Now We See!

A Study of Shopper Traffic Patterns

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The art of legerdemain teaches us that sometimes the most effective way to hide something is right in plain sight. Just because our eyes visually record something doesn't mean that we *see* it. This phenomenon can plague market research because if we are not all marketers, we *are* surely all consumers/customers. And so at some level we feel that we know and understand certain things about the market, just because of our personal exposure to it, and our presumed perceptive and analytical abilities. However, there are complexities before us that may elude us. . .

This is illustrated in the study of the paths that shoppers take through stores. For a variety of reasons, most studies of shopper paths have focused on limited data sets. The limitations tend to fall in two general areas. Where manufacturers have studied shopper paths they have usually restricted themselves to details from one or a few areas that they judge pertinent to their specific products. Here the limitation is of scope. Retailers are of course interested in a broader picture of the shoppers' experiences, but have relied on cultural anthropology studies of at most a few hundred shoppers. Here the limitation is of depth.

Nevertheless, both of these types of studies, the one focused and the other broad, have provided richness to our current understanding of the shopping experience. Until a bigger picture is available, we can only imagine the real extent of the limitations to our knowledge. But it is this bigger picture that we seek in attempting to catalog the details of every shopper's behavior, wall-to-wall and entrance-to-exit, in retail stores. Conceptually, we want a time-exposure photo of shoppers in the store, as suggested by a time-exposure of that other type of traffic:

What we seek is to push the frontier of knowledge about shopping behavior by bringing together these three technologies:

1. Close-up: personal interviews and observation of shoppers at the shelf, enhanced by video technology to extend the study in time but to a limited area.
2. Broad picture: full-store tracking and observation of the complete shopping experience, enhanced by anthropological insight and analysis.
3. Electronic tracking of shoppers from the entrance to the checkout, using carts and baskets as surrogates, just as time-exposure photography reveals paths of drivers and their cars.

It is the early phases of this third technology that we report on here.

Tracking Methodology

In order to conduct the type of studies envisioned, it was necessary to acquire a tracking system that would provide data on the location and paths of shoppers. At the time of initiation of this study, the only available system that was judged practical for the purpose was the real time locate system (RTLS) produced by WhereNet. It would obviously be of value to track the shoppers themselves, but the technology for doing this effectively on a whole store basis is not yet available. Therefore the location of shopping carts and baskets can be used as a surrogate for the location of the shopper. It is possible to evaluate the effectiveness of this surrogacy in at least two ways (in addition to direct observation): the percentage of shoppers who arrive at the checkout counter without a cart or basket and the percentage of products purchased that do not correspond to the path of the trip on which they were purchased.

The tracking system consists of four elements:

- A small "tag" mounted under the shopping cart that emits a uniquely coded signal every four seconds.
- An array of antennae around the perimeter of the store that continuously monitor the signals from each cart and basket.
- The WhereNet locate processor system that uses differential time of arrival (DTA) algorithms to iteratively triangulate the location of the "tags."
- The PathTracker™ system that integrates location data, purchase transaction data (from the checkout) and planogram data to produce marketing variables (discussed below).


Cart Tag

Antenna

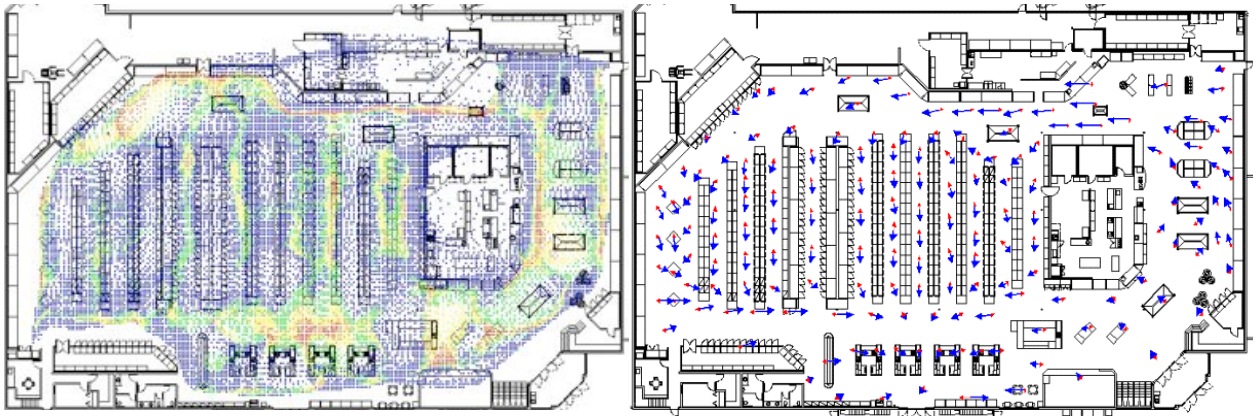
This report will focus on one area of learning from the PathTracker™ laboratory store (a typical suburban neighborhood supermarket) and show how this learning can be leveraged to understand shopping behavior in supermarkets across the U.S., with further amplification and clarification in 150 supermarkets in the U.S., England and Australia.

