Turning Bias and Walking Patterns: Consumers' Orientation in a Discount Store

by Andrea Groeppel-Klein and Benedikt Bartmann

The object of this paper is to investigate the concept of mental maps as a basis for explaining the ease of orientation experienced by consumers at the point of sale. Useful hypotheses explaining the formation of mental maps can be derived from environmental psychology and neurophysiology. This article consists of replication studies of the pointing task experiments of Sommer/Aitkens (1982) and Gröppel-Klein/Bartmann/Germelmann (2006), plus an additional observation study. In the new study, test persons had to conduct a simulated shopping task. The empirical studies reported here were conducted in two discount grocery stores with an identical assortment and identical prices, one guiding customers in a clockwise direction and the other in a counter-clockwise direction. Using a geographical information system (GIS), we found that the direction in which shoppers were guided, as well as the location of products (in peripheral aisles versus the interior section of the store), influenced the formation of accurate mental maps, the ease of orientation, and the efficiency of the shopping process.

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Acknowledgements: The authors would like to thank the anonymous referees for their helpful und constructive comments.

Keywords

Store layout, mental maps, orientation, retailing

1. Introduction

It has long been accepted that "a lost customer is a customer lost." It is estimated that up to 70 percent of buying decisions, depending on the product class, are made in-store (POPAI 1997). However, consumers can only buy articles that they can find on the shelves. As *Chandon*, *Hutchinson* and *Young* (2002) point out, "unseen is unsold." Consumers who cannot find what they are looking for usually give up or ask a salesclerk where they can find the product in question. For instance, in German home improvement (DIY) stores, most customer enquiries directed to salesclerks relate to the location of products (*Homburger* 2005).

This article examines the process of customer orientation in retail stores. It focuses on the impact of store layout on shoppers' ability to find products and orient themselves at the point of sale (POS). A number of key hypotheses relating to orientation behavior can be derived from environmental psychology. Environmental psychology is a special field of psychology modeling the influence of diverse environments (e. g. buildings, rooms, landscapes, or other human environments) on emotion and behavior. Both cognitive and affective approaches in environmental psychology tell us something about how store environments affect consumers' arousal and emotions during shopping trips. The cognitive approach looks primarily at the "geography of the mind." The findings of brain research, perception theory and Gestalt theory help to explain the representation in memory of spatial information – so-called "mental maps" (*Golledge* 1999; *Ittelson et al*. 1974, *Russell/Ward* 1982). Several empirical studies of store environments (*Groeppel-Klein* 2001; *Groeppel-Klein*/*Germelmann* 2003; *Grossbart/Rammohan* 1981) show evidence of a significant correlation between the existence of mental maps of stores (knowledge of product location, assortment, service points in malls, escalators, etc.) and consumers' feelings about how convenient the shopping experience is. Furthermore, *Reimers* and *Clulow* (2004) find a significant relationship between "mental search costs" and the perceived convenience of retail spaces: The more detailed the mental map, the less mental effort needed when searching for products. These studies imply that retailers should pay close attention to the way they communicate verbal and non-verbal information to shoppers. For example, landmarks improve shoppers' mental maps. These landmarks can be merchandising themes (products usually appearing side-by-side in the store as in real life), visually striking elements, or clearly separated aisles and product display zones (*Hackett/Foxall/Van Raaij* 1993).

The overall layout of the store also appears to influence customer orientation. Today, as in the past, most supermarkets, discount stores and even on-line stores (*Vrechopoulos et al*. 2004) use a "grid layout." The grid layout was designed to "steer the customer past the whole range of goods, which are displayed on the shelves. As consumers walk down each aisle, "they are exposed to all the products and are more likely to buy something they had not intended to buy" (*Newman/Cullen* 2002, p. 250). However, the guiding direction in a grid layout can vary: some stores lead customers clockwise around the store, others (in Germany an estimated 80 percent) counterclockwise.

The focus of this paper is on the guidance direction inside the store (within the grid). Our aim is to explore how different guidance directions influence the way consumers navigate retail space, recognize and find the products they want, and form mental maps. We draw on the findings of both environmental psychology and neurophysiology, in particular the fact that people exhibit a turning preference to the right (*Formisano et al.* 2002; *Güntürkün* 2003; *Scharine/McBeath* 2002; *Underhill* 2000).

2. Overview of the findings of environmental psychology and neurophysiology on orientation in stores

Environmental psychology analyzes the influence of different environments (e. g. buildings, rooms, landscapes) on people's emotions and behavior (*Mehrabian* 1976). Two different approaches exist: the emotional approach and the cognitive approach. Both approaches provide useful information on how store environments can impact consumer behavior at the POS.

The emotional approach concentrates on the emotional reactions of individuals in different environments. Empirical studies (e. g. *Donovan/Rossiter* 1982; *Donovan et al.* 1994; *Flicker/Speer* 1990; *van Kenhove/Desrumaux* 1997; *Groeppel-Klein* 2001) based on the emotional behavioral model of environmental psychology proposed by *Mehrabian* (1976) imply that the information rate that shoppers subjectively perceive in a store relates to the perceptual image that they have of the store. This information rate depends on the novelty of the environment (the degree to which it is unexpected, surprising or unfamiliar) and its complexity (the number of different elements, motions or changes in the setting). The more varied, novel, surprising and animating the environment, the higher the information rate.

Environmental stimuli generate primary emotional reactions (pleasure, arousal and dominance) that in turn serve as intervening variables determining people's reactions to their environment ("approach" vs. "avoidance"). Approach behavior at the POS, for instance, means that consumers enjoy staying at the POS, extend the duration of their stay, recommend the store to other consumers, spend more, rate their intention to come back often higher, and have a positive overall impression of the POS. Easy orientation is also a significant variable explaining perceived pleasure and approach behavior (*Groeppel-Klein/Germelmann* 2003).

The cognitive approach tries to determine how individuals perceive and remember environments. The basis for this ability is thought to be mental (i. e. cognitive) maps that are stored in consumers' memories. These mental maps can be defined as internal representations of external geographical realities and their spatial dimensions (*Hackett/Foxall/Van Raaij* 1993, p. 389). Mental maps are acquired by one's own motion in space (primary knowledge acquisition) or by drawing on visual or verbal descriptions of spaces (secondary knowledge acquisition).

