Consumer matching costs to context:

Status quo bias, temporal framing, and household energy decisions

Carrie A. Gill, Environmental and National Resource Economics, University of Rhode Island, Kingston Coastal Institute, 1 Greenhouse Road, Kingston, RI 02881, USA.

Stephen A. Atlas, College of Business, University of Rhode Island, Ballentine Hall, 7 Lippitt Road, Kingston, RI 02881, USA.

David J. Hardisty, Sauder School of Business at the University of British Columbia, 2053 Main Mall Vancouver, BC V6T 1Z2, Canada.

Shawn P. Scott*, Wheaton College, 26 E Main St, Norton, MA 02766, USA.

*Corresponding Author

Acknowledgements

The authors would like to thank Qualtrics for their financial support on this project, as well as the Social Sciences and Humanities Research Council of Canada. We also would like to thank the members of the Society for Judgement and Decision Making and the members of the Association of Environmental and Resource Economists for their feedback which was instrumental in the process of refining our manuscript. In addition, the authors would like to thank Ethan Rix for research assistance and Corey Lang for helpful comments. Finally, the authors would like to thank Albert Della Bitta for his help on feedback and comments.

Consumer matching costs to context:

Status quo bias, temporal framing, and household energy decisions

Abstract

One challenge of promoting energy-efficient behavior change is status quo bias: consumers are reluctant to change away from their current level of energy usage, even if their energy usage is higher than they would actively choose. Using experimental data, this paper examines what temporal frame minimizes status quo bias and encourages energy-efficient behavioral intentions. The authors find that individuals make the most energy efficient decisions when presented with a monthly framing because they are more easily able to think about monthly costs than daily or yearly costs. The authors investigate whether cognitive fluency could be an underlying mechanism, and find evidence that individuals are most fluent when energy costs are framed on a monthly basis.

Keywords

Status Quo Bias, Temporal Framing, Energy Conservation, Energy Efficiency, Behavior Change

1. Introduction

The US residential sector had a total consumption of 20,803 trillion BTU of energy in 2020, amounting to billions of dollars spent on household energy bills in addition to negative environmental and health externalities from conventional energy generation (US Department of Energy, 2021). Uptake of energy efficient technologies has been quite slow, in spite of the large savings available, presenting a problem known as the "energy paradox" (Jaffe and Stavins, 1994; Gerarden *et al*., 2017). One low-cost way to promote more energy-efficient behaviors is to make the costs and savings of energy behavioral intentions more salient. Energy-efficient behaviors (versus inefficient) can be seen in many consumer behaviors such as turning lights off when they leave a room (verses leave them on), unplugging appliances when not in use (verses leaving them plugged in, doing laundry with cold water (versus hit), or even using CFL or LED light bulbs (versus incandescent). Yet there is substantial variation in how these costs and savings are presented (e.g. per day, per month, per year) and there is opportunity to build on prior research to establish a more comprehensive framework to understand how individuals respond to these different timescales from a behavioral economic perspective and the underlying consumer behavior factor that drives their decisions.

For individuals who typically engage in energy-inefficient household habits and purchases, status quo bias could be a contributing factor towards energy consumption and persistent inefficiency (Samuelson and Zeckhauser, 1988). For example, individuals were more likely to keep a contractor's arbitrary light bulb behavioral intention, despite zero switching cost and the potential for future monetary savings (Dinner *et al*., 2011). In addition, limiting energy use often requires sacrificing comfort or convenience, which may make behavior change difficult (Kahneman *et al*., 1990). Emphasizing the costs of energy-inefficient choices and the benefits of

energy efficiency may help overcome reluctance to energy-efficient behavior change (Novemsky and Kahneman, 2005).

This paper examines the effect of costs framing in daily, monthly or yearly terms on the energy choices made by consumers. It also delineates other mediating factors affecting this choice. This research contributes to two bodies of literature. This research contributes to the literature on choice architecture previously suggesting that longer timeframes within the lifecycle of the product are most effective at promoting energy-efficient behavioral intentions (Hardisty *et al*., 2016). This research also contributes to the literature on temporal framing. In particular, results suggest the primacy of ease of processing fluency in designing effective temporal framing interventions.

We report two experiments providing evidence for three hypotheses. We show how individuals were found to make the most energy efficient decisions when presented with a monthly framing because they are more easily able to think about monthly costs than daily or yearly costs.

