Smart Shopping Carts: How Real-Time Feedback Influences Spending

Koert van Ittersum
Professor of Marketing and Consumer Well-Being
Department of Marketing
University of Groningen
Nettelbosje 2
9747 AE, Groningen, Netherlands
Phone: +31 50 363 6639
k.van.ittersum@rug.nl.

Brian Wansink
John S. Dyson Professor of Marketing
Cornell University
Ithaca, NY 14853-7801, USA
Phone: 607 254 6302
wansink@cornell.edu.

Joost M.E. Pennings
Professor of Marketing
Alex Investment Bank Professor of Finance
Maastricht University
Tongersestraat 53
6211 LM, Maastricht, Netherlands
Phone: +31 43 388 3934
joost.pennings@maastrichtuniversity.nl.

Daniel Sheehan*
Ph.D. student
Georgia Institute of Technology
800 West Peachtree Street, NW
Atlanta, GA 30332-0520, USA
Phone: 404 385 4173
daniel.sheehan@scheller.gatech.edu.

Forthcoming in Journal of Marketing

* The authors gratefully acknowledge the financial support of the Marketing Science Institute and the Association for Consumer Research. The authors thank Carry Cissna, Kelly Martinett, Paola Pulido, Ryan Ricks, and Evan Woolard for their support during the data collection process and Carter Posey and Kushal Sukthankar for their help with setting up the online grocery store. The valuable input received during presentations at the Annual Georgia Marketing Symposium (2012), Marketing Science Conference (2012), ACR conference (2012), University of Groningen (2012), and the Free University of Amsterdam (2013) is gratefully acknowledged. Finally, the authors thank the Editor and the three anonymous reviewers for their constructive feedback during the review process.
While the interest in smart shopping carts is growing, both retailers and consumer groups have concerns about how real-time spending feedback will influence shopping behavior. Building on budgeting and spending theories, the authors conduct three lab and grocery store experiments, which robustly show that real-time spending feedback has a diverging impact on spending depending on whether a person is budget constrained (“budget” shoppers) or not (“nonbudget” shoppers). Real-time spending feedback stimulates budget shoppers to spend more (by buying more national brands). In contrast, this feedback leads nonbudget shoppers to spend less (by replacing national brands with store brands). Furthermore, smart shopping carts increase repatronage intentions for budget shoppers while keeping them stable for nonbudget shoppers. These findings underscore fundamental unexplored differences between budget and nonbudget shoppers. Moreover, they have key implications for both brick-and-mortar and online retailers, as well as app developers.

*Keywords*: real-time spending feedback, grocery shopping behavior, smart shopping carts, budget shoppers, nonbudget shoppers
“Smart carts” are shopping carts equipped with scanners that track the total price of a consumer’s shopping basket as they shop. Consumer surveys indicate 72% of shoppers would welcome radio-frequency identification tags on products to help them better track their in-store spending (www.infosys.com), and 85% of leading retailers rate self-service customer-facing technologies—such as smart shopping carts—as one of the three top opportunities for increasing consumer satisfaction and revenue (Rosenblum 2007). In addition to enabling shoppers to track their in-store spending (Nelson 2008), smart shopping carts may help improve customer satisfaction by offering customized and timely promotions, recommending complementary products, sharing nutritional information and recipes, and even allowing customers to skip the check-out lane (e.g., Berberich 2007; Hui et al. 2013; Osborne 2012; Senne 2005). Their potential is further corroborated by the fact that smart carts have drawn the attention and involvement of high-tech companies such as IBM, Microsoft, and Fujitsu (e.g., Osborne 2012, Senne 2005).

Yet despite the widespread consumer, retailer, and manufacturer interest, smart carts curiously lag far behind early industry expectations (Vibert-Kennedy 2003) because of unresolved concerns. In addition to concerns about shoppers leaving the store with unscanned groceries, union action to protect the employment of cashiers, and high implementation costs (e.g., Berberich 2007; Senne 2005), retailers are fundamentally uncertain about how smart shopping carts will influence shopping, spending, and satisfaction (RetailWire 2012). Even though smart shopping carts offer a variety of opportunities to improve customer satisfaction, interested retailers remain reluctant to adopt smart shopping carts without fully understanding how real-time spending feedback—showing the total price of the items in the shopping basket while shopping—will influence grocery shopping behavior and profitability.
Building on the in-store tracking behavior literature that bridges budgeting (Du and Kamakura 2008), spending (Mehta, Rajiv, and Srinivasan 2003), and in-store decision-making theories (Bell and Lattin 1998), this research aims to increase the understanding of how real-time spending feedback influences shopping behavior. Although there is limited research on real-time spending feedback, one set of studies suggests that smart shopping carts may be especially beneficial for budget-constrained shoppers (Van Ittersum, Pennings, and Wansink 2010). Therefore, this research examines whether and how real-time spending feedback influences the shopping and spending behavior of shoppers who have a budget and those who do not (hereinafter, referred to as “budget shoppers” and “nonbudget shoppers,” respectively). Specifically, we examine three key issues: (1) “How does real-time spending feedback influence spending?”, (2) “How do shoppers adjust their shopping behavior to change their spending?”, and (3) “Does real-time spending feedback differentially influence budget and nonbudget shoppers?”.

This research contributes to a growing body of research on in-store decision making (Dhar, Huber, and Khan 2007; Khan and Dhar 2006; Stilley, Inman, and Wakefield 2010a; 2010b) by introducing novel and managerially relevant insights into the spending and shopping behavior of consumers in response to real-time spending feedback. Real-time spending feedback uniquely influences spending behavior differently for budget versus nonbudget shoppers. Specifically, we find that budget shoppers increase the total amount of money they spend by purchasing a greater number of national brands. In contrast, nonbudget shoppers reduce their spending by replacing national brands with lower-priced store brands. So while budget shoppers purchase national brands additively, nonbudget shoppers purchase store brands substitutively.

This research further contributes to budgeting literature that has implicitly assumed that budget shoppers spend their entire budget to maximize their utility (Du and Kamakura 2008;
Thaler 1985). We show that budget shoppers actually underspend on their budget, building a safety margin into their shopping trip to minimize the risk of overspending on their budget. Finally, although theory suggests that real-time spending feedback allows budget shoppers to maximize their utility, budget shoppers seem to interpret the spending room as a “windfall.” That is, budget shoppers who receive real-time spending feedback spend it readily and more frivolously by purchasing more hedonic products (Bodkin 1959; Levav and McGraw 2009).

We structure the remainder of this article as follows: To lay the foundation of this research, Study 1 demonstrates that budget shoppers underspend on their budget. Next, building on budgeting and spending theories, we formulate integrative hypotheses about the effect of real-time spending feedback on spending behavior for budget and nonbudget shoppers. To examine these hypotheses, we conduct two field studies. Study 2, conducted in an experimental online grocery store, shows an asymmetric response to real-time spending feedback for budget and nonbudget shoppers, and it provides empirical evidence for the proposed underlying mechanism driving the asymmetric response. Study 3 shows the robustness of these effects in a grocery store in Atlanta. Finally, we provide managerial implications and discuss the theoretical contributions to the consumer budgeting and spending literature.

**Budget Shopping**

An estimated one in three U.S. households shops on a budget (Arends 2008; Van Ittersum, Pennings, and Wansink 2010). A budget earmarks portions of income for specific uses (Bénabou and Tirole 2004). For budgeting to be an effective self-control strategy, budgets have to accurately project future spending and be consequential (Thaler 1999). Therefore, this work focuses on explicit budgets, which are based on a shopper’s resources and projects spending, rather than implicit budgets, which are based on previous expenditures in the category (Stilley, Inman, Wakefield 2010a). Budgeting insufficient funds in an account causes people to
underconsume goods they desire. However, when too many funds are allocated, people tend to overconsume the goods they desire less (Heath and Soll 1996). Neither over- nor underspending is considered optimal (Thaler 1985). Instead, budget shoppers should seek to spend their entire budget to maximize their utility (Hymans and Shapiro 1976). Therefore, we define budget shoppers as consumers who shop with an explicit and consequential budget in mind (Bliss 1988).