It is postulated that familiarity with an environment enhances the formation of mental maps (*Chebat/Gélinas-Chebat/Therrien* 2005; *Dogu/Erkip* 2000, pp. 749 f.; *Evans* 1980, pp. 272–275). *Bell*, *Teck-Hua* and *Tang* (1998) confirm that habitual visits to one store enhance the level of familiarity with the store (knowledge of the location of products, assortment, parking arrangements, etc.). This then reduces the "fixed costs" of repeat trips to the store. Irrespective of the actual performance of a store, *Rhee* and *Bell* (2002, p. 234) find that the longer a shopper stays, "the less likely a transition away becomes." Their explanation is that shoppers do not want to give up the "benefits of store-specific knowledge of assortment, layout and prices" (p. 225). This result can also be explained by the "mere exposure" effect (*Zajonc* 1968): The more a consumer becomes used to a store, the more he or she likes it. The "familiarity" factor should therefore be controlled for in empirical studies.

Orientation behavior has also received some attention in the field of hemisphere research. However, it is not yet fully understood how the left and right hemispheres of the brain interact in solving spatial tasks (*Kukolja/Marshall/Fink* 2006). In an experimental study, *Sack* (2003) analyzes this interaction, finding increased activity in the right hemisphere during spatial tasks. It is important to note that shoppers are able to recreate spatial environments in their minds (e. g. the location of products in a supermarket) even when they are in different locations (*Gärling/Böök/Lindberg* 1986). Active imagery processes occur when people retrieve the spatial environment of the store from their memory. In these processes, the left parietal lobe is dominant in producing mental images, while the right parietal lobe specializes in the spatial analysis of the imagined content (*Formisano et al.* 2002; *Sack et al.* 2005).

To sum up, neurological research indicates that the relevance of cognitive maps for orientation at the POS is an area that merits further research. As discussed below, a number of interesting theses can be derived by combining neurological results with findings from observations of in-store behavior and experiments investigating it. Furthermore, retailers often claim that they have implicit or tacit knowledge of how to improve shoppers' orientation and mental maps. In this study, we investigate some of the rules or regularities that appear to influence shoppers' ease of orientation in one specific retail environment – a discount grocery store.

3. Mental maps

To date, research into consumer behavior has paid little attention to product location in consumers' mental maps as a factor in retail success. One notable exception is a study by *Sommer* and *Aitkens* (1982) in which participants had to locate 11 different products on a store map. This "pointing task experiment" found that consumers' ability to locate items correctly was significantly higher for products located in peripheral aisles than for those in central aisles. In the current investigation, we try to determine whether the results of this study, conducted more than 25 years ago, are still valid today.

Nowadays, we can use more accurate methods for gathering data than were available to *Sommer* and *Aitkens;* in particular geographical information systems (GIS). "GIS is a powerful set of tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes" (*Burrough/McDonnell* 1988, p. 11). Detailed information about product location can be collected on a sketch map and then transferred to the GIS application. This procedure enables researchers to record all the relevant information and then select specific features.

GIS applications are currently used mainly in the commercial sector for analyzing location queries and optimizing routing and distribution, for example. Few studies to date have attempted to combine geographical information technology with consumer behavior, even though the walking behavior of consumers (e. g. their frequency in different aisles) is known to be crucial for the retail business (*Pun-Cheng/Chu* 2004). In earlier retailing studies, GIS is mainly used to visualize customer traffic flow (*Uotila/Skogster* 2007). But it can also be used effectively to process data in pointing task experiments, measuring the exact distance between customers' estimations of where products are and the actual location of the products. For example, if 100 people plot the location of ten different products, a total of 1,000 points must be analyzed. Similar to a navigation system, GIS automatically calculates the shortest route through the different aisles from the actual to the estimated location.

In their pointing task experiment, *Sommer* and *Aitkens* (1982) simply analyze the "hit rate." They fail to control for moderating variables, such as the direction of guidance (counter-clockwise or clockwise) and whether shoppers were right- or left-handed. Nor do they investigate the relationship between the number of products correctly plotted on the map and the subjective ease of orientation. The present study attempts to replicate their study, but with a modified experimental design addressing these shortcomings.

Retail practice, in line with neurophysiologic research, indicates that the direction in which shoppers are guided – i. e. the store layout – may be an important factor in the recognition of product location (used in this study as an operationalization of the accuracy of mental maps). Most discount stores guide customers through the store in a counter-clockwise direction (*Sorensen* 2003, p. 32). This is generally justified by two facts. First, in most countries, vehicles drive on the right. Thus, in most countries consumers are used to a counter-clockwise guiding direction. Second, most customers are right-handed and so have a tendency to notice products located on their right. This assumption is widely accepted in studies of American consumers (see for example, *Underhill* 2000, p. 76: "American shoppers automatically move to the right").

Neurophysiologic research, however, suggests a different explanation for consumers' turning preference. *LeNoir et al.* (2006) distinguish between intrinsic and extrinsic factors. Intrinsic factors include hormones, for example. Extrinsic factors are externally imposed constraints, such as the fact that when walking toward a table to pick up a cup, the direction of turning will be influenced both by the subject's hand preference and the position of the cup. Thus, orientation behavior is influenced partly by stimuli in the environment.

Studies investigating intrinsic factors indicate that an individual's turning bias is mainly caused by the hormone dopamine, which is responsible for locomotion. Right-handed individuals normally have a dopamine concentration in the left hemisphere of the brain. In healthy, right-handed subjects, the higher the dopamine concentration in the left hemisphere, the more attention (and hence locomotion) is focused on the right (*Mead/Hampson* 1996; *Mohr et al*. 2004). Accordingly, empirical studies mostly report a turning bias to the right (*Güntürkün* 2003; *Mead/Hampson* 1996; *Scharine/McBeath* 2002; *Weyers et al.* 2006; see *Tab. A1* in the Appendix).