2. Theoretical Framework and Hypotheses Development

2.1 Choice Architecture

Given the extent of energy consumption in the residential sector, encouraging household energy-efficient behavior change represents a significant strategy to conserve energy and mitigate externalities of electricity generation (Dietz *et al*., 2009). Economists, policy makers, and others have developed strategies to encourage energy efficiency ranging in degree of autonomy for the decision maker. On one end of the spectrum, there are policies like residential direct load control and regulations that mandate certain levels of energy efficiency. While such policies may be effective in increasing efficiency, they take away autonomy from the individual

and can lead to unintended negative consequences. These policies may impose an undue financial burden on poor consumers, or could lead to "rebound" effects and increased consumption due to lower perceived efficacy and impact of green products (Jansson *et al*., 2010; Lin and Chang, 2012). At the other end of the spectrum are nudges and non-price strategies that preserve individual freedom of choice while still encouraging energy efficient choices. Choice architecture provides a framework and series of tools to guide policymakers about how to present choices, including what content to present and how to present it (Johnson *et al*., 2012; Thaler *et al*., 2014; Ingendahl *et al*., 2021). One prevalent tool of choice architecture is defaults (Johnson and Goldstein, 2003). These authors showed that individuals were more likely to be organ donors when defaulted into the program and allowed to opt out rather than having to proactively opting into the program, although the way the decision is framed affected the end choice. The use of normative information to influence behavior is another example which can result in a boomerang effect causing low energy communication to increase consumption (Schultz *et al*., 2007). Similarly, previous research finds when costs are framed in periodic time frames (daily or yearly), consumers are more likely to agree to many more contracts (Gourville 1998; Atlas and Bartels, 2018) as framing out the benefits more narrowly highlights the costs more substantially.

Researchers have turned to concepts from choice architecture as a low-cost and politically feasible way to encourage pro-environmental behaviors without restricting the consumer's choice set (Abrahamse *et al*., 2005; Bull, 2012; Dinner *et al*., 2011; Min *et al*., 2014). Within the larger context of measures to reduce energy consumption, choice architecture is a non-price strategy that fits alongside recommended behavioral interventions (Allcott and Mullainathan, 2010), including peer comparisons (Allcott, 2011; Allcott and Rogers, 2014), commitment devices and goal setting (Becker, 1978; Harding and Hsiaw, 2014), feedback

(Jessoe and Rapson, 2014; Carrico and Riemer, 2011), and education (Agarwal *et al*., 2017; Gill and Lang, 2018). Recent research has also suggested a change in mindset from rerouting biases to simply making it easier for consumers to make decisions (McKenzie *et al*., 2018).

2.2 Temporal Framing

The recently revised fuel economy labels additionally report gallons per hundred miles, two measures of fuel cost, and information about greenhouse gas emissions. These additional measures not only make information about comparative fuel use easier to access, but the number of measures add weight to the fuel attribute in consumer choice, provide a signpost to consider environmental preferences, and provide a reference point against which to weigh attribute levels (Ungemach *et al*., 2017; Costa and Kahn, 2013; Weber *et al*., 1988; Larrick *et al*., 2015). These labels provide otherwise missing information about energy consumption and cost to consumers, and remove one barrier to consumers considering this attribute in their decision-making process (Newell and Siikimaki, 2014). Information like energy labels is amenable to choice architecture, and decisions about what information to present and how to present it affects the consumers' choices. In this paper, we seek to understand the role of temporal framing – over the time period energy-related costs and benefits are aggregated – in energy-related household choices.

Prior research has explored effects of temporal framing of energy costs in product evaluation, but there are gaps in the literature that prevent comprehensive understanding of these effects (Kaenzig and Wustenhagen, 2010; Heinzle, 2012). Most of this literature has focused on long-term temporal frames (per year or longer) and suggest that consumers put more weight on attributes whose levels are framed on longer terms (Larrick *et al*., 2015; Burson *et al*., 2009; Pandelaere *et al*., 2011; Kaenzig and Wustenhagen, 2010; Hardisty *et al*., 2020; Caroll *et al*., 2020). Increased purchase intentions for energy-efficient refrigerators are experienced when cost

information over the life of the product was provided more so than when annual cost information was provided (Hutton and Wilkie, 1980). Similarly, providing 10-year energy costs generally encourages more energy-efficient choices than providing 1-year or 5-year costs (Hardisty *et al*., 2016). While long-term temporal frames make intuitive sense for durable goods, such as refrigerators and air conditioners, unreasonably long frames may prompt the consumer to feel manipulated, be too abstract to fully comprehend, or be unreasonable timeframes to consider for behavior change or short-term decisions. For example, it may not make sense to the consumer to think of the cost savings of washing a load of laundry with cold water rather than hot water on a yearly or ten-yearly basis.

