

Squeezed: Coping with Constraint through Efficiency and Prioritization

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When consumers perceive that a resource is limited and may be insufficient to accomplish goals, they recruit and enact plans to cope with the shortage. We distinguish two common strategies: efficiency planning yields savings by stretching the resource, whereas priority planning does so by sacrificing less important goals. Using a variety of methods to explore both financial and time planning, we investigate how the two types of planning differ, how they vary with constraint, and how they interrelate. Relative to efficiency planning, priority planning is perceived as yielding larger one-time savings, but it feels more costly because it requires trade-offs within-resource (e.g., money for money) as opposed to cross-resource (e.g., time for money). As constraint increases and greater resource savings are required, prioritization becomes more likely. However, the shift to prioritization is often insufficient, and consumers tend to react to insufficient prioritization dysfunctionally, making a bad situation worse. Budgeting helps consumers behave more adaptively. Budgeters respond to constraint with more priority planning than nonbudgeters, and they report fewer dysfunctional behaviors, like overspending and impulsive shopping.

Everyone is short of something. The poor have little money. The busy have little time. Even those who are not chronically constrained feel exceptionally constrained at

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certain points in time (Sharma and Alter 2012; Shu and Gneezy 2010; Stille, Inman, and Wakefield 2010; Zauberman and Lynch 2005). There is growing interest in the psychology of constraint, especially uncontrollable constraint, which has been shown to produce stress, negative affect, diminished cognitive capacity, discounting of the future, and a focus on the near term (Haushofer and Fehr 2014; Mani et al. 2013; Shah, Mullainathan, and Shafir 2012).

In this article we explore the strategies that consumers use to help them cope with shortage (cf. Katona 1974; Miller, Galanter, and Pribram 1960). Planning has been defined in multiple ways in previous research. Our focus is on planning that is aimed at alleviating resource constraint. Economic theory suggests that consumers should treat all resources as limited, and therefore should always plan their expenditures (Buchanan 2008; Charnes, Cooper, and Rhodes 1978; Erdem and Keane 1996; Kopalle et al. 2012; Pareto 1927/2014). However, behavioral evidence shows that planning occurs only under some circumstances (Frederick et al. 2010; Spiller 2011), indicating the need for research on the consumer psychology of planning and its relation to resource constraint. Our article is organized as follows:

1. We will distinguish two forms of planning, which we call “efficiency planning” and “priority planning.” Efficiency planning yields savings by stretching the resource, whereas priority planning does so

by considering opportunity costs and sacrificing less important goals. These two types constitute separate cognitive categories, each characterized by a unique cluster of psychological properties.

2. We will further show that the mix of priority planning relative to efficiency planning (the “planning mix”) shifts with constraint. This occurs both at the cognitive level in terms of the speed of recruiting plans and at the behavioral level in terms of enacted strategies.
3. Though people shift the planning mix to more prioritization with increasing constraint, this adaptive response is often insufficient, and consumers tend to react dysfunctionally to insufficient prioritization, making a bad situation worse.
4. Finally, we show that budgeting prior to resource consumption helps consumers behave more adaptively. Budgeters respond to constraint with more priority planning than nonbudgeters, and they report fewer dysfunctional behaviors like overspending and impulsive shopping.

EFFICIENCY AND PRIORITY PLANNING

Prior research has discussed planning as a unidimensional construct. For example, Lynch et al. (2010) developed a scale measuring individual differences in “propensity to plan” in a given domain such as time or money, but the scale does not differentiate between different strategies for alleviating constraint. We propose that consumers plan in two distinct ways that differ in how they achieve savings in a resource.

Efficiency planning aims to avoid opportunity costs, achieving savings by stretching the resource to avoid waste. For instance, in planning online gift shopping, one might combine multiple orders together to take advantage of a bulk discount. Similarly, in the domain of time, trip chaining reflects efficiency planning when spending time to shop (Brooks, Kaufman, and Lichtenstein 2004). Visiting multiple stores in one trip is a more efficient use of time than visiting each on a separate occasion. Efficiency planning relates to the concept of a Pareto-efficient trade between two parties that makes one better off without making the other worse off (Pareto 1927/2014). However, efficiency planning is intrapersonal, rather than interpersonal.

In contrast, priority planning achieves savings by making trade-offs between one’s goals given resource constraints and opportunity costs. For instance, a consumer may decide to pass on having a car repair done this month in order to cover food and housing expenses. Likewise, if time is short, instead of chaining trips together, one might instead decide to give up on the trip to the hardware store and to prioritize grocery shopping.

We argue that the two types of planning represent distinct cognitive categories that are characterized by a set of correlated properties. Perhaps most fundamentally, priority plans necessitate explicitly trading off one goal for another.

Efficiency plans may entail trade-offs that are less explicit. For instance, coupon clippers trade off the time they spend looking for coupons for the financial savings they realize. Consequently, they are not avoiding opportunity costs. However, we argue that these kinds of trade-offs across different resources are not as salient to consumers as trade-offs within a resource that are the hallmark of priority planning. Consequently, we posit that efficiency planning feels like getting “something for nothing,” whereas priority planning feels bad, like a loss.

We ran a pilot study to evaluate this conjecture. We surveyed 150 US adults engaged in back-to-school shopping for school-aged children via Amazon Mechanical Turk (MTurk) in August 2013. They had already spent, or expected to spend, an average of \$287 on back-to-school shopping. We asked them to rate the frequency of a set of efficiency and priority behaviors in their back-to-school shopping (randomized for each participant) on a 1 to 5 not at all/very much scale. See table 1 for measures.

The two scales correlated ($r = .39$) and showed discriminant validity by Fornell and Larcker (1981) tests. The data fit a two-factor confirmatory factor analytic model well ($\chi^2 = 29.65$, $df = 19$, $p = .056$, $RMSEA = 0.061$) and significantly better than a one-factor model ($\chi^2 = 73.94$, $df = 20$, $p < .001$, $RMSEA = 0.135$). The fact that these constructs are discriminable provides preliminary evidence for the psychological reality of the distinction between efficiency and priority planning.

The key measures of the pilot study came after rating the frequency of behaviors for each type of planning. Participants rated “the extent to which doing that behavior makes you feel that you are giving something up” and “the extent to which doing that behavior makes you feel that you are accomplishing something” for all behaviors on 5-point not at all/very much scales. Averaging over the five priority items, and the three efficiency items, there was a significant interaction of plan type by perception type ($F(1, 149) = 77.09$, $p < .001$). Priority planning felt more like one is giving something up than efficiency planning ($M_{\text{priority}} = 3.39$, $M_{\text{efficiency}} = 2.94$; $F(1, 149) = 16.57$, $p < .001$), whereas efficiency planning felt more like one is accomplishing something than priority planning ($M_{\text{priority}} = 3.22$, $M_{\text{efficiency}} = 4.07$; $F(1, 149) = 91.25$, $p < .001$).

Efficiency and priority planning also differ in other ways. To illustrate, consider the following example from Mullainathan and Shafir (2013, 69), who use packing a suitcase as an analogy to financial constraint. They compare packing a large suitcase for a business trip, where little planning is necessary, to packing a smaller suitcase for the same trip that triggers more planning:

As before, you might start by casually tossing in the bare essentials. But these alone already fill the suitcase. You take everything out and pack again, this time more methodically. You carefully stack and arrange. You also become creative in making room. You stuff socks and a phone charger inside your shoes and uncoil your belt and align it around the suitcase edge instead. This leaves a bit of room to spare. Should

TABLE 1

EFFICIENCY AND PRIORITY PLANNING BEHAVIORS IN PILOT STUDY 1

Behavior
Efficiency planning ($\alpha = .67$):
I look in different stores to find a lower price for a particular product.
I combine items into a single order to save on shipping or to take advantage of a special deal.
I use coupons, loyalty programs, or other special deals to get a lower price on a product.
Priority planning ($\alpha = .82$):
I think about how the purchase will affect other areas of my budget such as the ability to eat out, pay my bills, etc.
I try to imagine how much each purchase affects how much I can spend on the other products on my shopping list.
I often consider other items I will not be able to buy if I make a particular purchase.
I cut back on other spending before the school semester to be able to afford to buy the back-to-school products I want.
If the items on my back-to-school shopping list prove to be more expensive than I had guessed, I change my plan for what to buy.

you take the sweater? The (optimistic) gym clothes? The umbrella? Is it better to risk the rain and give yourself at least a chance to start getting in shape? Packing the small suitcase forces trade-offs.

Mullainathan and Shafir (2013) did not distinguish efficiency planning from priority planning, but their example can be construed in these terms. The initial response of rearranging creatively fits the definition of efficiency planning, and the latter sacrifice of certain desired items given opportunity costs is an example of priority planning. As we have already discussed, efficiency planning (e.g., finding a place for the phone charger) feels free but requires cross-resource trade-offs (investments of time or energy). Pulling the umbrella out of the suitcase in favor of the gym clothes feels like a loss.

We further propose that thinking in efficiency planning is local in nature, narrowly focusing on achieving one's original plan. Goals exist in a hierarchy, with lower level goals supporting each higher level goal (Austin and Vancouver 1996; Baumgartner and Pieters 2008). Lower level goals tend to be narrower and implemental (Gollwitzer and Brandstätter 1997), triggering "inside thinking" like that underpinning the planning fallacy (Buehler, Griffin, and Peetz 2010). When trying to find a place for the phone charger, one conditions on this single goal and finds a way to accomplish it. Priority planning involves more global thinking in that it requires taking a step back and considering higher level priorities (Keeney 1996). Choosing between the umbrella and gym clothes requires a higher level analysis of which goals are most important. One result is that the final outcome of a priority plan tends to differ more from one's original set of goals than the final outcome of an efficiency plan.

We also propose that priority plans are generally perceived

as offering greater potential savings. Priority planning cuts out entire branches of the goal hierarchy, whereas efficiency plans involve rearranging subgoals. In the example above, curling the belt around the edge of the suitcase can only free up so much space. Removing the umbrella is more effective. The hypothesized characteristics of the two types of planning are summarized in table 2.

H1: Efficiency planning and priority planning are distinct categories of thinking that differ on the six dimensions described in table 2.

STUDY 1: GENERATING AND CHARACTERIZING PLANNING EXEMPLARS

The goal of study 1 is to test whether efficiency and priority planning constitute distinct categories of coping responses that are characterized by the properties in table 2. We adapted a two-phase procedure (Bhattacharjee and Mogilner 2014; Van Boven and Gilovich 2003) intended to test whether efficiency and priority plans generated by a set of actors were distinguishable as such by a set of observers. We asked a first group of participants to generate exemplars of efficiency and priority plans and to rate them on the characteristics in table 2. A second group of participants identified the plans as efficiency or priority and also rated them on the characteristics.