Shoppers, then, are generally oriented toward the right. This means that in a store that is arranged in a clockwise direction, they will frequently look toward the interior of the store. This is especially true when the retail fixtures do not go above eye level.

It has further been suggested that people have a general orientation toward walls. *Appleton* (1986) explains this in his Prospect Refuge Theory, which argues that people have an innate desire for security (walls are viewed as providing protection) and want to see as much as possi-

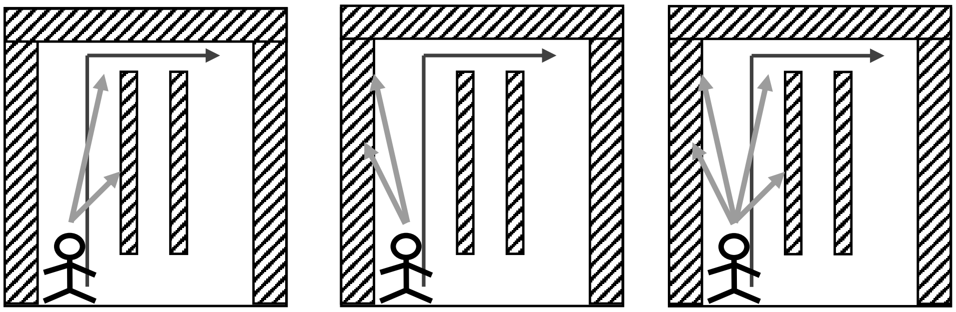

Figure 1: Customer orientation in a store with a clockwise layout

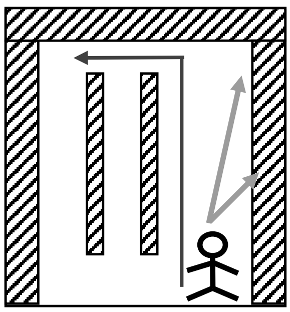

Figure 2: Customer orientation in a store with a counter-clockwise layout

ble without being seen themselves. *Batchelor* and *Goethals* (1972) also find that with respect to empty rooms, individuals prefer places near walls. Another example is the fact that diners in restaurants prefer tables located close to the walls rather than in the middle of the restaurant.

Buttle (1984, p. 115) describes the customer tendency to shop in the "perimeter of the store" as "wall-shopping." In the retail context, shoppers will therefore notice particularly products positioned on aisles close to the walls. Furthermore, *Vlaskamp* and *Hooge* (2006) found from eye-tracking experiments that the identity of a target (e. g. a product on a shelf) is more difficult to grasp when it is surrounded by distracters. These "crowding effects" negatively affect consumers' ability to remember the relevant target and their mental convenience (*Miura* 1990). It can be assumed that a wall, compared to an unbounded setting, offers less information to distract the consumer; consumers will therefore automatically turn toward the wall, as it offers a form of relief.

In a store with a clockwise layout, customers will therefore look both right and left. In a store with a counter-clockwise layout, customers will look mainly to the right. Accordingly, shoppers will remember more products and product locations in a store with a clockwise layout than in a store with a counter-clockwise layout. This is shown schematically in *Fig. 1* and *2* below.

This leads us to our first hypothesis:

H1: If shoppers are guided in a clockwise direction, they will have a more detailed mental map, evaluate the store more positively and be willing to spend more money than if they are guided in a counter-clockwise direction.

We may also re-examine the central finding of *Sommer* and *Aitkens* (1982) that customers remember products located in peripheral aisles better than those located in central aisles. "Cognitive anchors" – e. g. cold shelves, cubicles, displays – occur more frequently in peripheral aisles and help consumers remember products nearby; in other words, cognitive anchors help to establish mental maps. *Morales et al.* (2005) likewise assume that the shelving configuration or the location of an elevator in a store might direct shoppers to follow a special route. Moreover, in peripheral aisles customers are often forced by the store layout to follow a loop, with the result that they pass peripheral aisles more frequently than central aisles. Irrespective of the store's layout, peripheral aisles should also benefit from shoppers' orientation toward the walls (Buttle, 1984). In this connection, "wall-shopping" means that consumers should recognize more products on the shelves near the walls than in the store interior, and hence should also be able to recall them more accurately.

These arguments lead us to believe that the result found by *Sommer* and *Aitkens* (1982) is still valid: in peripheral aisles, consumers' accuracy in locating products correctly is significantly higher than in central aisles. This brings us to our second hypothesis:

H2: Irrespective of the store layout (counter-clockwise or clockwise), customers will recall products located in peripheral aisles better than those located in central aisles.

As discussed above, the accuracy of mental maps is also thought to influence shoppers' subjective perception of the store. We also wish to investigate whether the accuracy of shoppers' mental maps increases their perception of how easy it is to orient themselves in the store, and whether this yields a more positive evaluation of the value for money offered. As stated previously, several empirical studies of store environments (*Groeppel-Klein/Germelmann* 2003; *Grossbart/Rammohan* 1981) show that the existence of mental maps of stores has an impact on consumers' feelings about how convenient the shopping experience is. Moreover, *Grossbart* and *Rammohan* (1981) note that precise knowledge of the shopping environment, stored in the mental map, decreases the probability of a customer's confusion during shopping trips. A well-structured layout should thus enhance shoppers' perception of the ease of orientation. Shoppers may then transfer this positive appraisal to their evaluation of the store's value for money. A similar process occurs, for example, in the Cognitive Gravity Model, whereby consumers choose not the closest supermarket, but the supermarket with the least cognitive distance from them and the greatest cognitive attractiveness (*Cadwallader* 1981; *Timmermans* 1993). This leads us to our third hypothesis:

H3: The more accurate shoppers' mental maps are, the higher their evaluation of the ease of orientation of the store, and the more favorable their evaluation of the value for money offered.

If the direction of guidance influences the accuracy of shoppers' mental maps, we may reasonably expect this effect to occur for a clockwise layout only. As discussed above, we must also control for familiarity with the store in question ("store patronage") and the frequency of shopping; these factors should be equally distributed in both stores.

