A./ Granbois, D.H./Summers, J. (1983): Planning, search, certainty and satisfaction among durables buyers: a longitudinal study, Advances in Consumer Research 10, pp. 394- 399.

Decker, C./Kubach U./Beigl M. (2002): Revailing in retail black box interaction sensing, TecO, University of Karlsruhe.

Dhar, R. (1992): To choose or not to choose: This is the question, Advances in consumer research 14, pp. 735-738, Proceedings of the Association for Consumer Research, University of Chicago press.

Dhar, R. (1997a): Consumer preference for a no-choice option, Journal of Consumer Research, 24, 2, pp. 215-231.

Dhar, R. (1997b): Context and task effects on choice deferral, Marketing Letters, 8, 1, pp. 119-130.

Dhar, R./ Nowlis, S.M. (2004): To buy or not to buy: response mode effects on consumer choice, Journal of Marketing Research, 41, 4, pp. 423-432.

Dodd, C.A./Clarke, I./Kirkup, M.H. (1998): Camera observations of customer behavior in fashion retailing: Methodological propositions, International Journal of Retail & Distribution Management, 26, 8, pp. 311-317.

Donovan, R.J. (1994): Store atmosphere and purchasing behavior, Journal of Retailing, 70, 3, pp. 283-294.

Duncan, C.P./Olshavsky, R.W. (1982): External search: The role of consumer beliefs, Journal of Marketing Research, 19, pp. 32-43.

Durrandes-Morreau, A. (1999): Waiting for service: Ten years of empirical research: International Journal of Service Industry Management, 10, 2, pp. 171-194.

Economist (2009): The science of shopping. The way the brain buys. Dec 18th 2008, The Economist print edition.

Eroglu, S.A./Harrell,G.D. (1986): Retail crowding: Theoretical and strategic implication, Journal of Retailing, 62, 4, pp. 346-363.

Eroglu, S.A./Machleit, K.A. (1990): An empirical study of retail crowding: Antecedents and consequences, Journal of Retailing, 66, 2, pp. 201-221.

Eroglu, S.A./ Machleit, K./Barr, T.F. (2005): Perceived retail crowding and shopping satisfaction: The role of shopping values, Journal of Business Research, 58, pp. 1146-1153.

Fader, P./Moe, W. (2004): Dynamic conversion behavior at e-commerce sites, Management Science, 50, 3, pp. 326-335.

Greenleaf, E./Lehmann, D. (1995): Reasons for substantial delay in consumer decision making, Journal of Consumer Research, 22, 1, pp. 186-199.

Harrel, G.D. (1990): A new perspective on choice, Advances in Consumer Research, 17, pp. 737- 745. Twentieth Annual Conference. New Orleans. Association for Consumer Research.

Harrell, G.D./Hutt, M.D./Anderson, J.C. (1980): Path analysis of buyer behavior under conditions of crowding, Journal of Marketing Research, 17, 1, pp. 45-51.

Häuble Trifts (2000): Consumer Decision Making in Online Shopping Environments: The Effects of Interactive Decision Aids, in: Marketing Science, 19, 1, pp. 4-21.

Huber, J./Czajka, A.L. (1982): Modeling buy/no buy decision: a comparison of the two methods, Advances in Consumer Research, 9, 1, pp. 357-36.

Hui, M. K./Bateson (1991): Perceived Control and the Effects of Crowding and Consumer ?Choice on the Service Experience, Journal of Consumer Research, 18, 2, pp. 174-184.

Hui, S.K./Fader, P.S./Bradlow E. (2009): Path data in marketing: An integrative framework and prospectus for model building, Marketing Sciences, 28, 2, pp. 320-335.

Iyengar, S./Lepper, M. (2000): When choice is demotivating: Can one desire too much of a good thing?, Journal of Personality and Social Psychology, 79, 6, pp. 995-1006.

Janiszewski, C. (1998): The influence of display characteristics on visual exploratory search behavior, Journal of Consumer Research, 25, 12, pp. 290-301.

Katz, K.L. (1991): Prescription for the waiting-in line, Sloan Management Review, 32, 2, pp. 44-53.

Kostecki, M. (1996): Waiting lines as marketing issue, European Management Journal, 14, 3, pp. 295-303.

Kroeber-Riel, W./Weinberg, P. (2003): Konsumentenverhalten, München.