Methods and Measures

Two hundred US MTurk workers participated in this study. Half participated in phase 1 for a \$0.50 payment, and half participated in phase 2 for a \$2.50 payment. Participants in phase 1 were assigned at random to either the efficiency plan condition ($n = 47$) or the priority plan condition ($n = 53$) and were asked to describe a recent time when they saved money through planning. Those assigned to the efficiency plan condition were asked: "Think about a recent time when you saved money by being more efficient with your spending. By efficient, we mean a time when you did

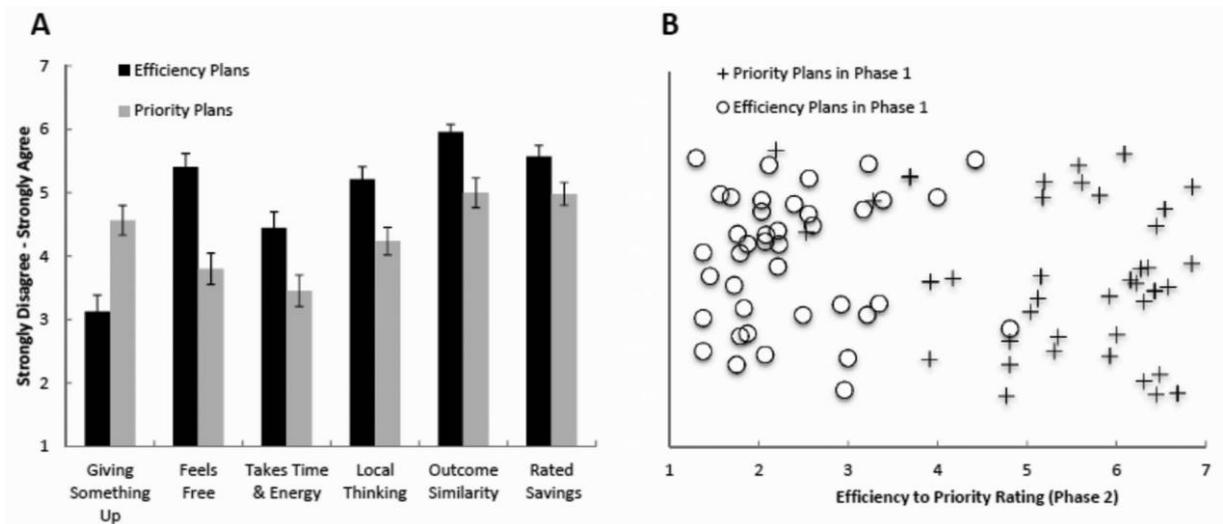
TABLE 2

PSYCHOLOGICAL PROPERTIES OF EFFICIENCY PLANNING AND PRIORITY PLANNING

Efficiency planning	Priority planning
• Avoids explicitly considering opportunity costs	• Involves explicit opportunity cost consideration
• Feels like accomplishing something	• Feels like giving something up
• Involves trade-offs across resources (e.g., time to find coupons)	• Involves trade-offs within a resource (e.g., this gift for that gift)
• Local focus	• Global focus
• Solution more similar to original plan	• Solution less similar to original plan
• Perceived lower savings	• Perceived higher savings

FIGURE 1

STUDY 1: CHARACTERIZING AND DISTINGUISHING PLANNING EXEMPLARS



NOTE.—A, Mean ratings of efficiency plans and priority plans generated in phase 1 with standard errors. B, Efficiency plans (circles) and priority plans (plus signs) generated during phase 1 as a function of the mean rating (1 = efficiency plan, 7 = priority plan) provided by “observer” participants in phase 2. For panel B, data points are jittered along the y-axis for ease of display only.

something that stretched your dollars so that you bought what you wanted but spent less money.” Those assigned to the priority plan condition were asked: “Think about a recent time when you saved money by prioritizing one expense over another. By prioritizing, we mean a time when you decided to give up one thing you wanted in order to be able to afford something else you wanted.”

Participants in both conditions entered their plans into a free response text box. Next, as a manipulation check, participants rated their plan on the extent to which it felt like they were giving something up (“I felt like I was giving something up”) and felt free (“I felt like I was getting something without having to give something up”). We have already demonstrated in the pilot study that when no such language was cued, respondents rated behaviors that we thought instantiated priority planning as feeling more like a loss and behaviors instantiating efficiency planning as feeling like accomplishing something.

Our substantive interest was in participants’ ratings of their plan on the extent to which it required cross-resource trade-offs (“Enacting the plan required spending time or energy”), involved local versus global thinking (“The plan involved thinking narrowly about one part of my budget rather than thinking broadly about different ways I could be spending my money”), resulted in a similar outcome to the original intent (“After I enacted the plan the outcome was similar to what I had originally desired”), and saved money (“It saved a great deal of money”). All ratings, including the manipulation checks were on a 7-point scale

coded 1 = “strongly disagree” and 7 = “strongly agree,” and question order was randomized for each participant. Participants also provided the dollar amount they saved by enacting the plan.

In phase 2, a different group of participants rated the plans as being efficiency or priority plans and also rated them on the same dimensions as phase 1. After removing verbatim responses that explicitly used the words “efficiency” or “prioritization” and one nonsensical response, we randomly sampled 40 plans of each type and assigned them to four sets of 20 plans, each composed of 10 efficiency and 10 priority plans. Participants were assigned at random to one of the four sets, and the 20 plans were displayed in a different random order for each participant. Participants first rated each plan on whether it was an efficiency plan or a priority plan, using the same definitions from phase 1. Responses were on a 7-point scale with endpoints “definitely efficiency” and “definitely priority.” Participants then rated the plans on the same dimensions as phase 1. The cross-resource trade-off question was omitted due to a programming error.

Results

Phase 1. Figure 1A shows the mean ratings of the efficiency plans and priority plans generated by participants from phase 1. The first two pairs of bars in figure 1A show responses to the manipulation check items. Participants who recalled priority plans felt more strongly that they were giving something up than participants who recalled efficiency

plans ($M_{\text{efficiency}} = 3.13$, $M_{\text{priority}} = 4.55$; $F(1, 98) = 16.83$, $p < .001$), and efficiency plans felt more free than priority plans ($M_{\text{efficiency}} = 5.40$, $M_{\text{priority}} = 3.85$; $F(1, 98) = 22.19$, $p < .001$).

Critically, however, efficiency plans for saving money were associated with spending more time and energy than priority plans ($M_{\text{efficiency}} = 4.45$, $M_{\text{priority}} = 3.49$; $F(1, 98) = 7.37$, $p = .008$). This suggests that efficiency plans that involve trade-offs across resources (giving up time and energy to save money) feel more costly than trade-offs made within resources (giving up a monetary purchase to save for another monetary purchase). Efficiency plans were also rated as involving more narrow thinking than priority plans ($M_{\text{efficiency}} = 5.21$, $M_{\text{priority}} = 4.17$; $F(1, 98) = 12.33$, $p = .001$), and the outcome of their plan was more similar to their original intent ($M_{\text{efficiency}} = 5.96$, $M_{\text{priority}} = 4.94$; $F(1, 98) = 13.74$, $p < .001$).

Contrary to our hypothesis that efficiency plans save less money than priority plans, efficiency planners rated their plans as saving more money than priority planners ($M_{\text{efficiency}} = 5.57$, $M_{\text{priority}} = 5.08$; $F(1, 98) = 3.97$, $p = .049$). We also analyzed dollar amounts saved as $\ln(1 + \$ \text{ saved})$ to reduce skewness. Savings were directionally but nonsignificantly higher for priority plans than efficiency plans. Transforming means back to dollars, $M_{\text{efficiency}} = \148.98 , $M_{\text{priority}} = \$171.83$; $F(1, 98) = 0.121$, $p = .729$.

Phase 2. As predicted, participants in phase 2 were able to consistently differentiate the efficiency and priority plans generated in phase 1. Figure 1B shows that plans generated in response to the efficiency planning prompt were rated as efficiency plans, and those generated in response to the priority planning prompt were rated as priority plans. This chart shows the relationship at the aggregate level, but the result also holds at the individual level. For each subject, we computed the point biserial correlation of the rating of more efficiency versus more priority with a dummy variable for whether the source was an efficiency plan or a priority plan (1 = priority, 0 = efficiency). The mean correlation is $r = .68$, with 95% confidence interval (CI) = .64 to .78. Evidently, the distinction between efficiency and priority plans was transparent to outside observers.

We also compared efficiency and priority plans on each hypothesis 1 dimension rated by the original participants, using a model that treats plans, plan sets, and respondents as random factors (Judd, Westfall, and Kenny 2012). With one exception, observers' perceptions aligned with the perceptions of the phase 1 respondents who generated the plans. Inconsistent with hypothesis 1 and the ratings of those generating the plans, observers rated efficiency plans as involving marginally less narrow thinking than priority plans ($M_{\text{efficiency}} = 3.74$, $M_{\text{priority}} = 3.95$; $\beta = .107$, $t(2.99) = 2.46$, $p = .092$).

Discussion

These results support our proposed distinction. Consumers were able to recall efficiency plans and priority plans

using the definitions we provided, and outside observers agreed closely with their classifications. Manipulation checks confirmed that efficiency planning felt less like one was giving something up and more like one was getting something for nothing, compared to priority planning, mirroring our pilot study results.

Despite rating efficiency plans as less costly than priority plans, participants acknowledged that efficiency plans required more time and energy to execute than priority plans. We surmise that this seemingly contradictory result obtains because efficiency plans are more commonly associated with trade-offs that are made across resources (giving up time and energy to save money), whereas priority plans are more commonly associated with trade-offs that are made within resources (giving up a monetary purchase to save for another monetary purchase). These cross-resource trade-offs may feel less costly than within-resource trade-offs because the exchange between resources is harder to specify or because the opportunity costs of expending a nonfocal resource are not as salient as the opportunity costs of expending a focal resource. Relative to priority plans, efficiency plans were also rated as invoking more local thinking and resulting in an outcome more similar to their original spending goal.

The one part of hypothesis 1 that was not supported was our conjecture that priority plans are associated with greater resource savings than efficiency plans. Dollar estimates of savings from the two types did not differ significantly in either phase, and on rating scales, efficiency plans were actually rated as saving more money than priority plans. We considered a potential artifact that could explain these results. Efficiency plans may be more likely than priority plans to yield savings multiple times, and our measures did not make clear whether participants should report one-time or aggregate savings.

To test this possibility, we conducted a follow-up study. We asked 101 MTurk workers to generate one efficiency plan and one priority plan, using the same definitions as in phase 1 of study 1. After a participant generated each plan, we displayed the plan verbatim and asked whether it was used to save money on one occasion or on multiple occasions. If a plan was used to save money on one occasion, we asked how much money was saved on that occasion in dollars. If a plan saved money over multiple occasions, we asked how often and how much money was saved on each occasion in dollars. Next, we displayed the verbatim text of both plans and asked which plan saved more on one occasion and which plan saved more over the course of a year, on 7-point scales anchored by 1 = definitely plan 1, and 7 = definitely plan 2 (recoded as 1 = efficiency plan, 7 = priority plan).