Traffic Flow and Purchasing in the PathTracker™ Laboratory

The diagram on the left illustrates the density of shoppers throughout the store for the five months (August through December) of 2001. The red areas represent the highest frequency of "blinks" from the location tags (hot spots) and the blue represent the lowest frequency (dead zones) with orange, yellow and green representing intermediate values of decreasing frequency. That is: hot spots = red > orange > yellow > green > blue = dead zones.

The lower right corner of the diagram is the main entrance, with the floral and produce on the immediate right and the in-store bakery and service deli forming a boundary to the left of produce. The perimeter "racetrack" continues across the back of the store from wine, seafood, fresh and processed meat, cheese and yogurt to the fluid milk in the far corner from the entrance.

Then there are the 12 center-of-store aisles and, finally, the checkout and service counters across the front of the store (bottom of diagram) and the exit (which is also a secondary entrance.)



This gives us a good graphic picture of where shoppers are located, but the diagram on the right gives us a better picture of how they got there. In this traffic flow diagram the blue arrows represent the dominant flow of shoppers in each of the 170 subzones in the store. The length of the arrow represents the strength of the flow. (The smaller red arrows represent the minority of shoppers who are moving in the opposite direction.)

There are a wide variety of learnings from these two diagrams and the tables that underlie them, but of greatest interest here are two dominant flow characteristics seen in the diagram at the right. The first is the large amount of traffic on the perimeter racetrack, and the fact that this traffic is predominantly in the counter-clockwise direction (CCW). This is not a surprising finding since the entrance of the store intuitively suggests that mode of travel. (However, only about half the shoppers actually enter the racetrack and follow this path.)

This brings us to a significant store design question: does the location of the entrance affect how shoppers shop the store? And, if so, what is the effect? These questions have very large implications because many hundreds of stores are built every year, some with the entrances on the right (as here), some on the left, and some in the center of the store. In the absence of clear data to indicate where the entrance should be, real estate (parking lot) and other considerations may dominate the decision.

Before we can adequately address these issues, we need some additional tools, particularly as they relate to shoppers' purchases. So we turn our attention to the second major flow pattern: from the back of the store to the front, through the center-of-store aisles. In contradistinction to the racetrack flow, this flow is *not* intuitive (until you are aware of it.) But it is a *major* factor in the overall shopping experience. A coalescence of observations will help to understand this.

First, it is helpful to keep in mind that the typical shopping trip only covers about 25% of the store. A variety of measures show that shoppers typically make their ways to the back of the store by the racetrack path and then are drawn to the front of the store by what we characterize as "the checkout magnet." This drawing to the checkout is in reality a termination of the shopping trip, whether through the attractive force of the checkout or because the shopper is "done" with

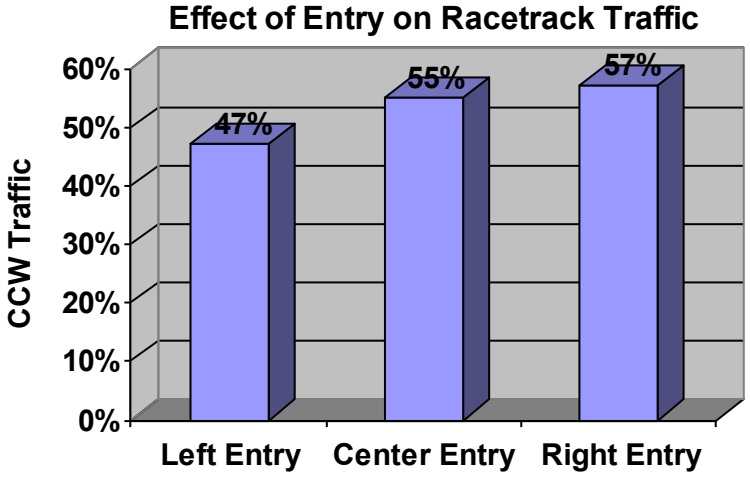
the trip. We can refer to this as *early*, or premature, termination of the trip, in the sense of less than the full store is being shopped. What is important to see here is that the stronger the flow toward the front in these center-of-store aisles, the shorter the average shopping trips will be – and the fewer the purchases.

The 100 Store Audit

The relevance of the observations above becomes clear when we assess traffic flow in a wider sampling of stores. It is not necessary to have a full PathTracker™ installation in each store in order to make measurements and apply the learnings more widely. In the present instance we audited 100 supermarkets across the U.S. in six markets: Boston, Tampa, Chicago, Dallas, Los Angeles and Portland. Of the 104 stores and 30 chains, only Albertsons (13%) constituted more than 10% of the sample; and those stores were spread over four of the six markets.