In general, retailing research suggests that the negative consequences associated with over- and underspending are asymmetric (Thaler 1980). That is, out-of-pocket costs (i.e., overspending) are viewed as losses, while opportunity costs (i.e., foregone products) are viewed as foregone gains (Thaler 1980). Because losses are weighted more heavily than foregone gains (Kahneman, Knetsch, and Thaler 1991), budget shoppers likely are more concerned about overspending than underspending.

While it may be considered optimal to accurately spend a budget, budget shoppers may have a difficult time accurately spending their entire budget as a result of (1) estimation biases and (2) spending uncertainty. Van Ittersum, Pennings, and Wansink (2010) demonstrate that budget shoppers exhibit significant estimation biases when attempting to track their in-store spending using mental computation strategies. This bias is further magnified by in-store retailing efforts aimed at increasing purchase quantities (Wansink, Kent, and Hoch 1998) or expanding the range of categories purchased (Chandon and Wansink 2012). These estimation biases result in opposing spending biases: those who underestimate their spending are likely to overspend on their budget, while those who overestimate are likely to underspend.

In addition, when mentally tracking their in-store spending, budget shoppers experience significant uncertainty about the total price of their shopping basket as they shop (Van Ittersum, Pennings, and Wansink 2010). This spending uncertainty negatively influences spending. That is,
budget shoppers perceive their budget as a reference point (Stilley, Inman, and Wakefield 2010a), they perceive a loss when they spend more than their budget (Tversky and Kahneman 1991), and these losses are weighted more heavily than the opportunity costs associated with underspending (Kahneman, Knetsch, and Thaler 1991; Thaler 1980). To minimize the risk of overspending and experiencing these losses, budget shoppers who are uncertain about how much of their budget they have already spent are inclined to spend significantly less than their budget (Pennings, Van Ittersum, and Wansink 2005). In essence, budget shoppers build a safety margin into their shopping trip to minimize the likelihood of spending more than their budget. This margin can be viewed as a monetary measure of the implicit “cost” of bearing the risk to exceed their budget (Arrow 1971; Pennings and Wansink 2004; Pratt 1964). It represents the amount of money that budget shoppers are willing to not spend in order to be reasonably confident they will not exceed their budget. Note that this safety margin is conceptually different from in-store slack (Stilley, Inman, and Wakefield 2010a), which is defined as a portion of shoppers’ (implicit) mental budget that they intend to spend but allocate while shopping (vs. planned purchases). To provide empirical evidence for the foundational assumption about budget shoppers underspending on their budget as a result of spending uncertainty, we conducted a lab experiment.

**Study 1: Budget Shoppers’ Spending Behavior**

Study 1 involved 66 university students who received partial course credit for participating. The average age of the participants was 21 (18–28), and 44.0% were women.

**Design and Procedure**

Study 1 employed a computer-simulated shopping task. To control for the number and type of products, participants were given a pretested shopping list with 16 product categories and asked to make their shopping selections. For each decision (one product category at a time, in
shopping-list order), participants were presented with a choice set consisting of two options: one store brand and one national brand. For each option in each choice set, a picture of the product, the unit size, and the price were presented. After participants made a choice, the next choice set appeared on the screen.

Study 1 was a between-subjects design with budget constraint (no budget constraint vs. budget constraint) as an experimental factor. Participants in the budget-constraint condition were asked to shop with a budget constraint of $60 (“Imagine that your budget for this shopping trip is $60”). This budget amount was established based on the prices of the 16 product categories on the shopping list. The total price of all store brands was $49.50, and the total price of all national brands $70.50. The average of these two totals is $60, which we used as the budget.

To make the budget consequential and thus effective (Thaler 1999), budget shoppers were informed that they would have to resolve several complex math problems if they breached their $60 budget. Participants in the nonbudget condition were merely asked to shop for the items on their list. Participants were randomly assigned to one of the two conditions.

**Measures**
The total price of each participant’s basket was recorded. After participants selected the final product, they were asked to write down the total price of their shopping basket. To measure spending uncertainty, participants’ confidence in the accuracy of the total price provided was recorded (1 = “not confident,” and 9 = “very confident”).

**Results and Discussion**
Consistent with expectations, analysis of variance, with the total price of the shopping basket as the dependent variable and budget constraint (no budget constraint vs. budget constraint) as an independent variable, revealed a significant main effect. Budget shoppers spent less than their
nonbudget counterparts ($55.45 vs. $60.53; F(1, 64) = 29.16, p < .01). Moreover, budget shoppers spent 7.6% less than their budget ($55.45 vs. $60; t(32) = 6.39, p < .01).

Controlling for estimation biases (actual spending – estimate spending) (Van Ittersum, Pennings, and Wansink 2010), an ordinary least squares (OLS) regression confirms that budget shoppers’ spending decreased with spending uncertainty (b = −.56, p < .01). In contrast, the spending behavior of nonbudget shoppers was not influenced by spending uncertainty (b = .09, p > .20). Bootstrapping analyses (Preacher and Hayes 2004) suggest that the effect of budget-constrained shopping on spending is mediated by spending uncertainty. The indirect effect of budget constraint on spending was significant (mean bootstrap estimate = −.71, SE = .40; 95% confidence interval = −1.82/−.16).

These results suggest that neither underspending nor overspending were desirable. If overspending were desirable, budget shoppers would have spent more. If underspending were desirable—indicating that participants did not need the entire budget to meet their shopping needs—nonbudget shoppers would not have spent more than budget shoppers. Moreover, budget shoppers’ underspending is significantly driven by their spending uncertainty.

The Effect of Real-Time Spending Feedback
One of the main premises of this research is that real-time spending feedback may help improve consumer welfare of budget shoppers by reducing their spending uncertainty, thus enabling them to spend more of their budget without the risk of exceeding their budget (Hymans and Shapiro 1976; Lynch and Ariely 2000). The resulting improvement in shopping experience as well as the increase in spending will benefit the retailer. Thus, smart shopping carts may be a win-win opportunity for budget shoppers and retailers. However, retailers are concerned that spending feedback could reduce the spending of nonbudget shoppers. That is, while real-time spending
feedback may reduce spending uncertainty of budget shoppers, it also may increase the basket price salience (i.e., the level of attention shoppers place on the total basket price during their shopping trip) of nonbudget shoppers (see Wathieu, Muthukrishnan, and Bronnenberg 2004). With an increased salience of the total basket price, the perceived importance and impact of the basket price on subsequent spending decisions also increases (Taylor and Thompson 1982; Wakefield and Inman 2003; Wathieu, Muthukrishnan, and Bronnenberg 2004). We propose that the reduction in uncertainty about the total basket price stimulates budget shoppers to spend more, while the increased salience in basket price among nonbudget shoppers stimulates them to spend relatively less than those without real-time spending feedback.

**Spending**

Because budget shoppers are inclined to track their in-store spending (Van Ittersum, Pennings, and Wansink 2010), the salience of their total basket price will be high (Wathieu, Muthukrishnan, and Bronnenberg 2004). Thus, the impact of real-time spending feedback on basket price salience will remain limited. However, real-time spending feedback will reduce the spending uncertainty that budget shoppers experience, allowing them to spend more without the risk of breaching their budget. Presuming that underspending is not optimal (Heath and Soll 1996; Thaler 1985), we expect that providing budget shoppers with real-time spending feedback will stimulate them to spend more of their budget on groceries and thus increase their spending.