One notable study looks at shorter-term temporal frames (McNeill and Wilke, 1979). This study found no differences in a set of measures regarding refrigerator evaluation when typical energy costs were framed in monthly versus yearly terms. In a study on preferences for fuel efficiency, providing information about fuel costs per 100 miles encouraged more fuel-efficient vehicle choices than when fuel costs were framed per 15,000 miles, and less efficient choices than a per 100,000 mile framing (Camilieri and Larrick, 2014) In sum, the literature suggests that presenting energy costs on larger scales may be most effective at encouraging energy-efficient choices, but the findings are inconclusive for how individuals respond to smaller scales and suggest there may be a nonlinearity in response.

2.3 Conceptual Underpinnings and Hypotheses

How costs and savings are framed influences how individuals perceive their choices which is fueled by the concept of loss aversion: individuals dislike losses more than they like equivalent gains (Tversky and Kahneman, 1991). In this way individuals can maximize utility by aggregating losses and segregating gains and through the principles of hedonic editing (Thaler,

1985) as consumers respond to changes from their present position to gain pleasure and avoid pain (losses). However, other research suggests individuals can overcomplicate choice (Schrift *et al*., 2011) or have limited ability to cope with multiple losses at the same time (Linville and Fischer, 1991). Individuals prefer to break up negative events to different days, which seemingly points toward segregating costs instead. Evidence from a third vein of literature suggests individuals tend to neglect small recurring costs, a phenomenon known as Pennies-a-Day (PAD) (Gourville, 1998; 2003). Under the PAD framework, individuals may be more likely to spend small monetary amounts per day to obtain comfort and convenience associated with energy-inefficient choices (Gourville, 1998).

There is evidence, though, that periodic pricing prompts people to consider repeat experiences of the purchase in question. As applied to recurring decisions about energy-related behaviors, narrowly framed savings may make the inconveniences or discomforts associated with a switch to energy efficiency more salient (Atlas and Bartels, 2018). In other words, messaging about saving $x per day by taking energy-efficient colder showers may call to mind the daily discomfort of each colder shower and steer individuals away from efficient choices.

Novemsky and Kahneman (2005) posit several boundaries of loss aversion. They find that loss aversion is attached to the benefits of the good rather than the attributes. In other words, an individual is willing to freely give up one good for another that provides the same benefits. They also find loss aversion does not apply for goods intended to be exchanged (e.g. cash). Therefore, if a consumer perceives energy costs as a fair exchange of money for energy (rather than an unexpected loss of money), loss aversion may not apply. More recently, it has been argued that loss aversion is mainly a restatement of inertia and status quo bias, and does not apply more generally (Gal and Rucker, 2018).

Our research further investigates whether choices about temporal framing can minimize loss aversion for energy inefficiency. We operationalize this through a scenario that sets up a status quo level of energy consumption and presents individuals with relative costs of energy-inefficient and an energy-efficient choice alternative. We posit that frames that make cost information most easy to process (processing fluency) will best encourage energy-efficient choices:

H_1: Consumers will intend to engage in more efficient energy efficient behaviors when energy costs are presented on a monthly basis compared to a daily or yearly basis.

Fluency and ease of processing has been shown to influence several areas of judgment (Lee and Aaker, 2004), with messages that are easier to process being linked to judgments of truth, preference, confidence, and familiarity (Alter and Oppenheimer, 2009). For example, individuals have stronger intentions to exercise and cook when the instructions were visually easy to read (Song and Schwarz, 2008). In relation to fuel-efficient vehicle choices, scale familiarity drives more fuel-efficient vehicle choices when fuel costs were presented per 100 miles rather than per 15,000 miles (Camilleri and Larrick, 2014). Familiarity or lack thereof can drive individuals to place more decision weight on attributes with familiar scales (Lembregts and Pandelaere, 2013), cause individuals find it difficult to translate between units and are prone to incorrect comparisons (Heinzle, 2012; Larrick and Soll, 2008), and encourage individuals to stick with status quo behaviors (Novemsky *et al*., 2007).

We hypothesize that individuals are most familiar with monthly energy bills are therefore able to process cost savings information most easily when the framing matches their implicit context. Therefore, we posit:

H_2: Consumers are more familiar with monthly energy costs temporal frames than daily and yearly.