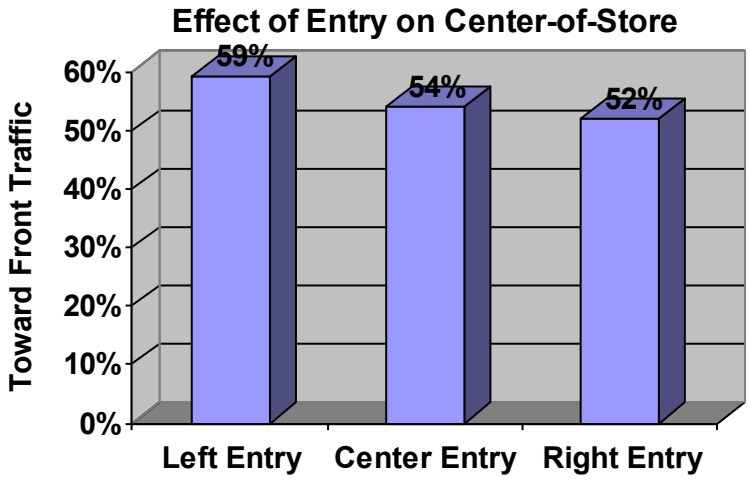
The prime issue motivating this particular study was the store design issue of where should the entrance be located, or does it make any difference? The audit of these stores consisted of a single snap shot of each store taken on a single Saturday across the country. The key measures were the direction and strength of the traffic flow on both the racetrack and in the center-of-store aisles. These were simply taken as the percentage of shoppers going each way: CW vs. CCW; toward the front vs. toward the back, for the racetrack and aisles, respectively. A total of 4168 shoppers were counted in the two target areas of the store. In addition, the location of the store entrances was noted (right, center or left), the relation of the parking to the store (more on the right, centered, more on the left), the number of checkstands as well as the number open and a count of the cars in the lot as a potential measure of store traffic – we did not attempt to count the total shoppers in the store.

For this sampling of stores there were a total of 57 right entry stores, 22 center entry stores and 25 left entry stores. First, we notice that the traffic on the racetrack is apparently affected by the location of the entrance.

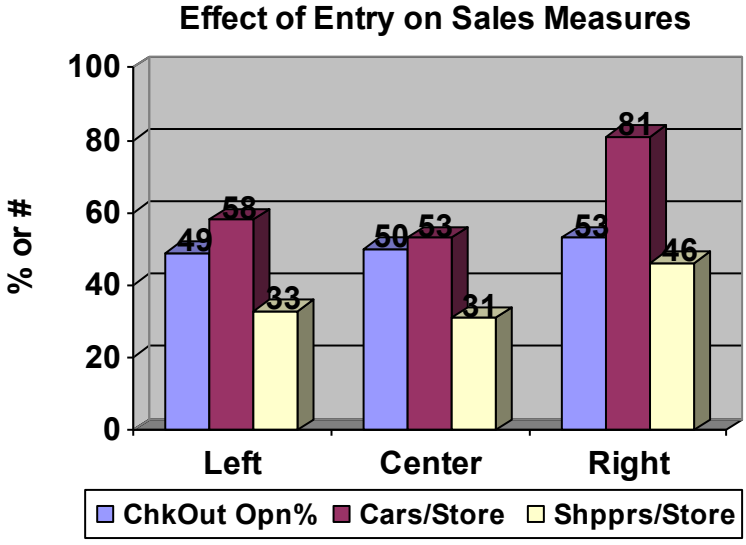


Just as in the PathTracker™ laboratory store, across the country we see a dominance of counter-clockwise traffic on the racetrack in right entry stores. Center entry stores also show this dominance. But for the left entry stores, not unsurprisingly there is a reversal of flow on the racetrack. The dominance for *clockwise* traffic in this case is weaker, but makes sense given that with a left entry store, the "logical" path is to enter the racetrack in a clockwise direction along the left wall of the store.

The question is what, if any, affect does this have on shopping? We might suspect that there would be some effect based on anecdotal accounts by checkout clerks describing the behavior of shoppers in these left entry stores who select their carts and then traverse entirely across the store to begin their trip where they would have entered had the entry been on the right. So we look to the center-of-store aisles to see the net effect of this reversal of flow in the left entry stores:



Based on this sampling there is a 7% greater flow from the back to front with left entry stores than with right entry stores. Since dominant flow from the back to the front is a consequence of early shopping trip termination, this suggests that left entry stores have shorter shopping trips and probably lower sales. We of course did not have access to sales figures for all of these stores, but on the presumption that high sales stores will tend to have more checkstands open, we determined the percentage of checkstands which were open in each type of store. We also evaluated the number of cars in the parking lot and the number of shoppers counted, rear aisle and center-of-store only. The trends here are as follows:



All three sales related parameters show an upward trend for right entry stores, with the effect being most dramatic when considering the number of cars in the various parking lots. Taken together these indirect numbers suggest that left entry stores shorten shopping trips by stimulating clockwise instead of counter-clockwise traffic. A more direct measure of this effect comes from an examination within the PathTracker™ laboratory store of the sales of those shoppers who circumnavigate the store in the clockwise instead of the counterclockwise direction. Even though the dominant direction is counterclockwise, there is a significant volume of traffic in the opposite direction.