Consistent with hypothesis 1, the dollars saved by priority plans on a single occasion were significantly higher than those saved by efficiency plans. We analyzed $\ln(1 + \$ \text{ saved})$ to reduce skewness. Transforming means back to dollars ($M_{\text{efficiency}} = \36.82 , $M_{\text{priority}} = \$60.97$; $F(1, 97) = 7.203$, $p = .009$). However, when multiplying the number of occasions the plan saved money over a year by the dollars

saved per occasion, there was no difference in the amount saved over the course of a year ($F < 1$). Moreover, 59% of efficiency plans saved money on multiple occasions, but only 46% of priority plans saved money on multiple occasions ($\chi^2(1) = 5.16, p = .034$; McNemar 1947). Similar findings came from the rating scale estimates of money saved. Priority plans were rated as saving marginally more than efficiency plans on a single occasion ($M = 4.45$, scale midpoint = 4; $t(100) = 1.696, p = .093$). Efficiency and priority plans did not differ in rated savings over the course of a year ($M = 3.80$, scale midpoint = 4; $t(100) = -0.748, p = .456$).

The results of this follow-up study support the idea that priority plans are perceived as generating greater one-time savings, but efficiency plans tend to repeat more and can generate equal savings over a longer time horizon. Combining these results with those from study 1, we conclude that efficiency plans and priority plans differ along the lines predicted in table 2.

THE MIX OF PLANNING STRATEGIES CHANGES WITH CONSTRAINT

Standard economic theory holds that one should never take an action without considering both whether it is the most efficient possible way to deploy multiple resources and whether the action has opportunity costs. However, we hypothesize that thoughts about these two concerns may or may not occur to a consumer on a given occasion. We showed in study 1 that efficiency and priority planning differ in their psychological characteristics. These differences lead to predictions about the likelihood of recruiting and enacting plans of different types as a function of the magnitude of constraint. Both types of plans represent creative, memory-based augmentations of the consideration set of possible actions, and research in this area has shown that activating a goal triggers recruitment of alternatives that best serve that goal (Nedungadi 1990; Ratneshwar, Pechman, and Shocker 1996). Even in novel situations, people spontaneously recruit alternatives that satisfy goals like “things to eat on a diet” or “things to sell at a garage sale” (Barsalou 1985).

Analogously, we propose that the likelihood of recruiting efficiency and priority plans depends on their fit with current needs. We have shown that consumers see priority plans as more costly than efficiency plans but more effective in producing resource savings than efficiency plans. At low levels of constraint, efficiency plans are good solutions. But if constraint increases, efficiency plans may not save enough to solve a problem, at least on a single occasion. It may then be more likely that consumers consider priority plans. As a consequence, we hypothesize that at higher constraint levels, priority plans will be more accessible in memory (cf. Spiller 2011) and will come to be a larger proportion of the mix of planning strategies that are retrieved and enacted.

H2a: The “planning mix,” or the amount of priority

planning relative to efficiency planning, increases with constraint.

H2b: The accessibility of priority plans relative to efficiency plans increases with constraint, leading to faster reaction times to generate plans.

STUDY 2: HOLIDAY GIFT PLANNING

In study 2, we tested hypotheses 2a and 2b by manipulating the level of financial constraint and asking participant to generate free-response plans to cope. Participants were asked to plan their holiday gift shopping and then modify their plans in the face of an unexpected bill that varied in magnitude. We coded the plans as efficiency or priority and measured response times. We predicted that increased constraint would be associated with a shift in the planning mix toward prioritization and would increase the relative speed of generating priority plans relative to efficiency plans.

Methods

Participants and Procedure. One hundred and two MTurk workers (52% female, $M_{\text{age}} = 32$) were paid \$1.00 for completing the experiment during the holiday season. They first listed the five most important people for whom they planned to buy gifts and wrote down a gift idea for each recipient. Participants then wrote down a URL for a site where the gift could be purchased and the price of each gift. The survey automatically computed and displayed the total price of all five gifts.

Participants were next randomly assigned to one of three levels of hypothetical financial constraint. They were told to “imagine that just as you are getting ready to begin your holiday gift shopping, you receive a bill in the mail in the amount of \$100/\$500/\$1,000. The bill is totally unexpected but needs to be paid right away. Therefore, as you begin your shopping, you have \$100/\$500/\$1,000 less in your bank account than you thought you would.” Participants reported the amount of the bill as an attention check, and those who failed the check were returned to the instructions page to reread it.

After passing the attention check, participants wrote down how, if at all, they would change their plan for each of their five gift recipients in light of the new bill. Participants were next asked a sixth question about any other changes they would make to their shopping plan in light of the unexpected bill. They therefore provided six free response plans in total. Each of the six free responses was presented on a separate screen.

Design. The manipulated variable in this study was the level of financial constraint. The unexpected bill was \$100 (“low”), \$500 (“medium”), or \$1,000 (“high”). There were two primary dependent variables: plan type and response time. Two hypothesis-blind research assistants independently coded the plans into three categories based on whether they described efficiency plans (e.g., search for

sales, buy locally to avoid delivery costs; 19% of all statements), prioritization plans (e.g., eliminate a gift, cut out other holiday expenses; 27% of all statements), or various categories of other behaviors (e.g., do nothing, raise funds by working more hours, use credit; 54% of all statements). Coder training emphasized the types of behaviors reflected in the closed ended efficiency and priority planning scale items in the pilot study, and the definitions used in study 1. Coder agreement was high (Cohen's kappa = .83), consistent with our finding in study 1 that plans of the two types are distinguishable by observers. The coders resolved coding disagreements via discussion, and all analyses used the agreed-upon coding. We also measured the respondent's time on the free response screen for each of the six plans.

Results

We predicted that as constraint increases, people increasingly engage in priority planning relative to efficiency planning (hypothesis 2a). Figure 2A shows the number of priority plans and efficiency plans by constraint condition. As predicted by hypothesis 2a, the planning mix shifts to more priority planning as constraint increases, reflected in a significant interaction of plan type (efficiency vs. priority) and the linear effect of increasing constraint ($F(1, 99) = 7.54, p = .007$). The interaction was driven by an increase in the amount of priority plans generated as constraint increased ($t(99) = 2.58, p = .012$), while efficiency planning did not change significantly with constraint ($t(99) = 1.39, p = .17$). In the interest of brevity, additional analytical details are provided in appendix E, available online.

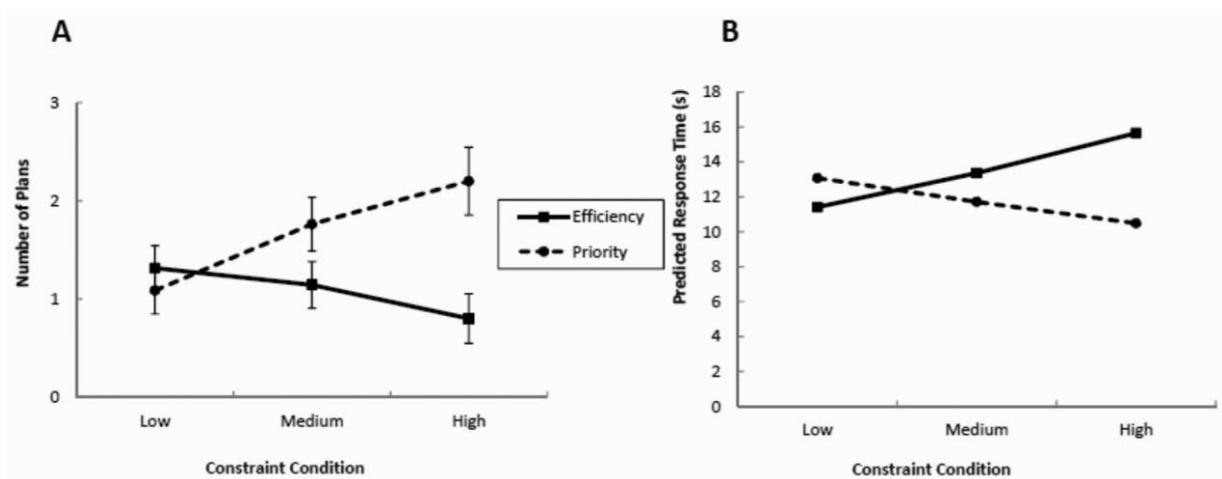
We also predicted that constraint would increase the accessibility of priority plans relative to efficiency plans, such that the speed of generating priority plans relative to efficiency plans would increase. To test this prediction, we analyzed the log-transformed response times using a random intercept hierarchical model that allowed us to model within-subjects effects despite different numbers of observations for different participants. This analysis also allowed us to distinguish within-person effects from illusory effects due to aggregating heterogeneous consumers (Hutchinson, Kamakura, and Lynch 2000). The model's predicted response times (converted to seconds) to generate efficiency and priority plans as a function of constraint condition are shown in figure 2B. Consistent with hypothesis 2b, the speed of reporting priority plans relative to efficiency plans increased with constraint condition, reflected in an interaction between plan type and the linear effect of constraint ($\beta = -.13, z = -2.03, p = .042$). For additional analytical details please see appendix E, available online.

Discussion

Study 2 supports hypotheses 2a and 2b by showing that the planning mix varies with constraint. As perceived constraint increased, the proportion and speed of generation of priority plans increased relative to efficiency plans. These results refer to how constraint changes the planning mix on average. We also analyzed how the pattern of efficiency planning and priority planning played out longitudinally over time (for details see app. E, available online). This analysis showed that the two types of planning "interfered"

FIGURE 2

STUDY 2: NUMBER OF PLANS AND PREDICTED RESPONSE TIMES BY CONSTRAINT CONDITION



NOTE.—A, Number of plans by constraint condition with standard errors. B, Predicted response times by constraint condition, derived from random intercept hierarchical model.

with one another, such that transitions to the same plan type were faster and more likely than transitions to the other type. This result follows from the literature on memory retrieval showing that people tend to enter a category and retrieve instances in clusters (Gruenewald and Lockhead 1980; Hutchinson, Raman, and Mantrala 1994) and further supports the notion that efficiency planning and priority planning are distinct cognitive categories. A further implication of this result is that thinking about solving a constraint problem by one method makes one momentarily less likely to think of a solution of the other type and slower to do so. In study 3 we further examine how planning of one type relates to the likelihood of enacting a plan of the other type.

STUDY 3: PLANNING FOR TIME IN A VIRTUAL SHOPPING MALL

In study 3, we examine efficiency and priority planning in a dynamic, experientially immersive environment, and we extend the analysis to the domain of planning for time. We used MATLAB software to create a virtual environment that simulates a shopping trip in a mall. Participants visited virtual stores and made purchases to complete three shopping lists. Each move in the game used a certain amount of simulated time. We manipulated constraint by varying the simulated time budget participants were given to complete their shopping trips.

Participants could engage in efficiency planning by visiting maps positioned in the mall that indicated the location of different store types throughout the mall and the items available in each store. They could adopt an efficiency planning strategy by visiting a map and determining an efficient route that would allow them to complete their list in fewer simulated minutes. Alternatively, they could take a more haphazard and less efficient route, which was also less cognitively effortful (e.g., moving from one store to the next). Real time using the map did not count against simulated time. The only cost in simulated time was the small amount of travel time to and from the map. Maps were centrally located such that travel time to them was relatively short from anywhere in the mall. Thus, the primary cost of efficiency planning was the cognitive effort required to design an efficient route and execute it correctly. The benefit of efficiency planning was a substantial savings in simulated time.

