



## Tag Team: Tracking the Patterns of Supermarket Shoppers

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To the untrained eye, the data presentation looks remarkably like an Etch-a-Sketch drawing, little more than a child's randomly drawn zigzag pattern on a favorite toy.

But to Wharton marketing professor [Peter S. Fader](#), those seemingly random lines represent a new dataset showing the paths taken by individual shoppers in an actual grocery store. The data -- charted for the first time by radio frequency identification (RFID) tags located on consumers' shopping carts -- has the potential to change the way retailers in general think about customers and their shopping patterns.



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In a new paper called "An Exploratory Look at Supermarket Shopping Paths," Fader, Wharton marketing professor [Eric T. Bradlow](#) and doctoral candidate Jeffrey S. Larson analyze this RFID-captured grocery store data, focusing exclusively on travel patterns without regard to purchase behavior or merchandising tactics. The results, they conclude, challenge many long-standing perceptions of shopper travel behavior within a supermarket, including ideas related to aisle traffic, special promotional displays, and perimeter shopping patterns.

Using a new "multivariate clustering algorithm," the authors identified 14 distinct grocery store travel paths during short, medium and long shopping trips. Based on this information, Fader, Bradlow and Larson conclude that:

- Grocery shoppers don't weave up and down all aisles -- a pattern commonly thought to dominate store travel. Instead, most shoppers "tend only to travel select aisles, and rarely in the systematic up and down patterns most tend to consider the dominant travel pattern."
- Once they enter an aisle, shoppers rarely make it to the other end. Instead, they "travel by short excursions into and out of the aisle rather than traversing its entire length."
- Shoppers prefer a counter-clockwise shopping experience. They tend to shop more quickly as they approach the checkout counters. Shoppers' behavior is driven more by their location in the store than the merchandise in front of them.
- The perimeter of the store -- often called the "racetrack" -- is actually the shopper's home base, not just the space covered between aisles. "Whereas previous folklore perpetuated the myth that the perimeter of the store was visited incidental to successive aisle traverses, we now know that it often serves as the main thoroughfare, effectively a home base from which shoppers take quick trips into the aisles," the paper states.

These findings, the researchers predict, will have important implications for store layouts, product placement, end-cap displays, and relationships between aisles and perimeter spaces -- not to mention a better understanding of how consumers shop and how retailers and suppliers can respond to these patterns. "There is a tremendous amount of research available on why people buy what they buy, but until now there was really no research on tracking the actual buying decision," said Fader.

## Tagging Grocery Carts

The mechanism to collect this unique shopping data is called PathTracker, a new technology developed by Sorensen Associates, a research firm founded by Herb Sorensen that has offices in Portland, Oregon and Minneapolis, Minn.

To gather the data eventually used in the Wharton research, PathTracker RFID tags were placed on the bottom of every grocery cart in a supermarket in the western U.S. According to Sorensen, these tags emit a signal every five seconds that is received by receptors installed at various locations throughout the store. Once collected, the signals are used to chart the position of the grocery cart and record its route through the entire store. This data is translated into the computerized, Etch-a-Sketch-like drawings of shopping cart paths that Sorensen presented several years ago to Fader.

Until researchers are able to obtain positioning data directly from the shoppers themselves, Fader argues that PathTracker offers the next best thing -- using customers' grocery carts as a proxy for their shopping path.

A career consumer consultant and expert on customer shopping patterns, Sorensen developed the PathTracker technology nearly four years ago, although the idea "goes back some 30 years when I was lying on the carpet with my kids and came across a time-lapsed photo of cars going through an intersection," he said. "I looked at those streaks of light, and thought it would be interesting to see all those paths inside [a supermarket]. That's exactly what I created with PathTracker."

After working with another company to develop the tracking system, Sorensen convinced a supermarket to place PathTracker and tracking receptors throughout the store. Since May 14, 2001, he has been tracking carts and shopping trips. "It wasn't the technology we were after," he said. It was the information. "RFID happens to be the best way to do what we are doing. It soon became clear that we were getting a wall-to-wall, door-to-door census of all shopper behavior in this store."

Sorensen had read a number of Fader's papers over the years. "I sent him our charts and graphs, and noted that we would be happy to share our data." Fader immediately recognized that the data generated by Sorensen and PathTracker was a novel use of the newly popularized RFID technology that offered obvious parallels to his ongoing research in the e-commerce area. The ability to track 'click-to-click' browsing patterns on the Internet allowed researchers, for the first time, to look at visiting patterns along with purchasing. PathTracker provided the same kind of luxury for ordinary retail stores. Fader likes to call this junction between the traditional retail environment and new kind of tracking technology a "golden spike" -- not unlike the joining of the East Coast and West Coast railroad systems in the 19<sup>th</sup> century. "PathTracker pulls it together," he said.

According to Bradlow, this new tracking data is a significant addition to shopping data collected by the introduction of scanner technology, which specifically details every item purchased, its price and whether a coupon was used. But what the scanner technology doesn't collect is in-store behavior, said Bradlow. "Where did you go to buy that product? What path did you take? Where did you spend time? In what order did you look at product categories? These are crucial issues in terms of layout, product placement and store profits. We will eventually start linking in-store movement to purchase decisions."

The Wharton researchers note in their paper that "other researchers have addressed the general topic of in-store shopping patterns in the past. Every 10 years or so, researchers seem to 'rediscover' this topic, and have applied very different methods to capture it." But no one has PathTracker data, noted Bradlow. Sorensen still uses the original PathTracker technology (although it is now a "fourth generation version"), and has expanded the concept to include digital video tracking in smaller stores. He is also experimenting with a hand-held tracking device, where a researcher can follow individual shoppers and track their patterns in what Sorensen calls "real time." So far, he has installed PathTracker systems in 20 retail stores and is in the process of outfitting 10 more. "We have created a generalized system for measuring the

movement of items," he said. "Until PathTracker came along, we didn't know diddly-squat about the behavior of shoppers."

### "Hot" and "Cold" Spots

The PathTracker technology and the ability to analyze its considerable data will no doubt have implications in other retail markets. "People will always want to understand the behavior of people inside the store," said Bradlow. "I think people in mass merchandising stores -- Toys R Us, Costco, retail clothing -- will see the value in this. We have all this lore in marketing. If you put popular items like milk in the back of the store, do people make more impulse purchases along the way? Does that actually happen? Imagine if you knew which products were at the back of the store and you could show how traffic flowed or changed because of that."

Eventually, Bradlow predicted, continued analyses could show shopping "hot and cold" spots in supermarkets, and predict movements and purchasing patterns that could lead to significant retail adjustments.

While this first paper explores in-store shopping paths, both Fader and Bradlow acknowledged that there are many more areas to analyze in the PathTracker data. For instance, they write, the data could be a springboard for further studies related to environmental psychology, giving researchers clues to ways in which "shoppers organize a store in their minds," which "may have important implications for their subsequent movements."

A study of the "linkage between travel and purchase behavior seems a logical next step," the Wharton researchers note. "Linking specific travel patterns to individual purchase decisions may lead to an improved understanding of consumer motivations for purchasing certain items, and can shed light on the complementarity and substitutability of goods in ways that a more traditional 'market basket' analysis cannot capture. Further exploration of travel behavior, independent of purchase, also seems another promising route for future research."

"We are actually trying to peel back the shopping onion," said Bradlow. "With this data, you know not only what happens at the checkout counter, but what happens inside the store. We now have a much more complete picture of the shopping experience."

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