Nonbudget shoppers, on the contrary, are less inclined to track their in-store spending. Consequently, the salience of the total basket price will remain relatively low compared with budget shoppers (Dickson and Sawyer 1990). We expect real-time spending feedback to increase basket price salience. Increasing the salience of the price of an *individual item* makes the price more important in the decision-making process (Van Ittersum et al. 2007; Wathieu, Muthukrishnan, and
Bronnenberg 2004), which in turn influences the purchase likelihood of the target item (Lalwani and Monroe 2005). Similarly, increasing the salience of the total price of the shopping basket with real-time spending feedback should increase the impact of the total basket price on subsequent spending decisions (Bell and Lattin 1998). As a result, we hypothesize that real-time spending feedback reduces spending among nonbudget shoppers.

\[ H_1: \text{The effect of real-time spending feedback on spending differs between budget and nonbudget shoppers. Real-time spending feedback (a) increases spending among budget shoppers but (b) decreases spending among nonbudget shoppers.} \]

**Number of Products Purchased**

While shopping behavior determines how much shoppers spend on a given shopping trip, real-time spending feedback increases shoppers’ awareness of how much they are spending while shopping. We expect this to influence their subsequent (in-store) shopping behavior. More specifically, budget shoppers may increase their spending by using their “safety margin” to purchase more products than budget shoppers who do not receive real-time spending feedback. In contrast, nonbudget shoppers, hypothesized to reduce their spending in response to real-time spending feedback, may forfeit products they would normally purchase.

\[ H_2: \text{The effect of real-time spending feedback on the number of items purchased differs between budget and nonbudget shoppers. In response to real-time spending feedback, (a) budget shoppers purchase more items, and (b) nonbudget shoppers purchase fewer items.} \]

**Share of Store Versus National Brands**

A different, well-documented strategy to change in-store spending is to replace national brands—nationally marketed brands owned by a manufacturer—with lower-priced store brands—brands owned by the retailer—and vice versa (Ailawadi et al. 2001; Bodkin 1959; Keller 2008). We expect that differentiating between store and national brands will yield novel and relevant insights (e.g., the retailer profit margin of store brands is higher [Ailawadi and Harlam 2004]).
Shoppers focus on quality and price when trading off between store and national brands (Erdem, Zhao, and Valenzuela 2004). Because budget shoppers tend to be more price sensitive, they are more inclined to purchase lower-priced store brands (Ailawadi, Gedenk, and Neslin 2003; Burger and Schott 1972; Lichtenstein, Ridgway, and Netemeyer 1993; Quelch and Harding 1996). Conversely, real-time spending feedback effectively increases budget shoppers’ spending room, allowing them to spend more money on what are perceived as higher-quality products (Steenkamp, Van Heerde, and Geyskens 2010). In turn, the additional spending room that budget shoppers experience during their shopping trip could stimulate them to replace (some of the) store brands they would normally purchase with national brands (Krishna et al. 2002).

Nonbudget shoppers, who are hypothesized to reduce their spending in response to receiving real-time spending feedback, can also accomplish this by purchasing more lower-priced store brands (Krishna et al. 2002). That is, we expect that nonbudget shoppers will replace (some of the) national brands they would normally purchase with store brands.

H3: The effect of real-time spending feedback on the type of brands purchased differs between budget and nonbudget shoppers. In response to real-time spending feedback, (a) budget shoppers purchase relatively more national brands, and (b) nonbudget shoppers purchase relatively more store brands.

We approach the question of whether shoppers will adjust their spending in response to real-time feedback by changing the number of items (H2) or the type of brands they purchase (H3), or some combination, as an empirical question.

Shopping Experience

Mentally tracking in-store spending can produce mental stress (Van Ittersum, Pennings, and Wansink 2010). Stress is defined as “a state of imbalance within a person, elicited by an actual or perceived disparity between environmental demands and the person’s capacity to cope with these
demands” (Maes, Vingerhoets and Heck 1987, p. 546). Real-time spending feedback eradicates the need to mentally track. Therefore, we expect real-time spending feedback to improve the shopping experience of budget shoppers by eliminating the stress associated with mentally tracking in-store spending (Linden 1991). The shopping experience of budget shoppers who do not receive real-time spending feedback will be relatively low (Swinyard 1993).

We hypothesize that real-time spending feedback stimulates nonbudget shoppers to reduce their spending, particularly on national brands. We expect that feeling pressured to give up some degree of quality to limit their spending will be experienced as a loss, triggering negative emotions (Lynch and Ariely 2000). Therefore, real-time spending feedback should negatively influence the shopping experience for these shoppers (Menon and Kahn 2002).

H4: The effect of real-time spending feedback on the shopping experience differs between budget and nonbudget shoppers. Real-time spending feedback (a) improves the shopping experience of budget shoppers but (b) reduces the quality of the shopping experience of nonbudget shoppers.

Table 1 summarizes our hypotheses on how real-time spending feedback influences the shopping and spending behavior of budget versus nonbudget shoppers. We examine these hypotheses in a field experiment in an online grocery store (Study 2) and a field study in an Atlanta grocery store (Study 3).

-------------------
Insert Table 1 about here
-------------------

**Study 2: Real-Time Spending Feedback in an Online Grocery Store**

Study 2 involved 194 participants from a professional panel of adult American consumers who are responsible for most of their household grocery purchases. The average age was 41.4 (18–77), and 55.2% were women. The average household size was 2.7 (1–6).
Design

The study design was a $2 \times 2$ between-subject design with budget constraint (no budget constraint vs. a $35$ budget constraint) and real-time spending feedback (unavailable vs. available) as experimental factors. Participants were randomly assigned to one of the four conditions and asked to shop using a pretested shopping list with 15 common product categories. The budget of $35$ was determined based on the prices of the product categories on the shopping list. That is, if participants selected the least expensive option for each product category on their shopping list, they would spend $24.65. If they selected the most expensive item for each product category on their list, they would spend $51.85. Participants were allowed to not purchase items that were on their list.

Participants were asked to shop for the products on the shopping list in an experimental online grocery store, named Grocery Square. The store offers more than 3,000 stockkeeping units (SKUs) (pictures, prices) in 18 categories, ranging from baby to pet food, and has the same functionality as a regular online grocery store (except for the actual financial transaction at checkout). For each product category (e.g., bagels) on the shopping list, participants could choose from between five and fifteen product options (e.g., blueberry bagels, plain bagels) from between two and eight different store and national brands (with between two and seven different price levels). For each option, a picture of the product, the unit size, and the price was presented. The store brand was a fictitious brand named “GS Value.” All participants were asked to presume that the store brand resembled the store brand in the store where they conduct most of their grocery shopping. The basket share of the store brand averaged 48.7%, which suggests that participants considered it seriously.

We created two versions of the store. For participants who received real-time spending feedback, the names of the products in their basket and their total price were continuously
present. Each time an item was added to the basket, the information was updated. For shoppers who did not receive the real-time spending feedback, only the names of products in their shopping basket were shown.

To incentive-align participants (Ding 2007; Ding, Rajdeep, and Liechty 2005), they were informed that one in ten shoppers was eligible for a prize package worth $75. Nonbudget shoppers were told that their prize package would consist of the items in their shopping basket and cash. If the total price of the items in their basket was $40, they would receive those groceries and $75 – $40 = $35 in cash. Budget shoppers received the same information; however, they were also informed that if they spent more than their budget of $35, they would only receive the remaining cash but not the groceries. For instance, budget shoppers who spent $40 on groceries, and thus breach the budget, only receive $75 – $40 = $35 and no groceries. Accounting for budget shoppers—with a covariate variable—who spent more than the $35 budget, and thus faced a different incentive than those who stayed within budget, did not influence our results. We measured how realistically participants took the decision-making process (“The choices I made accurately reflect what I would do in my regular grocery store,” “The comparisons I made between products and prices closely reflected how I make decisions in my regular store”; 1 = “totally disagree,” and 5 = “totally agree”, \( \alpha = .81 \)). We found no differences among the four conditions. On average, participants scored high (M = 4.2), suggesting that the incentive alignment worked and that the participants took the shopping task realistically.

**Procedure**

At the beginning of the study, participants were informed that they would be asked to shop for groceries in an online store and answer questions about their experience in order to help researchers understand how consumers shop for groceries. Participants were informed that they
would shop in a mock online grocery store that offered both store and national brands of a wide variety of products. Participants were asked to treat the store brand as they would in the store where they usually shop for groceries. Next, participants were shown a one-minute video clip detailing (1) how to create a personal account and enter the store, (2) how to shop for groceries in the online store associated with the experimental condition they were in, and (3) how to checkout and return to the online survey. Subsequently, participants received their shopping list and were asked to enter the store and shop for the items on their list. Their shopping list gave the product category (e.g., bagels) and the SKU (e.g., six-count). After they finished shopping, they returned to the online survey and answered the remaining questions.