We also gave participants the ability to prioritize. Participants were given a single time budget to shop at three separate malls and could choose how much time they allocated to each of three malls. The monetary incentive in the third mall was double that in the first two. However, participants were not allowed to go back to previous malls after leaving and had to complete the malls in sequential order. Thus, participants could prioritize by leaving the first two malls early to achieve higher rewards in the third mall. In some conditions, the time budget was insufficient to accomplish everything; timely prioritization was vital to achieving the highest payoff. This allowed us to study the

interplay of efficiency planning and priority planning as participants shopped with different time constraints. A full description of the paradigm is provided in appendix A.

Hypotheses and Predictions

Planning Mix. To generalize the results of study 2, we varied the time budget across conditions, creating three levels of constraint. Similar to the effect of constraint on the planning mix in study 2, we predicted that prioritization would increase with increasing constraint and be reflected in participants leaving malls 1 and 2 earlier in exchange for more valuable returns in mall 3.

In study 2, we found that transitions to the same plan type were faster and more likely than transitions to a different plan type. We expected a similar effect here; participants engaging in more intensive efficiency planning (i.e., spending more real time at the map with the simulated clock stopped) would use more of their time budgets before prioritizing by moving to the more valuable mall 3.

Insufficient Prioritization and Dysfunction. Including monetary payoffs in this study allowed us to encourage prioritization and to test how participants respond in mall 3 when they fail to prioritize adequately in malls 1 and 2. Previous research suggests that many participants will not prioritize soon enough. Consumers dislike making trade-offs and only spontaneously consider opportunity costs (as in priority planning) under certain circumstances (Frederick et al. 2009; Spiller 2011). They also tend to persevere too long for a marginal payoff at the expense of better opportunities (Koehler and Massey 2011). Moreover, prior work on the planning fallacy shows that people are overoptimistic about the likelihood of accomplishing monetary and time goals (Buehler et al. 2010; Ülkümen, Thomas, and Morwitz 2008). Participants may convince themselves that they can complete their lists in the earlier malls *and* complete the third mall (cf. Peetz and Buehler 2009). Given strong evidence from previous research, we treat this prediction as an assumption we will verify in the data, rather than as a novel hypothesis.

Given our assumption that prioritization will be inadequate, we can ask how people will react when they arrive in mall 3 without sufficient time to complete their goals. One possibility is that participants will respond by being especially efficient. As time elapses and payoffs are high, it is especially important to make the most of each minute. However, research suggests that when consumers fail to prioritize adequately and their errors become apparent, they are likely to respond dysfunctionally, compounding the mistake. Townsend and Liu (2012) show that considering a concrete plan for goal implementation creates emotional distress for those in poor goal standing, undermining their motivation for self-regulation. Other research shows a complex set of emotional and cognitive responses to failures that are often dysfunctional, including the “what the hell effect” and “choking” under pressure (Beilock and Carr 2005; Haws, Bearden, and Nenkov 2012; Wilcox, Block, and Eisenstein 2011; Zemack-Rugar, Corus, and Brinberg 2012). Thus we

predict that some consumers who fail to prioritize adequately will compound their error by behaving dysfunctionally and inefficiently in mall 3.

H3: Under high constraint, consumers who prioritize insufficiently are likely to compound the mistake by becoming inefficient in their use of the remaining time.

Methods

Sixty-two undergraduate business students at University of Colorado Boulder participated for partial course credit and for the opportunity to earn money based on their performance. They were randomly assigned to one of three levels of constraint: low constraint (320 simulated minutes), medium constraint (260 simulated minutes) or high constraint (200 simulated minutes). Software testing demonstrated that with optimal efficiency planning, each mall's list could be completed in just under 90 simulated minutes, or 270 minutes for all three malls. In the low-constraint condition, participants therefore had enough time to complete all three malls with perfect efficiency. In the medium-constraint condition they had enough time to get almost everything done at the three malls, but perfect performance was not possible. In the high-constraint condition they did not have nearly enough time to complete all three malls.

Participants were compensated based on their performance such that purchases in mall 3 were more valuable than those in malls 1 and 2. Participants were paid \$1 for completing their eight-item list in malls 1 and 2, but earned \$2 for completing the list in mall 3. Moreover, participants could earn lottery tickets to win a \$20 prize; they earned one lottery ticket for each item purchased in malls 1 and 2 but earned two lottery tickets for each item purchased in mall 3. Participants were reminded about the payoff structure in the instructions and by the experimenter.

Participants first completed instructions and training with a tutorial to familiarize them with the shopping program. Participants then completed their allotted time budget in the three malls. Finally, they answered demographic questions and completed the propensity to plan scale (Lynch et al. 2010). Additional procedural details are provided in appendix B.

Our key dependent variables were measures of efficiency planning and prioritization. We operationalized efficiency planning as the amount of real time spent at the map divided by the real time spent in the mall. As this number increases, the participant is engaging in more efficiency planning per unit of time. We also created a measure of prioritization reflecting the amount of time spent in the third mall in excess of what would be expected given the participant's rate of purchasing items across all three malls. As this number increases it suggests that the participant decided to leave the first two malls earlier than would be expected if he or she had not engaged in priority planning. To evaluate the sufficiency of planning and dysfunctional behavior as a reaction

to prioritization failure, we calculated several additional performance measures. More details on these measures are provided in appendix C.

Results

Planning Mix. First, we analyzed prioritization scores to test whether priority planning increased with constraint. Prioritization scores by constraint condition are shown in figure 3A. We analyzed the scores with a between-subjects ANCOVA with constraint as a between-subjects factor and efficiency planning in malls 1 and 2 as a covariate (the result was the same if the covariate was not included). As predicted there was a significant effect of constraint condition on prioritization ($F(2, 58) = 5.32, p < .01$). Post hoc comparisons indicated that those in the 200-minute condition prioritized more than in the other two conditions (both $p < .05$). The 320- and 260-minute conditions did not differ ($p > .5$). This broadly replicates the result in study 2. Also similar to study 2, efficiency planning did not vary with constraint. On average, people spent 51% of their real time in malls 1 and 2 looking at the map, but this did not vary with constraint ($F(2, 59) = 0.32, NS$).

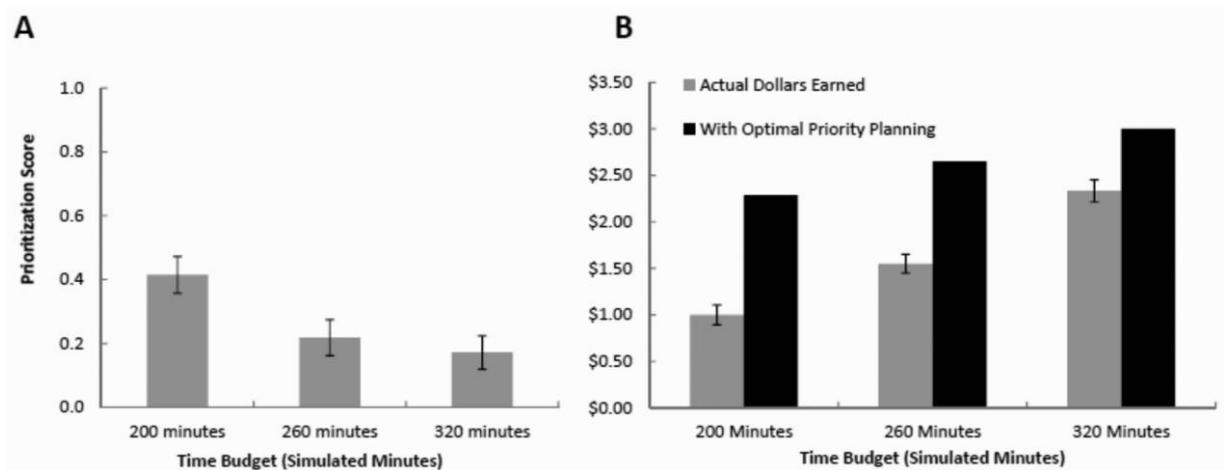
We predicted that those who engaged in more efficiency planning in malls 1 and 2 would be slower to prioritize and move to mall 3 with higher payoffs. Supporting this prediction, prioritization was negatively related to efficiency planning in malls 1 and 2 ($\beta = -.54, t(58) = 3.86, p < .001$). The zero-order correlation between efficiency planning in malls 1 and 2 and prioritization was $r = -.45, p < .001$. We found a similar negative correlation between efficiency planning in malls 1 and 2 and the number of simulated minutes remaining when one entered mall 3 ($r = -0.27, p = .035$). Apparently, those who engaged in more efficiency planning in malls 1 and 2 (i.e., spent proportionally more time at the map) prioritized later and entered mall 3 with less remaining time.

Insufficient Prioritization and Dysfunction in Mall 3. Next we looked at the sufficiency of prioritization. Participants in all conditions allowed themselves about equal amounts of time remaining in mall 3 ($F(2, 59) = 1.30, p = .28$, with means of 102, 72, and 83 simulated minutes from their original time budgets of 320, 260, and 200 simulated minutes). In all conditions, only 40.3% completed their high-payoff shopping list in mall 3, and this did not vary across conditions ($\chi^2(2) = 1.93, p = .38$).

In all conditions performance was substantially suboptimal. As an illustration, figure 3B shows the dollars earned by constraint condition and the dollars that could have been earned if purchases were allocated across the malls optimally. Actual earnings are significantly less than optimal earnings. For instance, in the high-constraint condition, participants earned \$1.00 on average on 13.29 items purchased. If participants had merely gone straight to the third mall and purchased eight items, they would have earned \$2.00. The pattern is similar albeit less extreme for lottery tickets earned. Prioritizing too late rather than too early primarily

FIGURE 3

STUDY 3: PRIORITIZATION SCORES AND ACTUAL AND POTENTIAL DOLLARS EARNED BY TIME BUDGET CONDITION



NOTE.—A, Prioritization scores by time budget condition with standard errors. B, Actual dollars earned with standard errors (gray bars) and potential dollars earned using optimal priority planning (black bars), by time budget condition.

drove suboptimal performance. Of the 25 participants who completed mall 3, only eight left more than 50 simulated minutes on the table.

We predicted that some participants who failed to prioritize sufficiently and entered mall 3 with insufficient time would react dysfunctionally. To test this, we calculated a measure of actual efficiency in mall 3 by dividing the number of purchases by the number of stores visited. A more efficient plan maximizes this measure, since visiting and inspecting stores is costly in simulated minutes. Controlling for actual efficiency in malls 1 and 2, entering mall 3 with fewer simulated minutes predicted being less efficient ($F(1, 54) = 6.30, p < .05$). Similarly, prioritization scores positively predicted actual efficiency in mall 3, controlling for actual efficiency in malls 1 and 2 ($F(1, 54) = 4.89, p < .05$); those who prioritized later were less efficient in mall 3.