Given that most consumers see their energy usage in monthly bills, this should create an ease or difficulty in processing when presented in a status quo scenario that either does or doesn't match their current behavior. Further, by providing an easy-to-process context (processing fluency) for the magnitude of the costs or savings, individuals may be more easily able to understand the benefits of alternatives in the choice set and more likely to overcome status quo bias.

H_3: Ease of processing (processing fluency) will mediate temporal framings' influence on energy efficient behavior.

3. Material and Methods

3.1. Experimental Overview

We test our hypotheses through two experiments. We rely on hypothetical scenarios and self-reported behavior intentions, which could lead to biased estimates of treatment effects in a non-experimental setting. However, we expect such biases (e.g. inflated intentions of pro-environmental behavior) to occur with equal likelihood across all treatment conditions due to random assignment. Therefore, our studies provide a solid foundation for hypothesis testing as outlined in prior research in the study of status quo bias (Samuelson and Zeckhauser, 1988). In the two studies that follow, we found that individuals were influenced by status quo behaviors, found it easier to understand decisions about energy use when the costs of alternatives were framed as monthly, preferred monthly framing for most activities, and fluency mediated the relationship between framing and choice.

The primary component similar across both studies was a scenario based around a household energy decision between energy-inefficient and energy-efficient alternatives. The results varied across the households who indicated behavioral intent rather than an actual purchase of energy efficient modes. Individuals read the scenario and were given information about the costs of choosing the energy-inefficient alternative. The main treatment we used was a random assignment of how the cost information was framed – per day, per month, or per year.

4. Results

4.1. Study 1: Experience with and preference for monthly framing

In this study we directly ask individuals for their preferences in frame. Individuals were given a scenario where they were asked to recommend which cost frame should be used to easily convey costs of energy inefficient behaviors to their neighbors. Then they were asked to indicate their preferred way of thinking about various expenses, including costs of energy-related behaviors and their energy bill. Individuals overwhelmingly prefer monthly cost framing.

4.1.1. Method

We recruited 315 online participants to complete a short study on household decisions from the Qualtrics panel of respondents. All participants were screened to ensure they pay their own energy bills. Individuals were presented with a scenario regarding how to frame costs of energy-related household behaviors. In this scenario, individuals were told that their neighbors each have energy meters in their homes. Each participant was randomly assigned to one of three treatment conditions and were told that their neighbors saw total household energy expenditures either per day, per month, or per year on their energy meters. They were then asked to advise a neighbor that wanted to design flyers with a cost frame that would be most easy to understand.

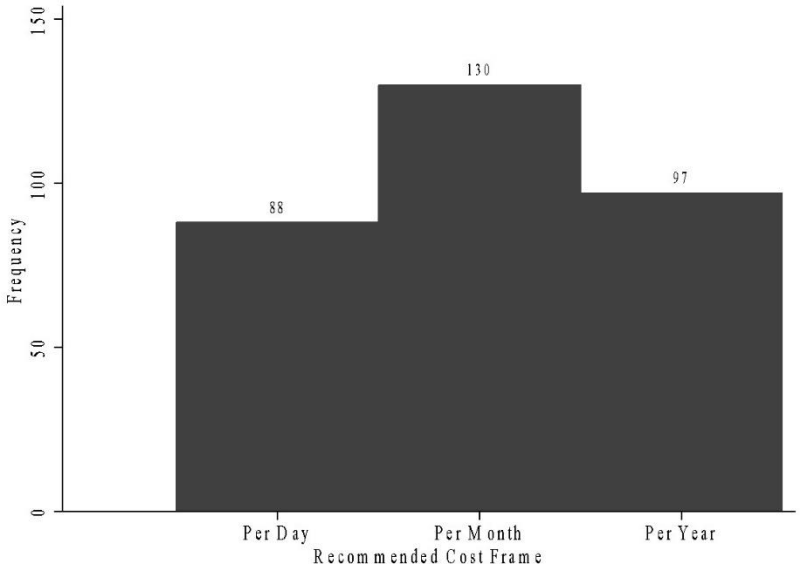
Individuals rated each frame on a 7-point Likert scale from “doesn’t make any sense at all” to “make complete sense.” Then individuals chose only one frame to recommend to the neighbor.

Next, individuals were given a scenario in which they were designing a flyer to convey costs of several various activities. Individuals indicated which frame made the most sense for each activity, choosing from a selection of seven frames (per day, per week, per month, per year, trip, per load, per fill-up). Activities included both energy-related activities and non-energy activities.