	CCW >60%	CW >60%	Other 40-60%	Total
Trip Count - N	17876	2895	7023	27794
Distribution of Trips	64.3%	10.4%	25.3%	100.0%
Average Dollars Spent	**$26.59**	**$23.96**	**$28.66**	

Nearly two out of three shoppers in the laboratory store are traveling in the counter-clockwise direction while barely 10% are moving clockwise. The other one quarter of the shoppers are not moving dominantly in either direction but are going both directions nearly equally (40/60 either way). One way for this to happen is for a shopper to proceed some distance around the racetrack (for example, to the dairy section) and then to retrace their steps most or all of the way before leaving the story.

The real significance is the extra $2.63, on average, that counter-clockwise shoppers spend over the clockwise shoppers. Taken in conjunction with the "sales" parameters from the 100 store audit, this is confirmation that leading shoppers into a clockwise path (with a left entrance) is probably a mistake in any case.

Nature vs. Nurture and Shopping Flow

Now that we see the impact of such a simple thing as the location of the entrance on traffic flow and (potentially) profits in the store, we turn our attention to an explanation of the effect. The source of the effect could be something inherent to the shoppers, something as simple as handedness – some natural tendency for right handed shoppers, for example, to hug the wall to the right, effectively leading them around the racetrack in a counter-clockwise direction.

Then there are cultural possibilities. Would shoppers in countries where driving is on the left side of the road translate this habitual left-side practice into following the wall around to the left, with a consequent clockwise traffic pattern in the store?

And then there is the physical Coriolis force that makes hurricanes in the northern hemisphere spiral in the counter-clockwise direction, while those in the southern hemisphere spiral in the clockwise direction. Might there be a difference in shoppers' predilection to go one way or the opposite, based on the location of the store in the northern vs. the southern hemisphere?

It seemed possible that the methodology and results described thus far could provide answers and clarity to these questions if the study were extended into England (northern hemisphere, driving on the left) and Australia (southern hemisphere, driving on the left). Of course we have as a baseline the data from the U.S. (northern hemisphere, driving on the right.)

We extended the study to England and Australia by auditing 25 and 26 stores, respectively, with a total of 3709 shoppers counted in the two store locations used in the U.S. study: center-of-store aisles and the rear racetrack aisle.

Quite remarkably, regardless of the location of the store entrance, both of these left side driving countries had similar dominant racetrack traffic of 53% *clockwise* vs. 47% clockwise. This is weaker directionally than the 57% counter-clockwise for right entry stores in the U.S. But even in the 19 right entry stores in England and Australia, the traffic is 53% clockwise. Before drawing any firm conclusions we should note both the smaller number of stores (51 in this extension) but still substantial number of counted shoppers (3709.) These limitations suggest appropriate caution.

But the logical first reading is that the cultural (nurture) factor dominates and that left side driving is associated with (if not causes) clockwise shopping. Not surprisingly there is no evidence that the weak Coriolis affect alters shopping in any way (England vs. Australia).

Without a personal examination and familiarity with the shopping milieu's in these two countries, we must consider explanations as strictly speculative. But if direct observations and larger studies confirm these numbers, it means that these shoppers are so strongly programmed for clockwise shopping that they pursue it even when the entry is on the right. That is, even though entering on the right they will traverse the store to begin their shopping on the left. This is in contradistinction to the right hand, counter-clockwise predisposed Americans who when entering on the left, proceed (in the majority case) with their counter-intuitive clockwise trip.

Where to From Here?

We have only reported here a small portion of our extensive studies in the PathTracker™ laboratory store. More importantly we have shown how basic learnings about shopper behavior can be expanded and buttressed across the category of supermarkets by audits and surveys. We are presently pursuing similar studies in other channels. The goal is twofold: to develop a more detailed quantitative understanding of the shopper experience; and to create a framework or model for describing shopping within and across channels.

Bibliography

Persaud, B. N. and V. F. Hurdle (1988b). Freeway Data from Time-Lapse Aerial Photography -- an Alternative Approach. *Transportation Science*, 22, pp. 251-258.

http://www.geocities.com/Heartland/Meadows/4495/vancouvertebig.html

http://hea-www.harvard.edu/~efortin/thesis/html/EMR_light.shtml