4. Study 1: Mental maps in discount stores

Our first study (*n* = 196) investigates the relationship between store layout, the accuracy of shoppers' mental maps and their ease of orientation in two stores. The stores both belonged to the same chain of discount grocery stores and were *identical* in terms of assortment, prices and shoppers' familiarity with them. In one store, however, customers were guided clockwise around the store, and in the other they were guided counter-clockwise: in other words, the stores were mirror images of each other. Further variables, such as the general location of the store and the proximity of competitors, did not differ: both discount stores were located in malls where there was one competitor (a supermarket). The two test groups showed no significant differences with respect to household size, income, age, gender, or familiarity with the store in question. Subjects were first asked if they were right- or left-handed, and those who were left-handed were excluded from the survey.

Before entering the store, the subjects were asked to indicate on a printed map of the store where they thought eight specific products were located. These products were located in both peripheral and central aisles (as in *Sommer* and *Aitkens* 1982) and were selected so as to represent products that are normally bought with different frequencies (e. g. milk and champagne). GIS was used to measure the subjects' level of accuracy in estimating the location of the products. The distance in meters between the estimated and the actual location of all eight products was calculated: the higher the total distance, the lower the subject's level of accuracy. We measured the distance the shopper would actually have to cover in order to reach the product rather than the distance as the bird flies, as shoppers obviously cannot pass through or over the shelves – see *Fig. A1, A2* and *A3* in the Appendix. We used the Euclidian ("city block") distance, as this measure accounts for the fact that in a store consumers cannot use "bee-lines" to find the relevant product if they choose the wrong aisle. GIS also calculates the linear distance (L1 norm) between the estimated and actual product location. The correlation between the L1 and L2 norm is quite high (*r* between .7 and .9 for the eight different products), however L2 demonstrates our results more clearly. In addition, we considered the different customer orientations implied by the different layouts.

Results: The results of the experiment, shown in *Tab. 1*, support Hypothesis 1: If shoppers are guided in a clockwise direction, they have a more detailed mental map, evaluate the store more positively and are willing to spend more money than if they are guided in a counter-clockwise direction.

Our replication of the pointing task experiment by *Sommer* and *Aitkens* (1982) also supports our second hypothesis, H2. Overall, subjects located 32.4 percent of the products they recalled correctly on the store maps. Of these, 70 percent were in peripheral aisles and 30 percent in interior sections (*chi square* = 17.417; *df* = 1; *p* = .000). Similar results were found for both stores, irrespective of the guidance direction.

To investigate H3, we tested the influence of mental maps on shoppers' perceived ease of orientation and value for money. The findings for H1 imply that such an influence may occur only for the clockwise layout. The results bear this out: Significant or marginally significant correlations were found only for the store with the clockwise layout (see *Tab. 2*). Thus "turning bias to the right" and "wall orientation" potentiate the ease of orientation in a clockwise layout.

Discussion: The results of the first study confirm our two hypotheses: they demonstrate the importance of the turning bias and confirm the relationship between the accuracy of shoppers' mental maps and their perceived ease of orientation. Furthermore, we were able to replicate the result found by *Sommer* and *Aitkens* (1982) that in peripheral aisles, consumers' accuracy in locating products is significantly higher than in central aisles. However, the exact reason for this consistent result could not be identified; we can only assume that all the different factors (greater frequency, more "cognitive anchors" and "orientation toward walls") may perhaps play a part in improving consumers' mental maps.

Two more potential problems with the first study should be noted. First, when asked to locate products on the store map, some subjects may have simply pointed to

				Levene's test for equality of variances		t-test for equality of means	
Dependent variables	Guidance direction	n	Mean	F	Significance	t	Sig. (2-tailed)
Hit rate	Clockwise	73	4.32	5.949	.016	-2.229	.027
Margin of error (in meters)[a]	Counter-clockwise	82	5.54				
Shopping convenience	Clockwise	91	.24	3.274	.072	3.324	.001
	Counter-clockwise	95	-.23				
Ease of orientation[b]	Clockwise	91	.25	10.439	.001	3.517	.001
	Counter-clockwise	95	-.24				
Perceived value for money[b]	Clockwise	91	-.06	2.849	.093	-.732	.465
	Counter-clockwise	95	.05				
Money spent (in EUR)	Clockwise	91	9.64	5.121	.025	2.259	.026
	Counter-clockwise	97	6.47				

[a] Mean average distance in meters between estimated and actual product location; the higher the value, the lower the hit rate
[b] Standardized mean values

Table 1: Results for H1 – Influence of store layout

Hit rate[a]	Ease of orientation	Perceived value for money
Both stores (n = 151)	+.147*[b]	+.139*
Clockwise layout (n = 71)	+.231**	+.326**
Counter-clockwise layout (n = 80)	Not significant	Not significant

[a] Measured in terms of the average distance in meters between estimated and actual product location; values in meters standardized and subsequently recoded to generate positive algebraic signs
[b] *$p < .1$; **$p < .01$

Table 2: Results for H3

any location rather than admitting that they did not know where the products were. Furthermore, some participants may have known where the products were, but lacked visualization or drawing skills. *Rovine* and *Weisman* (1989) found that sketch-map variables were a predictor of way-finding performance for a downtown area; however, some participants in our study may not have been familiar with floor plans. As a result, they may have achieved lower scores for pointing accuracy even though they knew where the product was located. This would affect the findings for both stores equally. In order to validate the findings, it is necessary to conduct additional search experiments involving simulated shopping tasks. For this reason, in Study 2 we conduct an additional observational study to find out how consumers actually behave when they have to find certain products on the shelves. Observational methods can also be used to analyze the different ways that consumers travel through stores.