The decreased efficiency in mall 3 appeared to be driven by participants entering mall 3 with little time reacting by visiting more stores per unit of time, which made them inefficient. A mediation analysis showed a significant indirect effect of time left entering mall 3 on actual efficiency via the mediator of store visits per minute; a 95% CI on the bootstrapped estimates of the indirect effect did not include 0, lower CI = .0009, upper CI = .0028. Those with less time left visited more stores per minute ($a = -.002, t = 4.16$); the partial effect of store visits per minute on actual efficiency was negative ($b = -10.36, t = 6.83$). The direct (partial) effect of time left on actual efficiency was not significant ($c = .0008, t = 1.55, p = .127$), consistent with indirect-only mediation (Zhao, Lynch, and Chen 2010).

We also analyzed whether people who left themselves insufficient time in mall 3 abandoned trying to plan altogether or rather were worse at converting efficiency planning into efficient shopping. The results support the latter interpretation. Prioritization had no effect on efficiency planning (i.e., map time per real time; $r = -.01$), only on actual efficiency. Moreover, there was a strong relationship between efficiency planning and actual efficiency in mall 1 ($r = .66, n = 58, p < .001$) and mall 2 ($r = .75, n = 58, p < .001$), but in mall 3 this relationship diminished greatly ($r = .36, n = 55, p = .007$). The correlation in mall 3 was significantly weaker than the corresponding correlations in mall 1 ($z = 2.17, p = .015$) or in mall 2 ($z = 3.27, p < .001$). In a multiple regression model that predicted actual efficiency in mall i by efficiency planning in mall i , controlling for efficiency planning in mall ($j \neq i$), the slope of the relationship between efficiency planning and actual efficiency was roughly half as big in mall 3 ($\beta = .47, t = 1.68, p = .101$), as in mall 1 ($\beta = 1.02, t = 5.89, p < .001$) or mall 2 ($\beta = .86, t = 5.69, p < .001$). Additional analyses are presented in appendix C.

Discussion

The results of study 3 broadly replicated the results from study 2 with an entirely different paradigm examining planning for time instead of money. As in study 2, prioritization increased with constraint. Moreover, participants who used the map more per unit of real time in the first two malls were slower to move to the more valuable third mall. This resembles the “interference” effect in study 2, but it is an

open question how closely related the effects in these two studies are. Whereas in study 2 memory retrieval effects are likely responsible for the effect, the effect in this study could reflect multiple processes such as “goal gradient” (Jhang and Lynch 2015; Kivetz, Urminsky, and Zheng 2006) or “inside” thinking like the type implicated in the planning fallacy (Kahneman and Lovallo 1993). Understanding the antecedents of this effect would be a useful avenue for research.

A novel result of this experiment is that many participants who failed to prioritize sufficiently reacted dysfunctionally in the third mall. Rather than making the best of their situation, they responded by speeding up the rate at which they visited stores and consequently performed less efficiently, like a “chicken with its head cut off.” This speeding up in response to time pressure is reminiscent of Ben Zur and Breznitz (1981) and Payne, Bettman, and Johnson (1988), except that here, trying to do the same thing faster impaired performance. Participants who prioritized less were thus less able to translate efficiency planning to efficient completion of their shopping lists. In the next section we explore whether budgeting prior to resource consumption helps attenuate dysfunctional reactions to constraint.

POTENTIAL BENEFITS OF BUDGETING

The dysfunctional behavior in study 3 is just one instantiation of a variety of suboptimal behaviors that have been documented in previous research. Based on our reading of the literature, there may be two broad classes of dysfunctional reactions. First, as in study 3, consumers may behave erratically or impulsively, essentially trying to do too much with the limited resource. As a consequence they become less effective at translating plans into desirable outcomes. Second, consumers who realize that no amount of planning can lead to an optimal outcome may be demoralized, leading them to abandon planning altogether. In the following studies we measure both of these classes of dysfunctional responses.

We propose that budgeting prior to resource consumption can help people to increase priority planning and avoid dysfunctional reactions like these. Budgeting is a special form of priority planning that occurs prior to encountering a resource consumption decision. Budgeting is more specific than merely stating abstract priorities. In holiday shopping, for example, budgeting may entail specifying exactly how much to spend on each person’s gift, whereas prioritizing may simply involve figuring out which gifts are more important than others.

We propose that people who do not engage in prior budgeting are hazy in their assessments of whether constraint is intense enough to justify prioritizing one goal over another. They may either be oblivious to an impending shortage of slack, or the vagueness of the situation may allow them to deceive themselves that prioritization is not yet required. Ambiguity causes people to be flexible in their mental accounting to convince themselves that a purchase is justifiable (Cheema and Soman 2006; Mishra et al. 2013)

and allows them to self-deceive (Sloman, Fernbach, and Haggmayer 2010). Setting budgets and tracking expenses decreases this type of ambiguity. Mental budgets provide a specific reference point with which to evaluate one’s spending, and tracking expenses facilitates the monitoring of one’s behavior relative to those reference points (Heath, Larrick, and Wu 1999; Krishnamurthy and Prokopec 2010). In addition, the specificity of prior budgets make them like “implementation intentions” and hence more likely to be retrieved and followed when cued. Budgeting causes people to pre-commit to certain expenditure levels, and people are motivated by a desire for consistency between stated intentions and behaviors (Bayer, Gollwitzer, and Achtziger 2010). We therefore predict that budgeting prior to resource consumption will increase the shift in the planning mix toward prioritization and decrease dysfunctional behaviors.

H4a: Budgeting prior to resource consumption and monitoring expenses increases the shift in the mix of planning strategies toward prioritization relative to efficiency.

H4b: Budgeting prior to resource consumption and monitoring expenses decreases dysfunctional behaviors.

Our theory posits that planning and dysfunctional behaviors are different ways of reacting to increasing constraint. Thus, a more specific hypothesis is that these effects should be concentrated among those who are highly constrained. It is when one is close to a binding constraint that budgeting is most useful in clarifying an emerging problem in time to cope by increasing prioritization.

H4c: The effects of budgeting on prioritization and dysfunction will be greater for those who are highly constrained.

Before testing these hypotheses experimentally, we conducted a correlational pilot study. In December 2012, we recruited 153 US residents via MTurk to complete a holiday shopping survey for a \$0.70 payment. Participants responded to a series of questions about their tendency to engage in efficiency planning, priority planning, and budgeting. Details of the study and its results are included in appendix F, available online. To measure planning we asked about the same behaviors used in the pilot study for study 1, except that we ran the study in December and adapted the questions to holiday shopping. We averaged the five priority planning responses to create a measure of priority planning and averaged the three efficiency planning responses to create a measure of efficiency planning. Then we computed a “planning mix” measure by subtracting the rated frequency of efficiency planning behaviors from the frequency of priority planning behaviors, such that higher numbers imply greater relative use of prioritization. We also collected a two-item measure of subjective financial constraint, a two-item measure of tendency to budget for holiday shopping, and a two-item measure of dysfunctional responses to overspending.

The results were consistent with hypotheses 4a–4c. More budgeting was associated with greater priority planning relative to efficiency planning, and with less reported dysfunction, such as shopping erratically and giving up on trying to control spending. Moreover, these effects interacted with self-reported financial constraint. More constraint was associated with more dysfunction for low budgeters but not high budgeters ($t(149) = -2.959, p = .0036$). More constraint was associated with increased prioritization relative to efficiency planning for high budgeters but not low budgeters ($t(149) = 2.223, p = .0278$).

Study 4 was designed to test for similar effects when budgeting was manipulated rather than measured. We conducted a field experiment where participants either did or did not budget prior to traveling for spring break. After the trip, they responded to measures of planning, dysfunction and perceived constraint similar to those used in the pilot study.

STUDY 4: BUDGETING FOR SPRING BREAK

Students at University of Colorado Boulder who were traveling for spring break were recruited to participate in a two-part study. In the first part, they visited the lab prior to spring break and provided a baseline measure of efficiency and priority planning. Half of the students were randomly assigned to budget for their upcoming spring break trip while the other half completed an unrelated task. In the week after spring break, students reported on their spending behaviors during the spring break trip. The measures we used were similar to those from the pilot study but with additional items used to explore a greater variety of dysfunctional behaviors.

Methods

Seventy-five business students (7 MBA, 68 undergraduate) at University of Colorado Boulder participated in return for a \$10 payment. Two participants who did not travel over spring break were excluded from analysis. Wave 1 of the study occurred in the week prior to spring break. Students came to the lab and were first asked about their tendency to engage in efficiency and priority planning during the past holiday shopping season, as a baseline measure, using the same measures from the pilot study. Next, participants in the budgeting condition completed a detailed budgeting exercise in which they planned out their expected travel expenses in an excel template. Procedural details are provided in appendix D. They were instructed to keep their completed budget sheet with them while they traveled to log their actual expenses. Participants in the control condition completed an unrelated study.

Wave 2 occurred in the week after spring break. Students completed an online survey asking them about efficiency and priority planning during their spring break trip. We used the same three measures for efficiency planning ($\alpha = .65$)

and five measures for priority planning ($\alpha = .82$) as in part 1 but adapted for spring break travel expenses.

Next, participants responded to nine questions about dysfunctional behaviors. The first eight questions were measured on a 7-point scale, ranging from 1 = not at all, to 7 = very much. These questions began with the following stem: “During your spring break trip, when thinking about your trip spending, to what extent have you done the following” and ended with (1) “throw your hands up and figure you’ll deal with it after the trip is over”; (2) “pushed financial concerns out of your mind,” (3) “tried not to think about how much you were spending”; (4) “decided to forego budgeting during this trip”; (5) “found yourself making erratic shopping decisions and not shopping as carefully”; (6) “worried about your spending decisions”; (7) “had trouble making a purchase decision”; and (8) “made purchases impulsively.” We also asked participants whether they spent more or less money than they had original anticipated, anchored by 1 = spent much less than expected, 4 = spent the same as expected, and 7 = spent much more than expected.

Those in the budgeting condition then uploaded the budget that they had completed in the lab before spring break. All participants next reported perceived financial constraint on using two items (“During this past semester in general, how would you describe your financial situation?” 1 = very constrained; 5 = very comfortable. “Imagine that next month you had an unexpected expense of \$1,500 such as a medical bill or a necessary car repair. How likely is it that you would be able to pay this bill in full and on time without having to dip into your retirement fund, borrow money or charge it to a credit card?” 1 = very unlikely; 11 = very likely), reverse coded so that higher numbers reflect higher constraint, converted to Z scores and averaged for analysis ($M = 0, SD = .83$). Participants also answered demographic questions.

In our analysis of the dysfunction measure, we first had to purify the scale and determine if it was unidimensional (Churchill 1979; Gerbing and Anderson 1988). When including all nine items of this measure in a confirmatory factor analysis, a one-factor model was rejected ($\chi^2 = 71.802, df = 27, p < .001$). We ran an exploratory factor analysis to determine which items loaded on the same factors. We removed items 6 (worried about spending) and 7 (trouble making decision). The remaining seven items fit a one-factor model ($\chi^2 = 20.57, df = 14, p = .113$) and formed a reliable scale, $\alpha = .80$.