**Measures**

Each choice and the total price of their basket were recorded for all participants. After participants selected the final product and checked out of the store, they were asked to write down the total price of their shopping basket. To measure spending uncertainty, their confidence in the accuracy of the total price provided was recorded (1 = “not confident,” and 9 = “very confident”). In addition, measures were taken to assess basket price salience (“I tried very hard to keep track of the total price of my shopping basket”; 1 = “totally disagree,” and 5 = “totally agree”) and shopping experience (“I am satisfied with my shopping experience in the online store”; “I enjoyed shopping in the online store”; “Overall, I am satisfied with the online grocery store experience”; 1 = “totally disagree,” and 5 = “totally agree”). Next, participants responded to several statements about relevant personality characteristics such as their general attitude toward store brands, store price image, and for instance their quality consciousness (see Table 2 for measurement details).

| Insert Table 2 about here |
The results in Table 2 suggest that participants viewed the store brand favorably and believed that the prices were reasonable. In addition, we find a positive correlation between shoppers’ general attitude toward store brands and the number of store brands in their final shopping basket ($r = .30, p < .001$). Furthermore, quality consciousness is negatively correlated with the number of store brands ($r = -.33, p < .001$), while price consciousness is positively correlated with the number of store brands in their basket ($r = .23, p < .001$). This suggests that the results have face validity. Finally, sociodemographic information (e.g., age, gender, income) was collected.

**Results**

*Testing the hypotheses.* A significant interaction revealed that the effect of real-time spending feedback differed between budget and nonbudget shoppers ($F(1, 190) = 11.14, p < .001$) (see Figure 1). Consistent with $H_{1a}$, budget shoppers spent 9.3% more when they received real-time spending feedback than budget shoppers who did not receive real-time spending feedback ($33.14 vs. $30.31; F(1, 190) = 4.93, p < .05$), while staying within budget. In addition, real-time spending feedback reduced spending among nonbudget shoppers by 12.2% ($35.12 vs. $40.00; F(1, 190) = 9.13, p < .01$), in support of $H_{1b}$. We further confirmed these results when we analyzed the log of the total amount of spending.

Analysis of variance with the number of items purchased as the dependent variable revealed a significant interaction effect ($F(1, 190) = 4.63, p < .05$). Budget shoppers purchased more items in response to receiving real-time spending feedback (14.7 vs. 13.6; $F(1, 190) = 5.15, p < .05$). Nonbudget shoppers, however, did not significantly reduce the number of items purchased (14.1 vs. 14.4; $F(1, 190) = .57, p > .20$). Thus, the findings confirm $H_{2a}$ but not $H_{2b}$.
A significant interaction effect suggests that the share of store brands varied across conditions ($F(1, 190) = 13.59, p < .001$) (see Figure 1). While the share of store brands reduced from 62.6% to 49.6% ($F(1, 190) = 4.84, p < .05$) in response to the real-time spending feedback among budget shoppers, the share of store brands increased from 33.0% to 50.5% ($F(1, 190) = 9.15, p < .01$) among nonbudget shoppers. Real-time spending feedback stimulated nonbudget shoppers to increase the number of store brands in their baskets (4.7 vs. 7.3; $F(1, 190) = 9.27, p < .01$) and reduce the number of national brands (9.7 vs. 6.7; $F(1, 190) = 13.57, p < .001$). The change in store-brand share among budget shoppers is due to purchasing more (nationally branded) products and not by replacement purchases. While real-time spending feedback did not change the number of store brands in the baskets of budget shoppers (8.8 vs. 7.4; $F(1, 190) = 2.50, p > .10$), it increased the number of national brands (4.8 vs. 7.3; $F(1, 190) = 9.23, p < .01$). These findings confirm $H_{3a}$ and $H_{3b}$.

Finally, real-time spending feedback uniquely influenced the shopping experience of budget versus nonbudget shoppers ($F(1, 190) = 14.63, p < .001$). While real-time spending feedback improved the shopping experience of budget shoppers (3.6 vs. 4.3; $F(1, 190) = 13.96, p < .001$), it had a marginally significant, negative effect on the quality of the shopping experience of nonbudget shoppers (4.3 vs. 4.0; $F(1, 190) = 2.73, p = .10$). Thus, the findings confirm $H_{4a}$ and $H_{4b}$. Furthermore, real-time spending feedback influenced shoppers’ intention to return to the store ($F(1, 190) = 5.08, p < .05$). Specifically, real-time spending feedback increased budget shoppers’ repatronage intentions (3.4 vs. 3.9; $F(1, 190) = 6.00, p < .05$). For nonbudget shoppers, there was no significant effect (3.3 vs. 3.2; $F(1, 190) = .52, p > .20$).

*Exploring the mechanism behind the results.* Consistent with expectations, real-time spending feedback reduced spending uncertainty, but more so among budget shoppers ($F(1, 190) = 10.6, p$
Furthermore, a significant interaction effect (F(1, 190) = 8.09, \( p < .01 \)) shows that real-time spending feedback increased the basket price salience among nonbudget shoppers (F(1, 190) = 21.4, \( p < .001 \)) but had little impact on the basket price salience of budget shoppers (F(1, 190) = .30, \( p > .20 \)) (see Figure 2).

The results of OLS regressions in Table 3 suggest that real-time spending feedback eliminates the negative effect of spending uncertainty on spending among budget shoppers. Bootstrapping analyses (Preacher and Hayes 2004) confirm that the effect of real-time spending feedback on budget shoppers’ spending is mediated by spending uncertainty. The indirect effect of real-time spending feedback was significant (mean bootstrap estimate = 3.91, SE = 1.03; 95% confidence interval = 2.22/6.36). For nonbudget shoppers, the indirect effect of real-time spending feedback was insignificant (mean bootstrap estimate = –.20, SE = .87; 95% confidence interval = –2.28/1.37). Instead, as we expected, the effect of real-time spending feedback on nonbudget shoppers’ spending is mediated by basket price salience. The indirect effect of real-time spending feedback was significant (mean bootstrap estimate = –2.74, SE = 1.11; 95% confidence interval = –5.30/–.85). Basket price salience does not mediate the impact of real-time spending feedback on budget shoppers’ spending (mean bootstrap estimate = –.28, SE = .53; 95% confidence interval = –1.50/.64).

Discussion

The results of Study 2 show that real-time spending feedback influences shoppers differently depending on whether they are constrained with a budget. Real-time spending feedback reduces spending uncertainty, which stimulates budget shoppers to spend more money without breaching...
their budget. In contrast, real-time spending feedback reduces spending among nonbudget shoppers, an effect that is attributed to real-time spending feedback increasing the basket price salience (Bell and Lattin 1998; Wathieu, Muthukrishnan, and Bronnenberg 2004).

The results further show an asymmetric response in how budget and nonbudget shoppers change their spending in response to receiving real-time spending feedback. Nonbudget shoppers lower their spending by replacing national brands with lower-priced store brands. Budget shoppers, in contrast, increase their spending by purchasing more national brands. This asymmetric response is consistent with a straightforward utility maximization explanation for both shoppers. Budget shoppers try to maximize their utility given their “extra” spending room by purchasing more national brands. Purchasing more national brands yields more utility than spending the extra money on replacing store brands with national brands. Nonbudget shoppers minimize the loss of utility associated with the reduction in spending by replacing national brands with store brands. Replacing national brands with store brands represents a smaller loss in utility associated with the reduction in spending than reducing their spending by forfeiting certain grocery items (Steenkamp, Van Heerde, and Geyskens 2010). From a utility maximization point of view, these results seem consistent and provide a rationale for the lack of support for H2b.

Finally, real-time spending feedback improves the shopping experience of budget shoppers and increases their intention to return to the store. Although the quality of the shopping experience of nonbudget shoppers declined, their intention to revisit the store was unaffected.