Sorensen (2003) uses an electronic tracking tool to monitor shopper behavior. In contrast to our study, he finds a different result with respect to "money spent" for clockwise and counter-clockwise shoppers. Using a flow diagram showing the traffic flow of the customers, he is able to distinguish between clockwise and counter-clockwise shoppers in stores. In *Sorensen* (2003), customers were allowed to find their own way through the store, but most of them were influenced in their walking behavior by the location of the main entrance to the store, which was on the right, thus forcing counter-clockwise behavior. Nevertheless, clockwise shoppers also occurred. The significance here is that counter-clockwise shoppers spend on average USD 2 more per trip than clockwise shoppers. Although *Sorensen's* (2003) sample size is impressive (200,000 shopping trips were observed), he does not control for frequency of shopping, age, household size, or income with respect to the two groups. Furthermore, he conducted the study only within one store, so we do not know if the counter-clockwise shoppers were frequent customers who were simply used to the store layout. For these reasons, the impact of the layout on buying behavior should be reinvestigated.

In Study 2, we investigate travel patterns. Again, we use two outlets belonging to the same chain of discount grocery stores that were identical in terms of assortment, prices and shoppers' familiarity with them, but different in terms of layout (clockwise vs. counter-clockwise). We observe consumer behavior to control for the above-mentioned shortcomings of Sorensen's investigation and to overcome some of the limitations of our first study.

5. Travel patterns

Titus and *Everett* (1995, 1996) analyze the different "travel patterns" and search strategies used by consumers when they navigate retail space. They use a protocol technique in which shoppers were asked to comment on their actions and path decisions while being recorded on tape. The main goal of their study was to describe the basic mechanism underlying consumer search strategies at the POS and to develop a conceptual model of shoppers' retail search process. However, their study also reveals that many in-store search errors occur due to difficulties in understanding the store environment and lack of product or assortment knowledge. In other words, customers often simply do not know where the products are located.

In an exploratory study, *Larson*, *Bradlow* and *Fader* (2005) fitted shopping carts with RFID chips[1] that reported the location of the cart every five seconds. This approach produced a large amount of quantitative data that enabled the investigators to group the different travel patterns through the store into clusters. The large number of observations and the innovative clustering technique make this a particularly valuable contribution to our understanding of the subject. One key finding of *Larson et al.* (2005) is that shoppers can be grouped into short- and long-distance shoppers (see *Fig. 3*).

Despite their evident value, the above-mentioned studies have a number of shortcomings. For example, the investigators in the experiments did not know what tasks the subjects were actually completing. Thus, shoppers walking long distances through the store may have done so because they could not find the product they wanted, or because they wanted to buy many different products. In addition, household size and income may have influenced purchases. And, of course, the RFID chip tracked only the path of the shopping cart, not the exact path of the customer. As a result, no conclusions regarding shopping efficiency are possible from these studies.

Both *Titus* and *Everett* (1995, 1996) and *Larson et al.* (2005) highlight the relevance of shoppers' orientation at the POS. However, they do not investigate the relationship between orientation and efficiency. Accordingly, we decided to perform a second study again looking at stores with counter-clockwise and clockwise layouts.

Study 2: In this second study, participants carried out set shopping tasks. The main goal of the study was to investigate the efficiency with which actual products could be found, as reflected by the distance traveled by shoppers. We assumed that grocery shoppers try to minimize their effort in order to maximize the benefits of their shopping trip. For example, they try to spend as little time in the store as possible (*Bitgood/Dukes* 2006). *Gärling* and *Gärling* (1988) also demonstrate that in downtown areas, consumers try to minimize walking distance.

Bäckström and *Johansson* (2006) show that store layout is a crucial factor in retailing. It can provoke positive experiences if shoppers perceive the layout to be logical and can find the products they want easily. However, it can provoke negative experiences if the structure of the assortment confuses shoppers and obliges them to spend more time than they originally intended in the store.

Our hypothesis is that if the clockwise layout is indeed superior to the counter-clockwise layout, consumers should cover shorter distances in locating products in a clockwise-oriented store. In other words, shopping efficiency should be influenced by a clockwise layout and

[1] In another study, *Skogster et al. (2008)* used wireless local area networks (WLAN) to detect and identify shopper behavior at the POS.

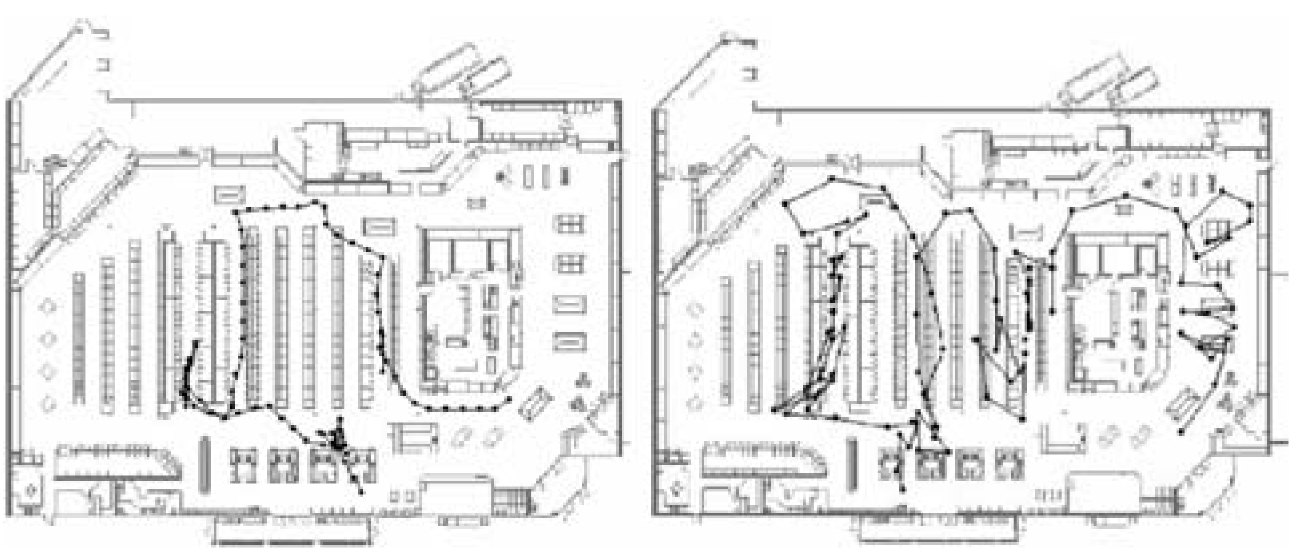

Figure 3: Travel patterns according to Larson, Bradlow and Fader (2005)

the mental maps it creates. This is expressed in our fourth hypothesis:

H4: In a clockwise store layout, there will be a significantly larger number of "efficient shoppers" (in terms of distance and/or time) than in a counter-clockwise layout.