Liebmann, H.P./Zentes, J. (2001): Handelsmanagement, München.

Machleit, K.A./Eroglu, S.A./Mantel, S.P. (2000): Perceived retail crowding and shopping satisfaction, Journal of Consumer Psychology, 9, 1, pp. 29-42.

Maister, D. (2005): The psychology of waiting lines, in: Czepiel, J./Solomon, M.R. /Surprenant, C.F. (eds): The service encounter, Lexington Books, Lexington (MA).

McCullagh, M.J./Thornton, S. (1995): In-store surveys of customer movement and behavior, University of Nottingham.

Mitchell, V.-W./Papavassiliou, V. (1999): Marketing causes and implications of consumer confusion, Journal of Product & Brand Management, 8, 4, pp. 319-339.

Mitchell, V./Walsh, G./Yamin, M. (2005): Towards a conceptual model of consumer confusion, Advances in Consumer Research, 32, pp. 143-150.

Moe,W. (2003): Buying, searching, or browsing: differentiating between online shoppers using in-store navigational click stream, Journal of Consumer Psychology, 13, 1/2, pp. 29-39.

Nie, W. (2000): Waiting: Integrating social and psychological perspectives in operations management, The International Journal of Management Science, 28, 6, pp. 611-29.

Payne, J.W./Bettman, J.R./Luce, M.F. (1996): When time is money: Decision behavior under opportunity-cost time pressure, Organizational behavior and human decision processes, 66, 2, pp. 131-152.

Peritz, J. (1993): Retailers who keep score know, what their shoppers value, Marketing News, 27, May 24, p. 9.

Peter, J. P./Olsen, J.C. (1990): Consumer behavior and marketing strategy, Boston.

Philips, H./Bradshaw, R. (1991): Camera tracking: a new tool for market research and retail management, Management Research News, 14, 4/5, pp. 20-22.

Philips, H./Bradshaw, R. (1993): How customers actually shop: customer interaction with the point of sale, Journal of the Market Research Society, 35, 1, pp. 51-62.

Pons, F./Laroche, M./Mourali, M. (2006): Consumer reaction to crowded retails settings: cross-cultural differences between North America and the Middle East, Psychology & Marketing, 23, 7, pp. 555-572.

Rau, P./Samiee S. (1981): Models of consumer behavior: the state of the art, Journal of the Academy of Marketing Science, 9, 3, pp. 300-316.

Rudolph, T./Schweizer, M. (2004b): Wenn Käufer streiken: Mit klarem Profil gegen Consumer Confusion und Kaufmüdigkeit, Wiesbaden.

Schröder, H./Möller, N./Zimmermann, G. (2007): Die Analyse des Such- und Entscheidungsverhaltens von Kunden im stationären Einzelhandel - Ein Vergleich ausgewählter Beobachtungsmethoden, Frankfurt/Main.

Schweizer, M. (2005): Consumer Confusion im Handel: Ein umweltpsychologisches Erklärungsmodell, Wiesbaden.

Solomon, M.R. (1994): Consumer Behavior, Prentice-Hall International, London.

Stokols, D. (1972): On the distinction density and crowding: Some implications for future Research, Psychological Review, 79, 3, pp. 275-278.

Tauber, E. M. (1972): Why do people shop?, in: Journal of Marketing, 36, pp. 46-49.

Taylor, S. (1994): Waiting for services: the relationship between delays and evaluation of services, Journal of Marketing, 58, 2, pp. 56-69.

Tom G./Lucey S. (1995): Waiting time delays and customer satisfaction in supermarkets, Journal of Service Marketing, 9, 5, pp. 20-29.

Turnbull P./Leek S./Ying G. (2000): Customer confusion: the mobile phone market, Journal of Marketing Management, 16, pp. 143-163.

Walsh G./Hennig-Thurau T./Mitchell V. (2007): Consumer confusion proneness: scale development, validation and application, Journal of Marketing Management, 23, 7-8, pp. 697-721.

Wells, W.D./LoSciuto, L.A. (1966): Direct observation of purchasing behavior, Journal of Marketing Research, 3, 3, pp. 227-233.

Wiswede, G. (1997): Einführung in die Wirtschaftspsychologie, München.

Zhou, R./Soman D. (2003): Looking back: exploring the psychology of queuing and the effect of number of people behind, Journal of Consumer Research 29, 4, pp. 517-530.