Results

Budgeting and the Planning Mix. To test hypothesis 4a we ran a moderated regression on the reported spring break planning mix (priority planning – efficiency planning) as a function of the budgeting manipulation (1 = budget, –1 = control), constraint, and their interaction, using wave 1 planning mix as a covariate. Perceived constraint was unaffected by the budgeting manipulation ($F(1, 71) = 1.29, p = .26$). Consistent with our findings in the pilot study, there was a significant constraint \times budgeting interaction ($t(68) = 2.04$,

$p = .046$); budgeting pushed the planning mix toward relatively more prioritization, and this effect was magnified by constraint, as depicted in figure 4. The simple slope of constraint was not significant for either budget or control group (all $p > .1$). A floodlight analysis (Spiller et al. 2013) found that the positive simple effect of budgeting on planning mix was significant for all values of constraint above the Johnson-Neyman point of 0.35. This suggests that for people facing high financial constraint, budgeting shifted the planning mix toward more prioritization relative to efficiency planning.

Budgeting and Dysfunction. We analyzed our dysfunction index as a function of the budgeting manipulation, constraint, and their interaction, coded as in our analysis of the planning mix. We found a simple main effect of budgeting at constraint $z = 0$; budgeting decreased dysfunction ($\beta_{\text{budgeting}} = -.344$, $t(69) = -2.63$, $p = .011$). There was also a marginal main effect of constraint ($\beta_{\text{constraint}} = .297$, $t(69) = 1.88$, $p = .064$). Though there was a directional trend for the effect of budgeting to be stronger under higher constraint, we did not replicate our finding from the pilot for study 4 of a budgeting \times constraint interaction ($\beta_{\text{budget} \times \text{constraint}} = -.052$, $t(69) = -0.326$, $p = .745$).

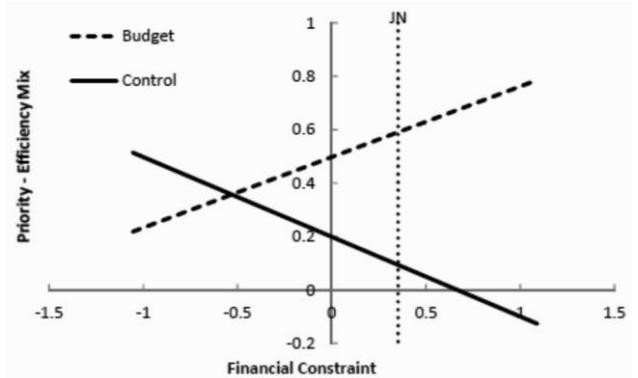
Discussion

Consistent with the pilot study, budgeting shifted the planning mix toward more prioritization relative to efficiency planning, and this tendency was greater for those who reported higher subjective constraint. Budgeting also decreased dysfunctional responses to overspending. The one result that did not replicate from our pilot study was the interaction of budgeting with constraint on dysfunctional behaviors. This effect was directionally consistent with the pilot but not close to statistical significance. To determine whether this null result should be coded as a “failure to replicate,” we conducted two meta-analytic tests from Rosenthal and Rosnow (1991). First we tested whether the interaction p -values in the two studies were significantly different. They were not ($Z = 1.41$, $p = .14$). Thus, we cannot reject the null hypothesis that the two effects come from a common distribution. Second, we tested for the significance of the interaction, combined across the two studies, and weighted by sample size. This was significant ($Z = 2.26$, $p = .024$). Taken together, the two studies provide some support for the premise that the benefits of budgeting in ameliorating dysfunctional response to overspending are greatest for those with higher constraint, but this merits future research. These results are notable in light of research showing that highly constrained individuals are less susceptible to many classic context effects in judgment and decision making (Shah, Shafir, and Mullainathan 2014). Thus, budgeting appears to be a more promising corrective for those in need than subtler framing manipulations sometimes advocated in the behavioral finance literature.

Finally, study 4 confounded the effects of budget setting and budget monitoring, as those in the budgeting condition

FIGURE 4

STUDY 4: EFFECT OF BUDGETING ON PLANNING MIX



NOTE.—The dotted vertical line indicates the Johnson-Neyman point; when financial constraint is greater than 0.35 ($M_{\text{constraint}} = 0$, $SD = .83$), the difference in planning mix between budgeters and control participants is significant.

were instructed to monitor their spending relative to the budget throughout their trip. Future research should examine the separate and interactive effects of budget setting and monitoring. There is evidence that budgeting does not work for some people in some circumstances (Transparency Project 2014). Perhaps creating budgets without adequate monitoring is insufficient to achieve the beneficial effects documented in study 4 and the pilot study.

GENERAL DISCUSSION

Across four studies and two pilots, we explored how consumers plan to cope with resource constraint. We distinguished two kinds of planning. Efficiency planning is characterized by behaviors that get the most out of a resource without considering opportunity costs from competing goals, and without making explicit trade-offs. Priority planning occurs when one accepts that the resource is too constrained to accomplish everything, decides what is most important, and forgoes less important goals.

This research takes an initial step in developing a theory of these two types of planning. Findings across the studies generally supported the psychological properties we predicted to be associated with the two types of planning. In a pilot study and in study 1, we found that priority planning feels like a loss, whereas efficiency planning feels free, despite the fact that it often necessitates cross-resource trade-offs. Evidently, the substitution of one resource for another feels like an accomplishment rather than a loss. Efficiency plans involve “local” thinking that results in a solution that feels more similar to one’s initial plan, perhaps contributing to the sense that one is avoiding a trade-off. Priority plans are perceived as generating greater resource savings on a

single occasion. They are good for solving an acute temporary problem, though we find that efficiency plans tend to yield savings repeatedly and can add up over time. Future work should examine the cumulative effect of repeated efficiency versus priority plans on savings.

These differential psychological properties help to explain why the mix of efficiency and priority plans varies with constraint in the ways we showed in studies 2–4. Consistent with work on goal-derived categories, we found that as constraint increases, priority plans become more accessible in memory and are produced more often relative to efficiency plans. With modest constraint, the planning mix is more balanced between the two types of coping response. We would conjecture that these conditions make it easier to become caught up in efficiency planning responses because efficiency planning feels good and effective in the moment. This can lead to inaccessibility of priority plans.

In study 3 we pursued these ideas in a shopping task where time was the scarce resource. Though participants prioritized more in response to increased constraint, most respondents could have made more money by moving more quickly to the last mall where payoffs were doubled. Moreover, those who focused more on efficiency planning in the first two, lower payoff malls, were late to arrive at the third mall. Ironically, the later they were to arrive at the third mall, the more they responded with frantic but ineffective attempts to make the most of their remaining time. Those arriving later visited more stores per unit of time and were therefore less effective at translating efficiency planning into actual efficient use of their time to increase payoffs.

Finally, in study 4 we showed that budgeting tilts the adaptive response toward more priority planning and reduces dysfunctional responses to overspending. This may be because budgeting reduces vagueness in the constraint level, and budgeters are therefore less likely to be surprised by a shortage that leaves them unable to cope.

Future Research

Given that this is the first article exploring the consumer psychology of efficiency and priority planning, there are several areas of the research deserving of deeper exploration. Below we elaborate on three avenues for future studies.

1. Deeper Exploration of Dysfunctional Reactions to Constraint. In study 3, we showed that consumers who failed to prioritize in a time-planning task reacted dysfunctionally when the error became apparent. They appeared to act in a frantic manner in mall 3, trying to do too much in the limited time, which led to poor outcomes. In the budgeting studies we asked about a variety of dysfunctional behaviors including those of this erratic variety and those that are better characterized as capitulation or “giving up.” Surprisingly, responses to all of these items loaded on a single factor. Of course, this does not mean that the distinction between these two different kinds of dysfunctional reactions is not a meaningful one. On the contrary, we suspect that these two classes of behaviors may have distinct antecedents and conse-

quences. Does it matter if one realizes that one is short of a resource due to one’s own failures to manage the resource or if the resource shortage is attributed to external factors? Is the response that dominates a function of the discrepancy between aspirations and what one now realizes is possible?

Relatedly, what are the emotional correlates of these two dysfunctional responses of throwing up one’s hands and trying to do too much? If frantic responses are accompanied by a sense of anxiety and heightened arousal, does this produce inability to translate efficiency planning to efficient outcomes? One might expect that arousal would lead to narrowing of attention to the most diagnostic cues in the environment (Easterbrook 1959; Pham 1996). Alternatively, the elevated levels of arousal may increase cognitive load (Fedorikhin and Patrick 2010), inhibiting the effective translation of planning into outcomes. Capitulation responses may be particularly relevant to the study of poverty, where consumers often perceive a lack of control over their fates, accompanied by feelings of hopelessness and despair (Wilson 2011).

2. Deeper Exploration of “Interference” Effects. In studies 2 and 3 we found that efficiency planning and priority planning at one point in time affected the likelihood and speed of engaging in the other type of planning. This may be related to what Mullainathan and Shafir (2013) call “tunneling,” the tendency for resource scarcity to inhibit consideration of nonfocal goals. These effects are complex and likely to be multiply determined. What are the roles of purely cognitive processes like memory interference (Alba and Chattopadhyay 1985) versus motivational effects (Brendl, Markman, and Messner 2003; Shah, Friedman, and Kruglanski 2002), and do these effects generalize outside the laboratory?

3. Why Does Efficiency Planning Feel Free? We found that efficiency planning for money felt less costly than priority planning and more like an accomplishment, despite requiring greater expenditure of time and energy. We hypothesized that cross-resource trade-offs are generally less painful than within-resource trade-offs. Future work should test this hypothesis across other contexts and explore its antecedents. Under what conditions do consumers neglect or discount the costs of cross-resource trade-offs?

Conclusions

This research provides some guidance for consumers who want to improve at planning their time or money. What we decide to forego is often just as important in determining outcomes as how hard or efficiently we work to achieve a goal. Unfortunately, all too often, prioritization comes to mind when it is already too late. Consumers should be mindful of this and avoid getting stuck in the “efficiency trap.” Efficiency may feel right in the moment, but it is counterproductive if it comes at the expense of more important priorities. Consumers should create budgets (financial or temporal) to facilitate a clear view of the constraint level

and make hard choices early and often. Finally, if consumers find themselves in a tight spot, they should fight the tendency to react dysfunctionally, which only makes a bad situation worse. They should pick the best of what seem like bad options relative to their original goals and accomplish what they can as efficiently as possible.

This article adds to a growing body of research on the psychology of scarcity (Mani et al. 2013; Martin and Hill 2012; Mullainathan and Shafir 2013; Peñaloza and Barnhart 2011; Shah et al. 2012; Sharma and Alter 2012). Some of this work has sought to understand the antecedents of poverty with an eye to helping consumers make short-term decisions that better match their long-term goals. We admire this application of behavioral research to the understanding and improvement of consumer welfare. It is not only the financially poor who can benefit from psychological insights about how people use planning to cope with shortage. Ev-

eryone is short of something at one time or another, and everyone has had the experience of wishing they had planned differently or adjusted their plan more beneficially in the moment.

DATA COLLECTION INFORMATION

The data for the pilot to study 1, study 1, study 2, and the pilot to study 4 were collected via MTurk in the summer of 2013, spring of 2014, fall of 2012, and fall of 2012, respectively. The data for study 3 were collected by research assistants at the University of Colorado Boulder in the fall and winter of 2011, under the supervision of the first and third authors. The data for study 4 were collected by the second author and research assistants at the University of Colorado Boulder in the spring of 2014. All three authors jointly analyzed the data.