Again, as in Study 1, it was necessary to control for participants' familiarity with the store and the frequency of their shopping trips. Additionally, in this study it was necessary to control for the accuracy of participants' mental maps.

6. Study 2: Travel patterns in clockwise and counter-clockwise discount stores

Study 2 uses a similar research design to Study 1. As before, the two discount grocery stores belonged to the same chain, had an identical assortment and prices but a different direction of guidance (counter-clockwise versus clockwise). Again, only right-handed subjects participated in the experiment as the "turning bias" is thought to be valid only for right-handed people. This time, however, the subjects (n = 76) were asked to actually get eight specific products from the shelves, rather than just estimating their location as in Study 1; on completing the task, they could do their own shopping. In this way we could analyze their travel pattern, which reflects their level of shopping efficiency for the task. Subjects were not told the objective of the study; a pointing task as in Study 1 was carried out only after the experiment, so as not to reveal its purpose.

During the experiment, two disguised observers kept track of the walking behavior of the participants. Unlike *Larson et al.* (2005), we analyzed the aisles used by subjects irrespective of whether they took their shopping cart with them or not. The observers also noted whether the subjects found the products they were looking for and if they asked a salesclerk for help. The inter-coder reliability between the two observers was acceptable (*Cohen's Kappa* = .919).

Results: Study 2 found no significant difference between the numbers of products found in the two different store layouts. On average, participants found seven items correctly in both stores. However, differences occurred in the amount of time spent locating items (see *Tab. 4*). We discuss these differences below.

As in Study 1, we used GIS to process the data. The distance in meters covered by the subjects was standardized. We then placed subjects in one of two groups depending on whether their scores were positive or negative: "short-distance shoppers" (those covering a short distance in completing the task) and "long-distance shoppers" (those covering a long distance). Importantly for H4, there were no significant differences between the two groups regarding store patronage and shopping frequency. Furthermore, we not only compared the number of "efficient shoppers," but also time needed and distance covered in the stores.

The results of the analysis, given in *Tab. 3*, support H4. Significantly more shoppers traveled a shorter distance to complete the given shopping task in the store with the clockwise layout than in the store with the counter-clockwise layout. We also found that, irrespective of the shopper profile, in the clockwise layout consumers needed less time (05:30 minutes vs. 06:17 minutes) and walked shorter distances (191 meters vs. 214 meters) than in the counter-clockwise layout.

Tab. 4 shows the results of the pointing task, the time spent locating products, the percentage of subjects asking salesclerks about the location of products, and the participants' subjective perception of the ease of the task, rated on a five-point rating scale (established by means of a short survey carried out after the experiment).

Short-distance shoppers have a more detailed mental map of the location of the products in the store and perceive the task of locating them to be easy. This affects their behavior: they complete the task faster and do not need the assistance of salesclerks – an important consideration for retailers. In terms of how much money shop-

	Clockwise layout ↻ (n = 39)	Counter-clockwise layout ↺ (n = 37)
Short-distance shoppers	27	14
Long-distance shoppers	12	23
	Chi square = 7.532, *df* = 1, *p* = .011	

Table 3: Results for H4

	Pointing task experiment: distance between actual and estimated locations	Time spent locating the 8 products	Percentage of subjects asking salesclerks about product locations	Perceived ease of task (percentage of subjects who found it easy)
Short-distance shoppers	5.81 meters	04:57 minutes	22.5%	82.5%
Long-distance shoppers	7.63 meters	07:07 minutes	42.9%	57.1%

Table 4: Characteristics of short- and long-distance shoppers

Dependent variable	Distance covered	n	Mean (in EUR)	Levene's test for equality of variances: F	Levene's test for equality of variances: Significance	t-test for equality of means: T	t-test for equality of means: Significance (2-tailed)
Money spent	Short-distance shoppers	37	20.93	1.263	.265	1.693	.095
	Long-distance shoppers	35	16.14				

Table 5: Differences in amount of money spent

pers spend in the store, the results of the study are not significant (on the five percent level). However, there is a clear tendency for short-distance shoppers to spend more money than long-distance shoppers in the store (see *Tab. 5*).

To allow for possible factors influencing the amount of money spent, we also investigated details of household size and income for the two groups; no significant difference between the two groups was found. We thus conclude that the old adage that "the longer the time spent in the store, the more money spent" is *not* true if shoppers in fact waste a lot of time in the store walking up and down trying to find the products that they want to buy.

7. General discussion, future research and implications for retailers

Unlike *Sorensen* (2003), who investigates shopper behavior in one store only, and *Sommer* and *Aitkens* (1982), who compare two stores belonging to different retail categories and retailing companies, our experiments investigated two stores that were identical in terms of all their marketing instruments except for the layout. Our replication of the study by *Sommer* and *Aitkens* (1982) shows the validity of GIS as a tool for measuring the accuracy of mental maps. It also reveals that the key finding of *Sommer* and *Aitkens* still applies today: Products located on shelves in peripheral aisles are remembered better than those located in central aisles.

Our studies only investigate discount stores. The main reason for this is that in discount stores, at least in Germany, the route taken by shoppers is almost entirely determined by the layout. The shopper is guided from aisle to aisle and has few opportunities for choosing a different route. In this way, shoppers are confronted with as many products as possible in all parts of the store. Indeed, the fact that the two stores investigated both work like this and have an identical assortment and prices makes our experiments possible in the first place.

The methods used in the two studies reported here are useful tools for investigating customer orientation at the POS. Thus observation is a valuable technique in studying the actual behavior of shoppers, and pointing tasks combined with GIS can efficiently measure the accuracy of shoppers' mental maps.