To test the robustness of the findings, we conducted a field study in a brick-and-mortar grocery store involving real shoppers during an actual shopping trip for ten or more items. In addition taking our research to a real grocery store, with real shoppers making real decisions, we decided not to use a shopping list in this research. As long as shoppers intended to shop for ten or
more items, they could participate. A second differentiator was that we did not manipulate the budget constraint. Instead, we asked participants if they were shopping on a budget. Furthermore, we wanted to explore whether and how real-time spending feedback influences the purchase of hedonic items. The purchase of many grocery items is predominantly motivated by functional aspects (Hirschman and Holbrook 1982). Products such as milk and meat are utilitarian goods (Batra and Ahtola 1990; Dhar and Wertenbroch 2000; Voss, Spangenberg, and Grohmann 2003). However, supermarkets also sell a wide array of hedonic goods—such as ice cream and chocolate—that provide experiential pleasure and excitement (Gill 2008). Given the basic nature of utilitarian versus hedonic goods, shoppers generally first try to satisfy their utilitarian needs before indulging in hedonic products (Hirschman and Holbrook 1982). Hedonic products also generally require more justification than utilitarian products (Khan and Dhar 2010). This raises an unanswered question of whether budget shoppers will use the extra spending room to purchase more hedonic products. Moreover, will nonbudget shoppers feel more inclined to give up hedonic products to save some money?

**Study 3: Field Study in an Atlanta Grocery Store**

Study 3 involved 198 adult shoppers who were intercepted at the beginning of their shopping trip in a grocery store located in Atlanta. The average age was 52.0 (20–91), and 62.4% were women. The average household size was 2.3 (1–7).

**Design and Procedure**

Study 3 involved a $2 \times 2$ between-subjects design with budget constraint (no budget constraint vs. budget constraint) and real-time spending feedback (unavailable vs. available) as experimental factors. Upon entering the store, shoppers were approached by a trained interviewer and asked
how many items they intended to purchase during this shopping trip. Shoppers who were shopping for ten items or more (Van Ittersum et al. 2010) were invited to be a part of the study.

Before the interviewer provided them with additional study details, they first asked participants whether there was a maximum amount of money they intended to spend on that shopping trip (i.e., budget) and, if so, how much they intended to spend (Stilley, Inman, and Wakefield 2010a). After they received additional instructions (discussed next), all participants were asked to continue on their regular shopping trip, go through the checkout, and then return to the interviewer to answer some questions.

To observe the solitary influence of real-time spending feedback, half of the participants were randomly asked to shop using an iPad with a shopping tracker that allowed them to accurately track their in-store spending. The iPad was attached to the shopping cart using a specially designed mounting arm. The tracker allowed participants to enter the price of each item purchased and calculate the total price with an “enter” button, like a cash register. The other half of the participants shopped without the iPad.

Participants received $10 for participating and were offered a 10% chance of winning a prize package worth $150 (incentive-aligned study). Nonbudget shoppers who purchased $100 of groceries had a 10% chance of receiving those groceries for free along with an additional $50 in cash. Shoppers who spent more than $150 would receive $150 in groceries and no cash. For budget shoppers—consumers shopping with an explicit and consequential budget in mind (Bliss 1988)—we added the constraint that they needed to spend within their self-reported budget (to make the budget constraint consequential). If they stayed within their budget, they had a 10% chance of receiving $150 in groceries and cash (just like the nonbudget shoppers). However, if they spent more than their budget, they would only be able to receive ($150 – total price of
basket) in cash. Making the participants’ subject to consequences if they exceeded their budget is consistent with theory that states that for budgeting to be an effective self-control strategy, budgets must be consequential (Thaler 1999). Because the degree to which a budget is consequential is difficult to self-assess, we decided to make it relatively consequential for all budget shoppers, which may have affected the reported effect sizes for real-time spending feedback among shoppers who came to the store with relatively inconsequential budgets.

**Measures**

After participants finished their shopping trip and paid for their groceries, their final receipt was copied to determine the actual total price of their basket as well as the number and type (utilitarian vs. hedonic) of products and brands (store vs. national brands) purchased. Two independent coders who were unaware of the research objectives classified the products, resolving any discrepancies through discussion. The agreement between the coders was high (Cohen’s κ > .85, p < .01).

We eliminated eight of the self-proclaimed budget shoppers from the sample because they spent over five times more than their self-reported budget while still claiming to be motivated to stay within budget. For those in the real-time spending feedback condition, the total dollar amount reflected on the iPad was collected to determine whether participants actually and accurately used it to track their spending. With the exception of nine participants, everyone correctly and accurately used the iPad. On average, the difference in total spending according to the tracker and their final receipt was $.19 (t(86) = .37, p > .20).

Following this, demographic information related to gender, age, household size, and income was collected. Except for income, none of these variables differed among the four conditions. Budget shoppers reported earning significantly less per month than their nonbudget counterparts ($2,231 vs. $4,141; F(1, 142) = 18.69, p < .001). Furthermore, we measured the motivation of
budget shoppers’ to stay within budget (1 = “not motivated,” and 5 = “very motivated”) as well as how confident they were that they spent less than their budget (1 = “not confident,” and 5 = “very confident”). Budget shoppers’ motivation to stay within budget was high (M = 4.4).

Receiving real-time spending feedback did not influence their motivation (4.3 vs. 4.5; F(1, 84) = .32, p > .20). Budget shoppers who received real-time spending feedback reported significantly higher confidence in not having breached their budget than those who did not receive real-time spending feedback (4.2 vs. 2.9; F(1, 84) = 18.53, p < .001). Finally, measures were taken to assess shopping trip experience (“I am satisfied with the shopping trip”; 1 = “totally disagree,” and 5 = “totally agree”) and repatronage intention (“If the store would offer it, I would return and use technology to track my spending”; 1 = “totally disagree,” and 5 = “totally agree”).

**Results**

Consistent with the previous study, a significant interaction revealed that the effect of real-time spending feedback differed between budget and nonbudget shoppers (F(1, 177) = 7.96, p < .01) (see Figure 3). Consistent with H1a, budget shoppers spent 34.7% more when they received real-time spending feedback than budget shoppers who did not receive real-time spending feedback ($42.04 vs. $31.21; F(1, 177) = 4.52, p < .05), while staying within their budget of $44.23.

Testing H1a based on the share of budget spent revealed a similar finding. Budget shoppers who received real-time spending feedback spent a significantly higher share of their budget than those who did not receive real-time spending feedback (94.6% vs. 79.2%; F(1, 84) = 17.01, p < .001). Real-time spending feedback reduced spending among nonbudget shoppers by 24.9% ($54.75 vs. $41.09; F(1, 177) = 5.21, p < .05), confirming H1b. We further confirmed these results when we analyzed the log of the total amount of spending.

Insert Figure 3 about here
Analysis of variance with the number of items purchased as the dependent variable revealed a significant interaction effect ($F(1, 177) = 4.54, p < .05$). Consistent with Study 2, budget shoppers purchased more items when they received real-time spending feedback (21.2 vs. 17.6; $F(1, 177) = 4.40, p < .05$). Nonbudget shoppers, on the contrary, did not significantly reduce the number of items purchased (22.8 vs. 20.2; $F(1, 177) = 1.67, p > .20$). These findings confirm $H_{2a}$ but not $H_{2b}$.

Furthermore, the effect of real-time spending feedback on the share of hedonic products purchased is also dependent on a shopper’s budget situation ($F(1, 177) = 4.88, p < .05$). Budget shoppers increased the share of hedonic products in response to real-time spending feedback (26.8% vs. 20.6%; $F(1, 177) = 4.49, p < .05$). Nonbudget shoppers did not significantly reduce the share of hedonic products when they received real-time spending feedback (19.0% vs. 21.7%; $F(1, 177) = .96, p > .20$).