APPENDIX A

ADDITIONAL METHODOLOGICAL DETAILS FROM STUDY 3

Description and Screenshots of Virtual Shopping Paradigm Used in Experiment 3

The virtual shopping paradigm consists of a graphical user interface (GUI) programmed in MATLAB. It includes the following elements:

1. The largest item on the screen is a schematic of the mall depicting the location of stores, the location of maps, and the current location of the participant. The display changes as the participant executes actions. There are 28 stores arranged around the periphery of the mall and maps at four locations toward the center of the mall. There are eight different types of stores: Book Store (three locations), Clothing Store (four locations), Electronics Store (three locations), Housewares (four locations), Jewelry Store (three locations), Pharmacy (four locations), Sporting Goods (four locations), and Toy Store (three locations). Store types are indicated by a single letter (e.g., "S" denotes sporting goods). The store type is only revealed when the participant moves to the adjacent store. The distribution of store types in the mall is always the same, but the locations vary for different shopping trips within the same experimental session. At the bottom left of the screen is a legend that reminds participants of the type of store denoted by each letter.
2. There is a set of buttons that the participant pushes to execute commands. The button labels and commands are as follows:
 - a) "Go to next store:" This button moves the participant to an unexplored adjacent store. If both or neither of the adjacent stores have been explored, the program chooses randomly which of the two adjacent stores to move to.
 - b) "Choose store:" When this button is clicked, participants can move the cursor to any store, click on it, and they will move directly to that store.
 - c) "Go to nearest map": When this button is clicked, participants move directly to the nearest map.
 - d) "Inspect store": When positioned next to a store, participants can click this button to reveal the list of items available at that store. When the button is clicked, a window opens listing the available items. Beneath the list are two buttons, "make purchase" and "done." If any of the items on the shopping list are available in the store, the "make purchase" button will be active and when clicked, will purchase the item(s). Clicking "done" closes the window.
 - e) "View map": When positioned next to a map, this button will be active and when clicked will reveal the map. The map opens to the right of the main schematic and looks identical, except it is smaller. The map contains two kinds of information not available on the schematic. First, the store type of every store in the mall is visible. Second, by clicking on a store participants can view the items available in that store. These items appear as a list to the right of the map and disappear when the participant clicks on a different store or closes the map. The participant closes the map by clicking the "done" button beneath it.
3. There are three types of clocks positioned to the right of the main schematic: Each action in the simulation takes a certain amount of simulated time, and participants are given a time budget to complete the shopping list.

- a) The top clock shows the simulated time remaining. This clock is slightly larger than the others and flashes red a few times after each action, as the simulated time remaining changes.
 - b) The middle clock shows the simulated time spent on the last action.
 - c) The bottom clock shows the simulated elapsed time.
4. The amount of simulated time for each action is as follows:
- a) Travel time depends on Euclidean distance. Traveling to an adjacent store takes 2 simulated minutes. Traveling from one corner of the mall to the other (the longest possible travel distance) takes about 20 simulated minutes.
 - b) Inspecting a store takes 5 simulated minutes.
 - c) Making a purchase takes 5 simulated minutes.
 - d) Viewing the map does not take any time. However, the participant must travel to the map. Travel time to the map depends on location in the mall and varies between 3 and 4.2 simulated minutes.
5. To the right of the clocks are a list of “items needed” and a list of “items purchased”: The “items needed” list shows items the participant must purchase to complete the shopping trip. The list items come from different store types, and the store type is obvious based on the item. For instance, “decongestant” is clearly found in a pharmacy. The “items purchased” list is empty to begin with. When an item is purchased, it moves automatically from the “items needed” list to the “items purchased” list. The trip is complete when the “items needed” list is empty.

Screen shots of the GUI as it appeared upon first entering a mall, when viewing a map, and during a store inspection are shown below (some text is enlarged in the images relative to what participants saw to make it more visible). Participants always began the shopping trip in the southwest corner of the mall. The shopping list always contained eight items from six different store types. Two store types had two different items represented on the list. For instance, the list might contain “bedding” and “plates,” both found in Housewares. Aside from the eight items on the list, the stores had various other items that are typical of their store type. The selection of items in each store was determined pseudo-randomly.

FIGURE A1

GRAPHICAL USER INTERFACE SCREEN AS IT APPEARED WHEN A STUDY 3 PARTICIPANT FIRST ENTERED A VIRTUAL MALL

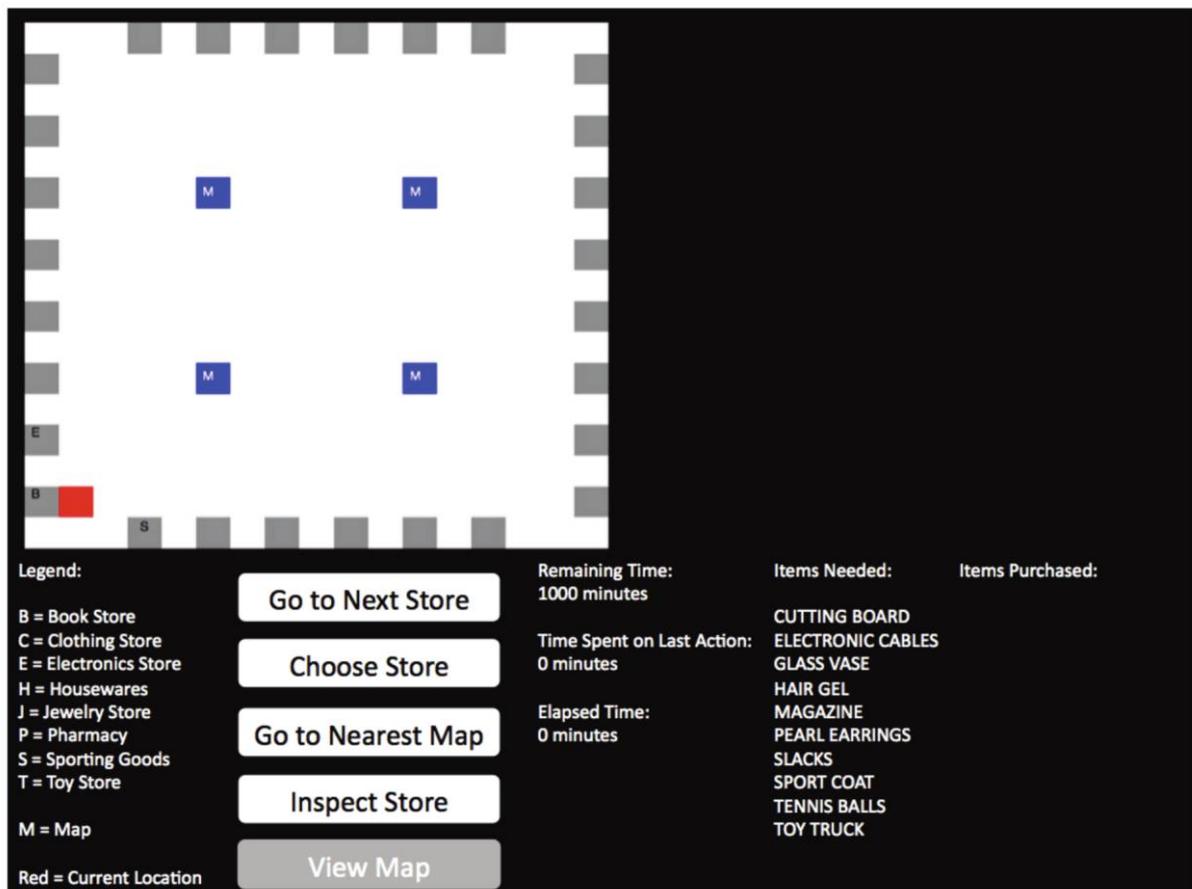


FIGURE A2

SCREEN AS IT APPEARED WHEN A STUDY 3 PARTICIPANT VISITED AND VIEWED A MAP

The screenshot displays a navigation application interface. On the left is a large map with a grid of letters (B, C, E, H, J, P, S, T) and several blue squares labeled 'M'. A red square indicates the current location. Below the map is a legend:

- B = Book Store
- C = Clothing Store
- E = Electronics Store
- H = Housewares
- J = Jewelry Store
- P = Pharmacy
- S = Sporting Goods
- T = Toy Store
- M = Map
- Red = Current Location

Below the legend are five buttons: "Go to Next Store", "Choose Store", "Go to Nearest Map", "Inspect Store", and "View Map".

On the right side of the interface, there is a smaller map titled "Push Buttons on the Map to See that Store's Items". Below this map is a "Finished" button. To the right of the smaller map is a list of items:

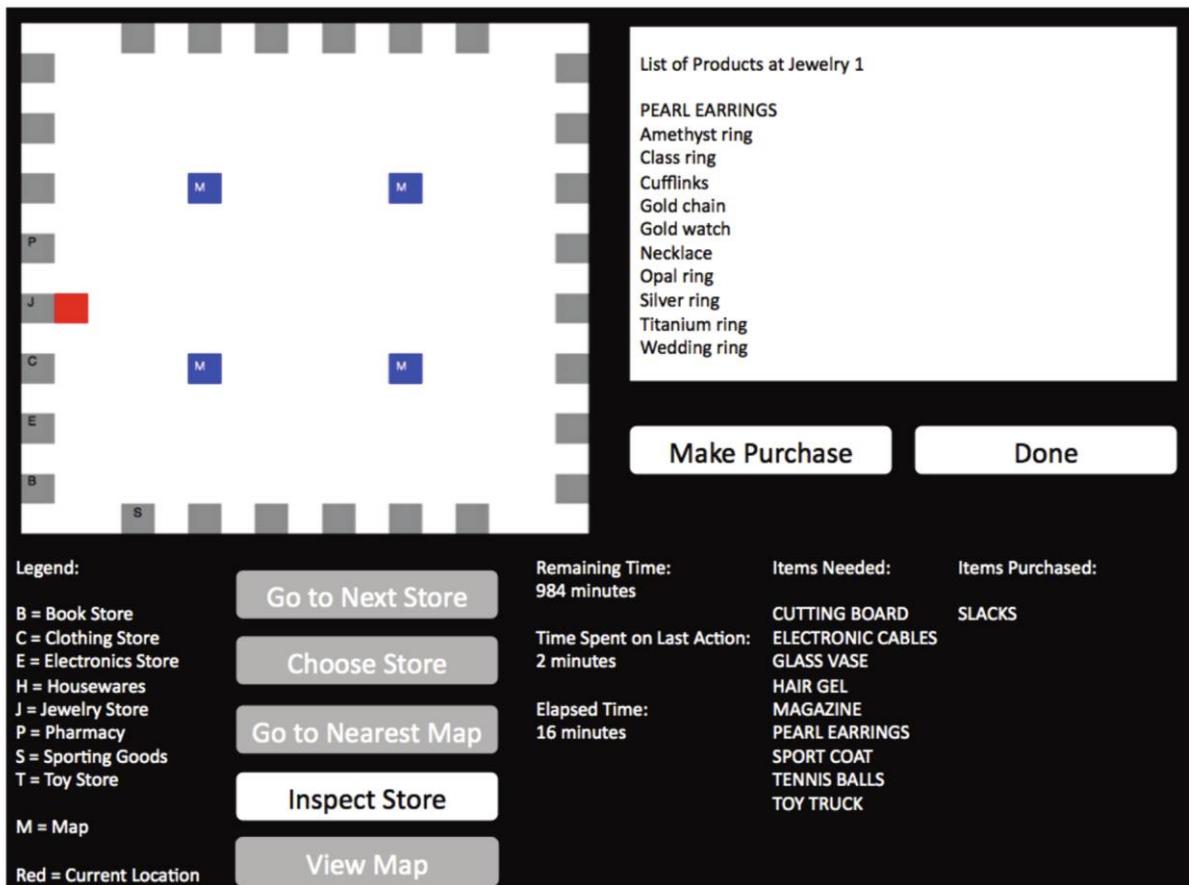
- GLASS VASE
- Area rug
- Bedding
- Coffee mug
- Pillow
- Plates
- Serving dish
- Silverware
- Toaster
- Trash can
- Wine glasses