Further research in different retail categories would be needed in order to understand fully how shoppers' turning bias and orientation toward the walls of stores functions, and how these two phenomena interact at the POS. In hypermarkets and self-service department stores, for example, the layout creates almost no restrictions for the shopper. Shoppers have many opportunities to decide for themselves whether to turn left or right, or to avoid parts of the store where there are no products that they want to buy. In such situations, orientation probably plays a different role in shoppers' perceived satisfaction with the layout of the store. Furthermore, in department stores the hedonic dimension of "shopping motivation," normally less apparent in discount stores, should also be considered. The interplay between hedonic motives and the ease of orientation is certainly different, and shoppers in department stores often enjoy browsing without thinking about the efficiency of their shopping in terms of how much distance they cover and the time they spend in the store.

Hidden observation of shoppers *not* involved in the experiment would also strengthen the results of our studies and increase their validity. A larger sample size would also be preferable, although clearly this would require greater resources. Furthermore, a comparison of sales figures in the different layouts would be very interesting; unfortunately, the discount company did not provide us with this data.

The results of our investigation indicate that the anchoring of spatial information (i. e. the location of products) in shoppers' minds is a key factor in retail success. The more information anchored in the mental map, the more positive the customer's approach behavior. Both our studies show that retail layout impacts on the formation of shoppers' mental maps – such maps are improved by the direction of guidance and the location of products. Contrary to the belief of some retailers, we find that a clockwise store layout makes the best use of shoppers' turning bias.

One explanation for the superiority of stores with a clockwise layout could also be that it is an unusual layout for stores today. The unfamiliar layout (as a "collative stimulus") may stimulate shoppers' attention more than in familiar, counter-clockwise stores, leading to an increase in the accuracy of their mental maps. Further study would be necessary to determine whether clockwise layouts would continue to perform better in the long term if they were adopted by the majority of stores.

Implications: To summarize, the most important implications of our studies are that the store layout has an impact on the formation of mental maps, which in turn influences consumers' perceived shopping convenience. Ease of orientation is an important success factor. We can assume that consumers not only go shopping with a certain amount of money that can be spent at the POS, but that they also have time restrictions. Some of our subjects reported that after a certain amount of time they often stop shopping, irrespective of whether they have all products they originally intended to buy. They stop either because they feel that they have no more time for shopping or they simply cease to enjoy the shopping experience. The easier it is for them to find the products they are looking for, the more likely they are to have time for additional purchases, and the more positively they evaluate the value for money offered by the store.

Our studies show that, at least today, we can recommend using a counter-clockwise layout to improve shoppers' perceived ease of orientation. However, layout is only one of the factors that may be important here (*Hart/ Davies* 1996). The location of the different assortments, the "bundling" of items, in-store decoration and arrangement of products on the shelves should also be investigated from a consumer perspective: All of these factors can help shoppers find the products they are looking for "intuitively." This is an area where much further research is required.

Appendix

Author(s)	Year of publication	Title	Journal	Method (experiment/ observation)	Sample size	Conclusion (turning bias to the left/ right/no clear side preference)
Bitgood & Dukes	2006	NOT ANOTHER STEP: Economy of Movement and Pedestrian Choice Point Behavior in Shopping Malls	Environment and Behavior	Observation	500	Turning bias to the right
LeNoir et al.	2006	Intrinsic and extrinsic factors of turning preferences in humans	Neuroscience	Experiment	107	No clear side preference
Taylor et al.	2006	Turning bias and lateral dominance in a sample of able-bodied and amputee participants	Laterality	Experiment	100 30	Turning bias to the left
Mohr et al.	2004	Human side preferences in three different whole-body movement tasks	Behavioural Brain Research	Experiment	36	No clear side preference
Mohr et al.	2003	Human locomotion: Levedopa keeps you straight	Neuroscience Letters	Experiment	40	No clear side preference
Güntürkün	2003	Adult persistence of head-turning asymmetry	Nature	Observation	124	Turning bias to the right
Scharine & McBeath	2002	Right-handers and Americans favor turning to the right	Human Factors	Experiment	115	Turning bias to the right
Bradshaw & Bradshaw	1998	Rotational and turning tendencies in humans: an analog of lateral biases in rats?	International Journal of Neuroscience	Experiment	52	Turning bias to the right
Mead & Hampson	1996	A sex difference in turning bias in humans	Behavioural Brain Research	Experiment	75	Turning bias to the right
Yazgan et al.	1996	A direct observational measure of whole body turning bias	Cortex	Experiment	41	Turning bias to the left
Previc & Saucedo	1992	The relationship between turning behavior and motoric dominance in humans	Perceptual and Motor Skills	Experiment	111	Turning bias to the right
Gordon et al.	1992	The relationship between leftward turning bias and visuospatial ability in humans	International Journal of Neuroscience	Experiment	14	Turning bias to the left