The share of the store brands in this study is almost 14%. A significant interaction effect suggests that the share of store brands varied across conditions ($F(1, 177) = 22.12, p < .001$) (see Figure 3). While budget shoppers reduced the share of store brands from 20.1% to 11.1% ($F(1, 177) = 8.62, p < .01$) when they received real-time spending feedback, nonbudget shoppers actually increased the share of store brands from 7.1% to 17.9% ($F(1, 177) = 13.96, p < .001$). Real-time spending feedback did not change the number of store brands in the baskets of budget shoppers (2.7 vs. 3.2; $F(1, 177) = .52, p > .20$); instead, it increased the number of national brands (18.5 vs. 14.4; $F(1, 177) = 5.34, p < .05$). This suggests that the change in store-brand share among budget shoppers is due to purchasing additional nationally branded products and not replacing store-branded products. Real-time spending feedback stimulated nonbudget shoppers to increase the number of store brands (1.9 vs. 3.5; $F(1, 177) = 5.31, p < .05$) and reduce the number of national brands (20.9 vs. 16.7; $F(1, 177) = 6.14, p < .05$). Thus, the findings confirm $H_{3a}$ and $H_{3b}$. 
Finally, real-time spending feedback uniquely influenced the shopping experience of budget versus nonbudget shoppers (F(1, 177) = 4.04, p < .05). Real-time spending feedback improved the shopping experience of budget shoppers (3.7 vs. 4.3; F(1, 177) = 4.89, p < .05), confirming H4a. However, it had no significant effect on the quality of the shopping experience of nonbudget shoppers (3.9 vs. 3.7; F(1, 177) = .35, p > .20). Thus, we cannot confirm H4b. Furthermore, real-time spending feedback influenced shoppers’ repatronage intention (F(1, 164) = 3.43, p < .10).

Real-time spending feedback increased budget shoppers’ repatronage intentions (3.5 vs. 4.5; F(1, 164) = 10.33, p < .001) but had no influence on nonbudget shoppers’ repatronage intention (3.2 vs. 3.3; F(1, 164) = .23, p > .20).

Mediation analysis (Preacher and Hayes 2004) confirmed that real-time spending feedback improved the shopping experience of budget shoppers through a reduction in stress induced by mental tracking, operationalized using a proxy (“I had a difficult time keeping track of the total price of my basket”; 1 = “totally disagree,” and 5 = “totally agree”) (mean bootstrap estimate = .69, SE = .20; 95% confidence interval = .37/1.13). Moreover, shopping experience mediates the effect of the change in stress on budget shoppers’ repatronage intention (mean bootstrap estimate = −.22, SE = .06; 95% confidence interval = −.36/−.11). The shopping experience of budget shoppers improved as a result of the real-time spending feedback by reducing the stress associated with mentally keeping track of their spending. In turn, the improved shopping experience increased their repatronage intention.

The effect of real-time spending feedback on the shopping experience of nonbudget shoppers is not significantly mediated by a reduction in stress. Instead, it is significantly mediated by the increase in the share of store brands (mean bootstrap estimate = −.22, SE = .15; 90% confidence interval = −.50/−.02). The quality of the shopping experience of nonbudget shoppers declined
with real-time spending feedback because of the need to reduce spending by giving up high-quality national brands they normally purchase and replacing them with store brands. Note, however, that the shift in the shopping experience is directional, albeit insignificant. Furthermore, while the shopping experience correlates positively with nonbudget shoppers’ repatronage intention, it does not significantly mediate the relationship between the increase in the share of store brands and repatronage intention.

Discussion
Study 3 examined the robustness of our hypotheses in a brick-and-mortar grocery store involving real shoppers making real decisions during an actual shopping trip for ten or more items. The results are largely consistent with our hypotheses and the findings from Study 2. One exception is the effect of real-time spending feedback on the shopping experience of nonbudget shoppers. The marginally significant, negative effect found in Study 2 became insignificant in Study 3. While Study 2 was conducted in a new online grocery store with “new” customers, Study 3 was conducted in an existing store with existing customers. Shoppers’ past experiences in the brick-and-mortar store of Study 3 may have mitigated the negative effect of the real-time shopping on the shopping experience. Modality variations such as this have appeared elsewhere, generally being slightly weakened in field studies compared with lab studies. These results are consistent with that tendency.

Note that the participants who tracked their in-store spending did so by entering the prices of the items into a shopping calculator (as opposed to receiving the real-time spending feedback automatically through scanning). The market penetration of smart shopping carts and handheld scanners is still small and geographically concentrated. Grocery stores in the southeastern United States generally do not offer them, so we used iPads instead. This may have increased the salience
of the prices and consequently some of the effect sizes. Nonetheless, the directionalities of all the effects reported in Study 3 are nearly identical to those found in Study 2—during which participants received real-time spending feedback automatically. In this way, the results of Study 3 add external validity to the effects of real-time spending feedback for both budget and nonbudget shoppers.

Study 3 also yielded some novel insights into the effect of real-time spending feedback on the purchase of hedonic products. We elaborate on these findings in the “General Discussion” section.

**General Discussion**

The results of one lab experiment, a field study in an experimental online grocery store, and a field study in a brick-and-mortar grocery store converge on how real-time spending feedback influences the spending behavior of budget and nonbudget shoppers (see Table 4). Budget shoppers who receive real-time spending feedback increase their spending, without breaching their budget. They increase their spending by purchasing more (hedonic) products, as well as increasing the number of nationally branded products. This suggests that budget shoppers may believe that purchasing more nationally branded (hedonic) products yields more utility than spending the extra money on replacing store brands with national brands. Furthermore, real-time spending feedback improves the shopping experience of budget shoppers by reducing the mental stress associated with keeping track of total spending while shopping. It also increases their intention to return to the store to use the technology and receive real-time spending feedback while shopping.

<table>
<thead>
<tr>
<th>Insert Table 4 about here</th>
</tr>
</thead>
</table>

Nonbudget shoppers reduce their spending in response to real-time spending feedback. They accomplish this in part by replacing more expensive national brands with lower-priced store brands. The results suggest that nonbudget shoppers prefer to purchase store brands rather than forfeit the products they normally purchase. Replacing national brands with store brands may
represent a smaller loss in utility associated with the reduction in spending than reducing their spending by forfeiting certain grocery items (Steenkamp, Van Heerde, and Geyskens 2010). From a utility maximization point of view, these results seem consistent and provide a rationale for the lack of support for H2b. Notably, although the reported quality of the shopping experience declined in response to the real-time spending feedback, it did not have a significant effect on nonbudget shoppers’ intentions to return to the store.

**Contributions to Marketing Theory**

This research contributes to a growing body of research on in-store decision making (Dhar, Huber, and Khan 2007; Khan and Dhar 2006; Stilley, Inman, and Wakefield 2010a; 2010b) by introducing novel and managerially relevant insights into the spending and shopping behavior of consumers in response to real-time spending feedback. This research fills a knowledge gap at the interface of consumer budgeting, spending, and in-store decision-making theories. It bridges these theories by contributing to theory development on in-store tracking behavior. Furthermore, it contributes to existing budgeting, spending, and in-store decision-making theories.

**In-store tracking behavior.** This research expands existing theory on in-store tracking behavior, a critical research domain in the context of budgeting, spending, and in-store decision-making theories that has received little attention to date. Van Ittersum et al. (2010) demonstrate that many shoppers keep track of their spending while shopping for groceries and that the majority track because of budget constraints. While some shoppers use calculators and shopping lists, the most dominant tracking strategy involves mental computation. Shoppers who are motivated to be accurate—often those with the most stringent budgets—end up being less accurate than less motivated shoppers (because they tend to calculate instead of estimate the total basket price). Furthermore, shoppers who underestimate the total price of their basket are more
likely to overspend. Building on Pennings et al. (2005), the current research shows that budget shoppers cope with the spending uncertainty in part by building a safety margin into their shopping trip—that is, they spend less than their budget to prevent breaching their budget.