Below the "Finished" button and the item list are three columns of text:

- Remaining Time:** 975.8 minutes
- Time Spent on Last Action:** 3.2 minutes
- Elapsed Time:** 24.2 minutes
- Items Needed:** CUTTING BOARD, ELECTRONIC CABLES, GLASS VASE, HAIR GEL, MAGAZINE, PEARL EARRINGS, SPORT COAT, TENNIS BALLS, TOY TRUCK
- Items Purchased:** SLACKS

FIGURE A3

SCREEN AS IT APPEARED WHEN A STUDY 3 PARTICIPANT INSPECTED A STORE



APPENDIX B

ADDITIONAL PROCEDURAL DETAILS FROM STUDY 3

Procedural Details

Participants first read a series of instructions describing the shopping paradigm. They then read a handout summarizing the instructions, including a description of the amount of simulated time required for the various actions. After this they debriefed with a hypothesis-blind experimenter to make sure they understood the instructions. Next, they completed a tutorial session in the shopping program. During the tutorial the experimenter watched as the participant moved through the mall, explored stores, used the map, and made purchases from their shopping list. Participants were told that they should exit the tutorial as soon as they felt comfortable with the program. They were not obligated to complete the shopping list but were told that they must visit a map at least once during the tutorial. The experimenter watched to make sure they visited the map and tested its functionality. When the participant felt ready to proceed, he or she pushed a button that closed the tutorial screen. The experimenter then quizzed the participant to gauge understanding of the amount of simulated time required for various types of actions and corrected any misunderstandings.

Afterward, participants read more instructions introducing the practice shopping trip. During the practice trial the remaining-time clock started at 300 simulated minutes and counted down as the participant executed moves, but participants were told that they had as much simulated time as they liked and should feel free to explore in order to become more comfortable

with the program. The practice trial ended when the participant completed the eight-item shopping list. After completing the practice trip, participants were reminded how much simulated time they took to complete it.

Next, participants began the three test shopping trips. They were given additional instructions introducing the test shopping trips and were told how much simulated time they would have to complete all three malls (320, 260, or 200 simulated minutes depending on condition). Participants were told that they could leave a mall and proceed to the next one whenever they wanted by clicking a button. They could not, however, go backward, and they had to complete the malls in sequential order. They were also reminded about the incentive structure. Participants then completed their allotted time budget in the three malls. After completing the shopping trips, they answered demographic questions and the propensity to plan scale (Lynch et al. 2010).

APPENDIX C

ADDITIONAL ANALYTICAL DETAILS FROM STUDY 3

Dependent Variables

Our key dependent variables were measures of efficiency planning and prioritization. We operationalized efficiency planning as the amount of real time spent on the map divided by the real time spent in the mall. As this number increases it suggests that the participant engaged in more efficiency planning per unit time.

We also created a measure of prioritization reflecting how soon a participant moved to the third mall. Because the time budget differed across conditions, the raw percentage of time spent in mall 3 is not a good measure of prioritization. For instance, a participant who engaged in no prioritization in the high-constraint condition would never reach the third mall. In contrast, a participant who engaged in no prioritization in the low-constraint condition might have significant time remaining when reaching the third mall, if she was efficient in the first two malls. Therefore, we created a prioritization measure that represented the amount of time spent in the third mall in excess of what would be expected given the participant's purchase rate.

We first calculated an overall purchase rate (R_i) for each participant by dividing the total number of simulated minutes used across all three shopping trips by the total number of purchases across all three shopping trips.

$$R_i = \frac{\text{total simulated minutes}}{\text{purchases made}}.$$

We then calculated the expected proportion of their total allotted time that they would have spent in malls 1 and 2 (E_i) if they had simply purchased at this rate until completing their list (i.e., purchased 16 items) and not prioritized at all:

$$E_i = \min\left(1, \frac{|16 \times R_i|}{\text{time budget}}\right).$$

For example, someone who completed 10 purchases in the 200 minute condition has $R_i = 20$ and $E_i = 1$, because she would be expected to spend 100% of her time in malls 1 and 2 with no prioritization. Someone who completed 20 transactions in the 200-minute condition would have $R_i = 10$ and $E_i = 160/200$ or 80% of her time in malls 1 and 2.

Finally, to calculate the priority measure (P_i), we subtracted the actual proportion of allotted time spent in malls 1 and 2 (A_i) from E_i :

$$P_i = E_i - A_i.$$

As P_i increases, it means that the participant spent more time in mall 3 than would be expected if he or she simply purchased at a steady rate and continued until filling the list.

To evaluate the sufficiency of planning and dysfunctional behavior as a reaction to prioritization failure, we calculated several additional performance measures. We measured actual efficiency in each mall as purchases per store visited in that mall. The higher this number, the more people are focusing their shopping on stores carrying items on their list. We also measured store visits per minute of simulated time. The more stores participants visit per minute, the less selective they are about where they shop. Finally, we measured simulated time remaining from the participant's budget when entering the first, second, and third malls. A summary of measures used in this study is included in table C1 below.

TABLE C1
SUMMARY OF MEASURES USED TO ANALYZE STUDY 3

Measure name	Measure description
Efficiency planning	The amount of real time spent at the map divided by the real time spent in the mall.
Priority planning	The amount of simulated time spent in the third mall in excess of what would be expected given the participant's overall purchase rate and no prioritization.
Actual efficiency	The number of purchases divided by the number of stores visited.
Time left in mall 3	The number of simulated minutes remaining from the participant's time budget when entering mall 3.
Store visit rate	The number of stores visited divided by the simulated minutes spent in the mall.
Dollars earned	The total number of dollars earned. Participants received one dollar for completing the shopping list in malls 1 and 2 and two tickets for completing the shopping list in mall 3.
Lottery tickets earned	The total number of lottery tickets earned. Participants received one ticket for each item purchased in malls 1 and 2 and two tickets for each item purchased in mall 3.

Additional Analysis of Dysfunction

We also correlated the amount of remaining time participants had when they entered each mall with their actual efficiency in that mall. These correlations were nonsignificant in mall 1, $r = 0.06$, $p = .68$, and mall 2, $r = -.10$, $p = .46$, but highly positively related in mall 3, $r = .50$, $p < .001$. This correlation in mall 3 differed significantly from the correlation in mall 1, $z = 2.60$, $p < .01$, and mall 2, $z = 3.71$, $p < .001$, by the Raghunathan, Rosenthal, and Rubin (1996) test of the difference between correlated but not overlapping correlations. Thus, arriving with less time in mall 3 predicted inefficiency in mall 3.

Inefficiency can arise from visiting too many stores, rather than only visiting stores with items on one's shopping list. In all three malls, store visits per simulated minute were highly negatively correlated with actual efficiency ($r = -.53$, $-.70$, and $-.77$ in malls 1, 2, and 3, respectively). Store visits per simulated minute in mall 3 was strongly negatively correlated with time left entering mall 3, $r = -.50$, $p < .001$, but uncorrelated with time remaining in mall 1, $r = -.10$, or mall 2, $r = -.02$. The latter two correlations were significantly weaker than the correlation in mall 3: $z = 2.53$, $p < .01$, and $z = 3.37$, $p < .001$, respectively.

APPENDIX D

STUDY 4 BUDGETING PROCEDURE

Participants in the budgeting condition filled out the following budget planner in MS Excel. Prior to spring break, participants entered how much money they budgeted for each of the following categories in the "budget" column. If they did not intend to spend any money in a category, they entered \$0. If they wished to add a new category, they added it into the last row of each major category. Participants were instructed to keep this budget planner with them during spring break and to fill in the amount of money they actually spent into the "actual" column. This excel template automatically calculated the difference between actual and budgeted amounts.

FIGURE D1

STUDY 4 BUDGETING PROCEDURE

SPRING BREAK TRIP - Budget Planner			
SPRING BREAK TRIP BUDGET			\$0.00
ACTUAL SPENT			\$0.00
DIFFERENCE (over/under budget)			\$0.00
Transportation			
Item	Budget	Actual	Difference
Airfare			\$0.00
Transportation to/from airfare & airfare parking			\$0.00
Ground transportation (car rental, gas, etc)			\$0.00
Road tolls			\$0.00
Other (tab in last column of this row to add row)			\$0.00
Total	\$0.00	\$0.00	\$0.00
Lodging			
Item	Budget	Actual	Difference
Hotels, motels, campsite rental			\$0.00
Other (tab in last column of this row to add row)			\$0.00
Total	\$0.00	\$0.00	\$0.00
Food & Drink			
Item	Budget	Actual	Difference
Snacks & bottled drinks			\$0.00
Breakfasts			\$0.00
Lunches			\$0.00
Dinners			\$0.00
Bar & Pub & Club			\$0.00
Other (tab in last column of this row to add row)			\$0.00
Total	\$0.00	\$0.00	\$0.00
Pre-trip expenses			
Item	Budget	Actual	Difference
Clothes			\$0.00
Luggage			\$0.00
Language guides, map books			\$0.00
Other (tab in last column of this row to add row)			\$0.00
Total	\$0.00	\$0.00	\$0.00
Entertainment			
Item	Budget	Actual	Difference
Activity fees (e.g., golf fees)			\$0.00
Equipment rental (e.g., snorkel/scuba gear)			\$0.00
Excursions (e.g., sightseeing tours)			\$0.00
Tickets (e.g., show tickets)			\$0.00
Cover fees (e.g., nightclubs)			\$0.00
Other (tab in last column of this row to add row)			\$0.00
Total	\$0.00	\$0.00	\$0.00
Miscellaneous			
Item	Budget	Actual	Difference
Travel Insurance			\$0.00
Passports, visa and travel documents			\$0.00
Pet care while you are away			\$0.00
Currency exchange & bank fees			\$0.00
Long distance cell phone charges/roaming			\$0.00
Other (tab in last column of this row to add row)			\$0.00
Total	\$0.00	\$0.00	\$0.00

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