Table A1: Studies of turning bias

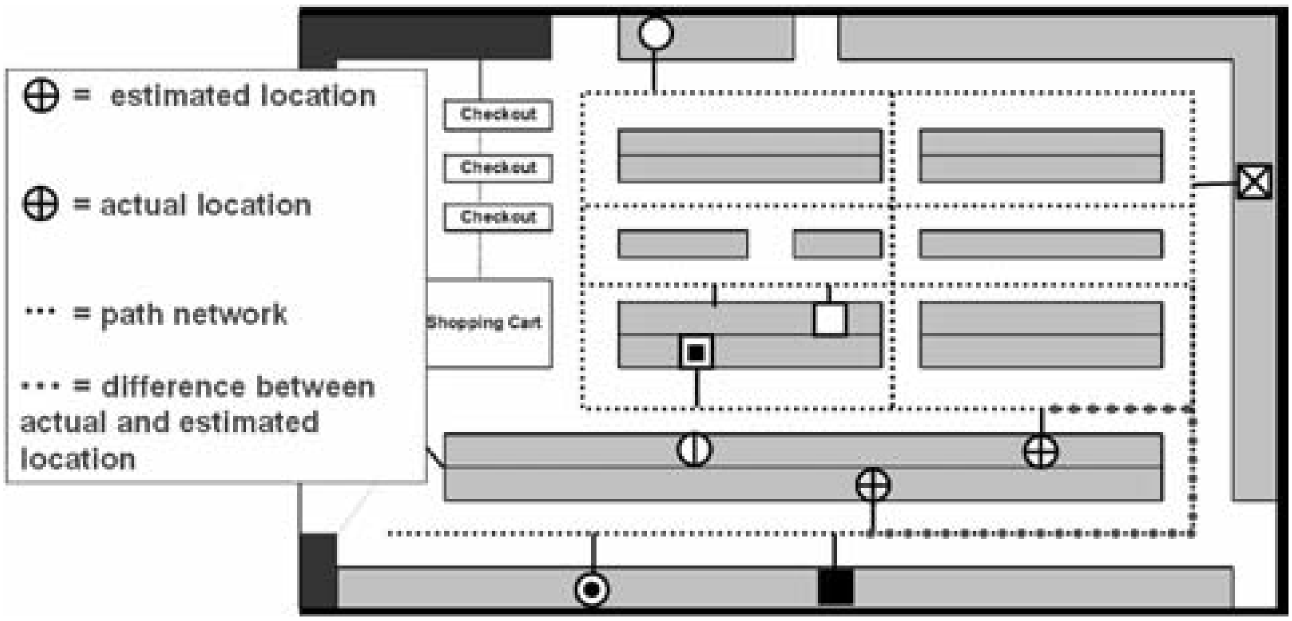

Figure A1: GIS measurement of pointing accuracy

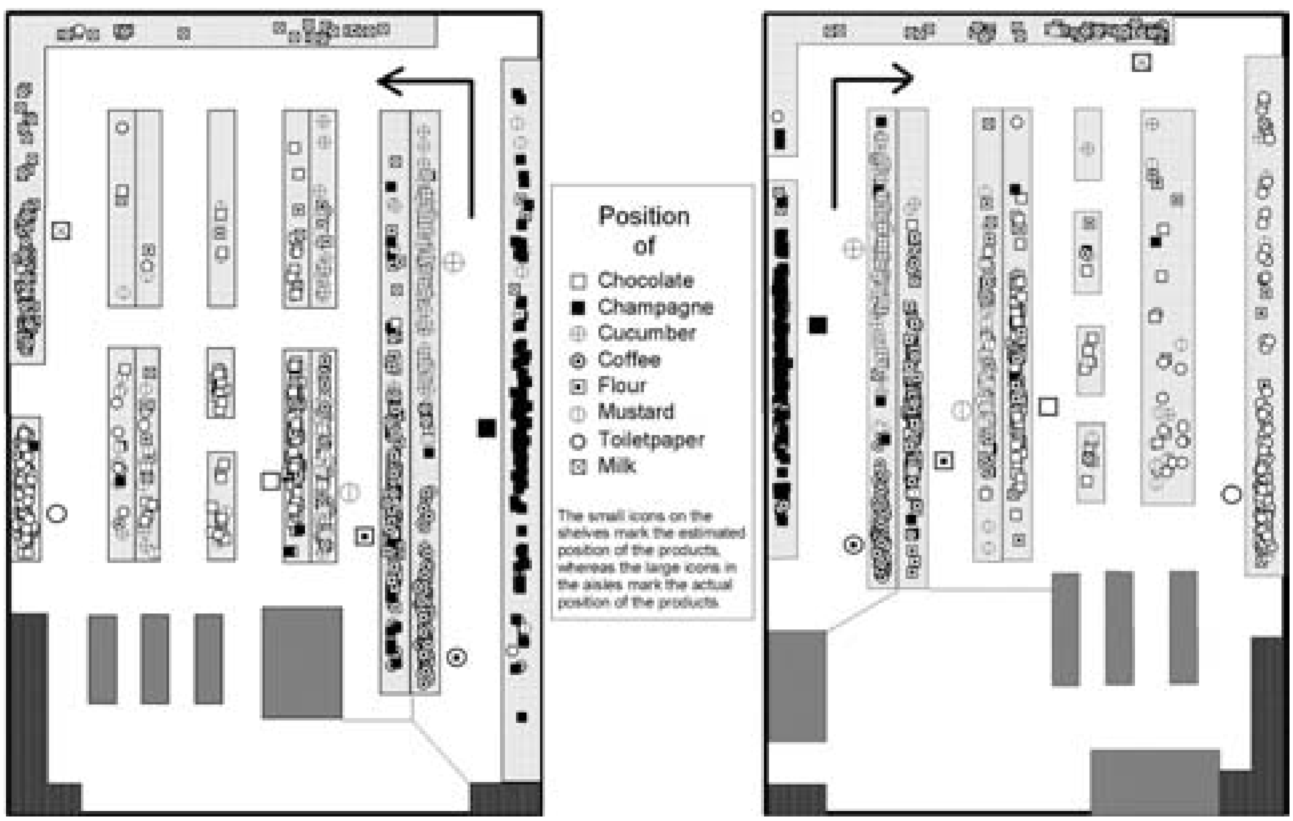

Figure A2: Discount store with counter-clockwise layout

Figure A3: Discount store with clockwise layout

Items	Factors: Perceived shopping convenience	Perceived ease of orientation	Perceived value for money
The service is always friendly and helpful here	**.807**	-.003	.022
This store is always clean and tidy	**.766**	.046	.152
Shopping is fun here	**.761**	.061	.188
The products in this store are arranged logically	**.692**	.197	.217
This store seems to have a lot of room	**.675**	.210	.131
I didn't have to search for a long time for a particular product	-.048	**.852**	.123
In this store, you don't have to search for a long time for products	.166	**.744**	-.083
The shopping area wasn't too crowded	.172	**.624**	.171
This store has always great special offers	.049	-.010	**.751**
Prices are generally low here	.189	.156	**.721**
You always get good value for money here	.414	.090	**.568**
Eigenvalues	3.749	1.538	1.108
Variance explained (in %)	34.083	13.977	10.070
Kaiser-Meyer-Olkin measure of sampling adequacy		.807	

Extraction method: Principal Component Analysis; rotation method: Varimax with Kaiser Normalization
Rotation converged in 4 iterations

Table A2: Factor Analysis

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