Across the studies we reported here, budget shoppers who did not receive real-time spending feedback spent only 86% of their budget. Real-time spending feedback alleviates spending uncertainty, stimulating budget shoppers to spend almost 95% of their budget, which is 10% more than budget shoppers shopping without receiving real-time spending feedback. In contrast, real-time spending feedback reduces nonbudget shoppers’ spending, an effect attributed to the increased salience of their total basket price. Finally, this research demonstrates the consequences of real-time spending feedback on in-store decision making. Real-time spending feedback stimulates budget shoppers to increase their spending by purchasing more nationally branded products. For nonbudget shoppers, instead of reducing the number of products purchased, they replace national brands with store brands. This theoretical understanding on in-store tracking behavior has important ramifications for existing budgeting, spending, and in-store decision-making theories.

*Budgeting and spending*. The budgeting (Du and Kamakura 2008; Larson and Hamilton 2012) and spending (e.g., Mehta, Rajiv, and Srinivasan, 2003; Stilley, Inman, and Wakefield 2010a, 2010b) literature examines how and why people budget, as well as how these budgets influence their spending behavior. The budgeting literature implicitly assumes that shoppers with budgets are knowledgeable about the total price of their shopping baskets as they shop (Bénabou and Tirole 2004; Ulkümen, Thomas, and Morwitz 2008). Van Ittersum, Pennings, and Wansink (2010) demonstrate that this assumption is problematic. That is, while budgets stimulate budget shoppers to track their in-store spending, the task complexity and spending uncertainty causes estimation biases that directly influence their spending.
The budgeting literature also assumes that for budget shoppers to maximize their utility, they need to spend their entire budget (Thaler 1985). However, we demonstrate that budget shoppers, faced with spending uncertainty, actually spend systematically less than their budget. Providing budget shoppers real-time spending feedback reduces this spending uncertainty, stimulating them to spend more of their budget, which is consistent with maximizing consumer utility (Hymans and Shapiro 1976; Lynch and Ariely 2000). These results warrant caution for the use of observed spending behavior to infer people’s budgeting behavior (e.g., Du and Kamakura 2008). Modeling variations in the share of people’s budget being spent may improve our understanding of how consumers allocate and spend their discretionary income.

**In-store decision making.** Real-time spending feedback stimulates budget shoppers to spend more of their budget. Existing theories suggest that real-time spending feedback allows budget shoppers to increase their utility, given their budget constraints (Lynch and Ariely 2000) and given knowledge of existing inventory levels in their home (Chandon and Wansink 2006). Notably, the results on the effect of real-time spending feedback on the purchase of hedonic items in Study 3 suggest that the reduction in spending uncertainty creates spending room that budget shoppers seem to interpret as a “windfall,” or an unexpected monetary gain. Note that because the money was designated to be spent on groceries, we do not claim that this money represents an actual financial gain. We merely suggest that budget shoppers experience the “extra” spending room as an unexpected gain (Levav and McGraw 2009). As a result, budget shoppers who receive real-time spending feedback spend it readily and more frivolously by purchasing more hedonic products (Bodkin 1959; Levav and McGraw 2009). The windfall effect seems to help them justify the purchase of these hedonic products, which generally require more justification than utilitarian products (Khan and Dhar 2010; Okada 2005).
This raises the potentially important question whether real-time spending feedback actually helps consumers or simply stimulates them to spend money that they typically would not. For example, one might argue that the purchase of hedonic products represents an important part of maximizing ones utility; budget shoppers take the opportunity to purchase these products when they realize they can afford it. The finding that nonbudget shoppers seem reluctant to give up hedonic products when they realize how much they are spending attests to the potential utility associated with hedonic products. Alternatively, the purchase of hedonic products may be driven simply by the novelty of the real-time spending feedback experience in our studies. That is, budget shoppers with more extensive real-time spending feedback experience may not experience the “extra” spending room as an unexpected gain (Levav and McGraw 2009) and, consequently, may spend the money on additional utilitarian products to maximize their utility. Examining the long-term effects of real-time spending feedback could provide further understanding.

We find that real-time spending feedback stimulates budget shoppers to buy national brands additively (not at the expense of store brands), whereas nonbudget shoppers buy store brands substitutively. Existing research suggests that consumer response to price promotions of branded products is brand-specific (Blattberg and Wisniewski 1989). More specifically, when higher-priced national brands are on sale, they will draw sales from lower-priced brands, but not vice versa (Sethuraman 1996). Consistent with this, we find that budget shoppers, who tend to favor store brands, are interested in purchasing more higher-priced national brands when they receive real-time spending feedback. However, when nonbudget shoppers, who tend to favor national brands, feel inclined to reduce their spending, they are more inclined to switch to store brands than to forfeit certain grocery items.
Contributions to Marketing Practice

Despite the growing interest in and availability of smart shopping carts, their adoption by retailers is lagging behind early industry expectations. This may be driven partly by concerns about whether and how real-time spending feedback influences retail performance. The current research improves our understanding of this question by examining the influence of real-time spending feedback on grocery shopping behavior and, ultimately, retail performance. Our findings should be useful to retailers that are deciding whether to invest in smart shopping carts.

Consider the following examples:

1. Real-time spending feedback increases budget shoppers’ spending: retailers with store locations in lower-income areas may benefit from offering smart shopping carts at these locations.

2. Real-time spending feedback increases budget shoppers’ spending but reduces that of nonbudget shoppers: retailers could assess the share of budget versus nonbudget shoppers at a particular store location and decide whether to offer in-store tracking technology.

3. Real-time spending feedback may offer a competitive advantage for retailers: smart shopping carts increase repatronage intentions for budget shoppers, but does not decrease it for nonbudget shoppers. Thus, smart shopping carts may offer an attractive opportunity to draw new customers—budget shoppers—to a store without running the risk of losing nonbudget shoppers.

4. Real-time spending feedback reduces nonbudget shoppers’ spending but stimulates them to replace lower-margin national brands with higher-margin store brands: retailers with a successful store brand may still find it profitable to offer smart shopping carts.

5. Real-time spending feedback is only one component in smart shopping carts: promotions, advertisements, loyalty program integration, and other tools offer a multitude of advantages to retailers. Furthermore, some of these tools may help retailers mitigate potential financial losses among nonbudget shoppers in response to receiving real-time spending feedback.
It will be important for retailers to be able to differentiate between budget and nonbudget shoppers. One proposed strategy is to use geographic income data to decide whether to offer smart shopping carts in a particular store. Alternatively, stores with loyalty cards can look for shoppers who have highly consistent periodic spending, which would suggest that they are generally conforming to a given spending amount. While targeting only specific customers with smart carts may be a bit more challenging, the smaller size of handheld scanners may offer more flexibility. For example, Stop & Shop allows customers to decide whether to use handheld scanners. Customers who opt to use these simply scan their store card and retrieve one. Using historic customer data from the store card, the retailer can then target customers who are most likely to shop with a budget. Alternatively, retailers may allow shoppers to decide for themselves whether they want to see their total spending while shopping.

The implications of these findings are relevant not only for smart-cart grocers but for any retailing context in which spending totals can be updated in real time. There are a variety of ways the total amount of money being spent on a basket of goods (e.g., Amazon.com) can be displayed. First, cumulative spending totals can either be consistently visible to the shoppers throughout the shopping trip or only visible when they check out. For budget shoppers, real-time spending feedback might encourage them to spend more than they would otherwise, which may increase their satisfaction with the site and ultimately with the retailer (Gómez, McLaughlin, and Wittink 2004). For nonbudget shoppers, real-time spending feedback likely reduces their satisfaction and decreases how much they spend. A key question for a retailer to consider is what type of consumers most regularly visits their site. A retailer catering more to budget shoppers may elect to present real-time spending feedback consistently throughout the shopping trip, although this would benefit from confirmatory research.
Another question of interest would be exactly what price should be displayed. It is common for e-retailers to show only the total amount of the items purchased until checkout time, at which point sales tax and shipping costs are added to the total. With registered users (for whom shipping costs and sales taxes are known), one option could be to offer an estimated running total cost that includes shipping, handling, and taxes. This may increase the amount that budget shoppers spend.

Similar issues should be considered by developers of mobile applications on smart phones or tablets that focus on providing users with updated information about their spending. Features such as running total versus end-of-shopping total or basket cost versus total cost could be useful differentiating features.

**Limitations and Further Research**

The converging results across different contexts lend important credibility to the findings. They support the theoretical foundation that explains the disparate results for budget versus nonbudget shoppers. To some degree, this lessens any concerns one might have had with any one study alone. What is yet to be investigated is whether the initial attention given to real-time shopping feedback would diminish with time (Van Houwelingen and Van Raaij 1989). That is, the first few times people are faced with such feedback, they might be more responsive to it than they would be after multiple trips.

The results suggest that the reduction in mental stress associated with mentally tracking total spending improves the shopping experience of budget shoppers. We also find a negative relationship between the share of store brands and the shopping experience of nonbudget shoppers, an effect we attribute to feeling forced to forfeit the national brands to which they have become accustomed. Notably, the relationship among real-time spending feedback, shopping experience, and shoppers’ intention to return to store yields a somewhat surprising finding: Consistent with what might be expected, for budget shoppers, an improvement in shopping experience leads to an increased
repatronage intention. However, a decline in the quality of nonbudget shoppers’ shopping experience does not significantly decrease their intention to return to the store and use the tracking technology. This suggests that the factors that influence nonbudget shoppers to return to the store are driven less by the shopping experience. Alternatively, nonbudget shoppers may acknowledge the benefits of real-time spending feedback (i.e., to help control their spending), even if this is not something they strongly prefer. These findings warrant additional attention in further research.

Real-time spending feedback generates novel dynamics for modelers. The brand-switching inversion that occurs for budget versus nonbudget shoppers offers an intriguing complexity to existing models of shopping behavior. The practical implication of this would be to determine how these elasticities vary across categories. The coarse distinction between hedonic and nonhedonic products provides a good foundation for this.

From a practical standpoint, it must be acknowledged that the total impact of real-time spending feedback on retail performance is the outcome of a complex interplay between how much money budget and nonbudget shoppers spend on higher-margin store brands versus lower-margin national brands. Therefore, analytical models can be developed to help retailers optimize their decision about whether to invest in smart shopping cart technology and how long it would take to recoup the investment.

Real-time spending feedback is only one aspect of how smart shopping carts may evolve to influence consumers during a shopping trip. For example, smart shopping carts may offer customized advertisements and promotions throughout the shopping trip or based on the time of day (Tal and Wansink 2013). The content and timing of these could be made dependent on the shopper-specific characteristics, loyalty card data, and even items already placed in the shopping basket (Hui et al. 2013). Product recommendations and customized shopping lists could become an integral part of the shopping experience. The dynamic nature of offering customized information during the shopping
trip offers opportunities that may yield important new theoretical insights and be of practical relevance for both consumers and retailers. Given these opportunities, gaining additional insights into which shoppers are most likely to use smart carts and handheld scanners will be invaluable.

**Conclusion**

The results of these studies offer robust insights that may help retailers create win-win strategies using smart shopping carts, handheld scanners, or mobile phones. These insights further contribute to the in-store tracking and spending behavior literature and benefit existing budgeting, spending, and in-store decision-making theories. We identify a variety of directions for further research related to the implications of the growing use of customer-facing technologies—such as handheld scanner and smart shopping carts—for consumers, retailers, manufacturers, and marketing researchers.

Looking forward, it would be promising to examine whether and how real-time feedback influences other types of behaviors. For example, how does a runner respond to real-time distance feedback while running, or how does a dieter respond to real-time calorie-intake feedback? With the growing market of apps that allow people to track many different aspects of their life, gaining a better understanding about the implications of real-time feedback is relevant and worthwhile.
REFERENCES


Hui, Sam K., J. Jeffrey Inman, Yanliu Huang, and Jacob Suher (2013), “The Effect of In-Store Travel Distance on Unplanned Spending: Applications to Mobile Promotion Strategies,” *Journal of Marketing*, 77 (March), 1–16.


### TABLE 1
How Real-Time Spending Feedback Influences Grocery Shopping Behavior

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Budget Shoppers</th>
<th>Nonbudget Shoppers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total spending ($)</td>
<td>$H_{1a}$ Increases</td>
<td>$H_{1b}$ Decreases</td>
</tr>
<tr>
<td>Number of products purchased</td>
<td>$H_{2a}$ Increases</td>
<td>$H_{2b}$ Decreases</td>
</tr>
<tr>
<td>Store vs. national brands (%)</td>
<td>$H_{3a}$ Decreases</td>
<td>$H_{3b}$ Increases</td>
</tr>
<tr>
<td>Shopping experience</td>
<td>$H_{4a}$ Increases</td>
<td>$H_{4b}$ Decreases</td>
</tr>
</tbody>
</table>

### TABLE 2
Psychographics of the Participants of Study 2

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Items</th>
<th>Average (SD)</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shopping experience</td>
<td>I am satisfied with my shopping experience in the online store.</td>
<td>4.1 (.92)</td>
<td>.87</td>
</tr>
<tr>
<td></td>
<td>I enjoyed shopping in the online store.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Overall, I am satisfied with the online grocery store experience.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intention to return to store</td>
<td>I could consider myself to be loyal to a real online grocery store that is similar to Grocery Square.</td>
<td>3.5 (1.09)</td>
<td>.89</td>
</tr>
<tr>
<td></td>
<td>I would definitely buy products from a real online grocery store that is similar to Grocery Square.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I would expect to purchase through a real online grocery store that is similar to Grocery Square.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Store brand attitude (GS Value)</td>
<td>I like the store brand.</td>
<td>3.4 (.80)</td>
<td>.78</td>
</tr>
<tr>
<td></td>
<td>I believe the quality of the store brand is high.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I feel confident about the quality of the store brand.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Store price image</td>
<td>I believe the online grocery store is expensive.</td>
<td>2.9 (1.03)</td>
<td>.85</td>
</tr>
<tr>
<td></td>
<td>The prices of the products sold at the online store are high.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General attitude toward store brands</td>
<td>I buy store brands.</td>
<td>3.9 (.96)</td>
<td>.73</td>
</tr>
<tr>
<td></td>
<td>My shopping cart contains store brands for several products.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I hardly ever buy store brands. (R)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality consciousness</td>
<td>For me, quality is decisive when purchasing products.</td>
<td>3.6 (.78)</td>
<td>.68</td>
</tr>
<tr>
<td></td>
<td>I am willing to pay for higher quality products.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price consciousness</td>
<td>I am a price conscious grocery shopper.</td>
<td>4.1 (.89)</td>
<td>.75</td>
</tr>
<tr>
<td></td>
<td>I find myself checking the prices even for small items.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Scores did not differ between four conditions.

Notes: (R) = reverse-scored item.
### TABLE 3
Study 2: How Spending Uncertainty and Price Salience Affect the Spending ($) of Budget and Nonbudget Shoppers (Controlling for Estimation Biases)

<table>
<thead>
<tr>
<th></th>
<th>Budget Shoppers</th>
<th>Nonbudget Shoppers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spending uncertainty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price salience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimation bias*</td>
<td>−.24**</td>
<td>−.40***</td>
</tr>
<tr>
<td>R-square</td>
<td>.37**</td>
<td>.16</td>
</tr>
<tr>
<td>F-value</td>
<td>8.29***</td>
<td>2.80**</td>
</tr>
</tbody>
</table>

*Estimation bias = estimated spending – actual spending.

Notes: n.s. = not significant.

### TABLE 4
How Real-Time Spending Feedback Influences Grocery Shopping Behavior in Field Studies

<table>
<thead>
<tr>
<th></th>
<th>Budget Shoppers</th>
<th>Nonbudget Shoppers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S2</td>
<td>S3</td>
</tr>
<tr>
<td>Total spending ($)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of products purchased</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Store vs. national brands (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shopping experience</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Estimation bias = estimated spending – actual spending.

Notes: n.s. = not significant.
FIGURE 1
Study 2: How Real-Time Spending Feedback Affects Spending ($) and the Percentage of Store Brands

FIGURE 2
Study 2: How Real-Time Spending Influences Uncertainty and Price Salience

FIGURE 3
Study 3: How Real-Time Spending Feedback Affects Spending ($) and the Percentage of Store Brands