4.1.2. Results and Discussion

Individuals chose one of the three frames to recommend as the frame that made the most sense to use to communicate costs of energy-related household decisions. Figure 1 illustrates the results of this question. A majority of individuals recommended describing costs in the monthly frame (N=130, 41.3%). The remaining individuals were approximately split between daily and yearly frames: N=88 (27.9%) recommended daily framing while N=97 (30.8%) recommended yearly framing. Interestingly, more individuals recommended monthly framing than daily or yearly regardless of the framing used in their neighbors’ energy meters. A test of proportions shows that both the daily ($z = 3.52$, $p = .004$) and yearly ($z = 2.7385$, $p = .0062$) framing were significantly different from monthly framing supporting H_1.

Figure 1. Stated preference for cost frame



Then, we elicited preferred cost frames for nine activities. Table 1 summarizes these results. Individuals preferred monthly framing for all activities except for the activities about washing laundry, driving, and grocery shopping. Of particular interest, 71.4 percent of individuals consider their energy bills on a monthly basis. This exercise provides additional evidence for monthly framing being both easy to process and familiar and supporting H_2.

Table 1. Stated preferences for cost frames in percentages

Cost	per day	per week	per month	per year	per trip	per load	per fill up
Washing laundry with hot water instead of cold	4.8	10.2	30.2	10.8	1.9	41.3	1.0
Using two refrigerators instead of one	13.3	4.1	49.8	30.5	1.6	0.3	0.3
Driving a gas-powered vehicle instead of an electric vehicle	3.5	11.1	25.7	14.6	10.2	0.6	34.3
Using a space heater or window air conditioner	19.4	6.0	56.2	16.5	0.6	0.6	0.6

Using incandescent instead of CFL or LED light bulbs	20.6	2.9	45.1	29.2	1.6	0.3	0.3
Going to the grocery store	3.5	31.8	26.0	4.4	33.0	0.3	1.0
My energy bill	9.2	2.5	71.4	15.2	0.6	0.6	0.3
My movie budget	3.2	7.3	44.8	23.5	20.0	0.6	0.6
Taking public transportation to work instead of a personal vehicle	11.8	14.3	27.3	11.1	31.8	1.6	2.2

4.2. Study 2: Fluency with monthly framing

In Study 2 building on study 1, we show evidence in support of monthly framing of costs being the easiest to process relative to other temporal frames. We presented individuals with one six scenarios. Specifically, we randomly assign individuals to either an energy efficient or inefficient status quo and presented the costs of changing behavior in either a daily, monthly, or yearly frame. We then asked individuals questions to measure fluency with the temporal frames. We found that individuals are more fluent with monthly costs and savings than with daily or yearly costs and savings.

4.2.1. Method

We conducted our study with students at a local university to complete a short survey on energy use decisions. We had 218 respondents with an average age of 20.39 years and 50% of the participants were male. Each participant was randomly presented with one of six scenarios regarding energy usage in a between-subjects 2 (status quo: energy efficient/inefficient) x 3 (temporal frame: daily/monthly/yearly) study. Our main dependent variable was their intention to engage in energy efficiency as measured by individuals' responses to the question "In this

scenario, what would you do?" Individuals indicated their intentions using a 0-10 slider scale between engaging in the energy efficient behavior (0=definitely turn the lights off and unplug electronics) or the inefficient behavior (10=definitely keep the lighting on and leave electronics plugged in).

Individuals then indicated their ease of processing using a seven-point Likert scale on five measures of fluency. Respondents were asked the question: "Would you say that the average person would think about the cost difference in this scenario as:" and answered on a seven-point scale for the latent measures of: "Clear/Unclear, Incomprehensible/Comprehensible, Difficult/Easy, Disfluent/Fluent, and Effortful/Effortless" as established in prior literature (Graf, Mayer, Landwehr, 2018). We aggregated responses to fluency measures using a standardized Cronbach's alpha (α = .879).

We also measured involvement in energy efficient behavior and cost savings behavior as potential covariates (Coulter, Price, and Feick, 2003) by asking "For this series of questions, please read the statements to the left and choose your best response". For energy involvement participants responded to: "In general I have a strong interest in saving energy; Saving energy is very important to me; Saving energy matters a lot to me; Saving energy means a lot to me". For cost involvement participants responded to: "In general I have a strong interest in saving money; Saving money is very important to me; Saving money matters a lot to me; Saving money means a lot to me". As with our fluency measures, we aggregated responses to energy involvement (α = .957) and cost involvement (α = .962) measures using a standardized Cronbach's alpha. The actual survey with all 6 randomized scenarios and measures can be seen in the digital appendix.

4.2.2. Results and Discussion

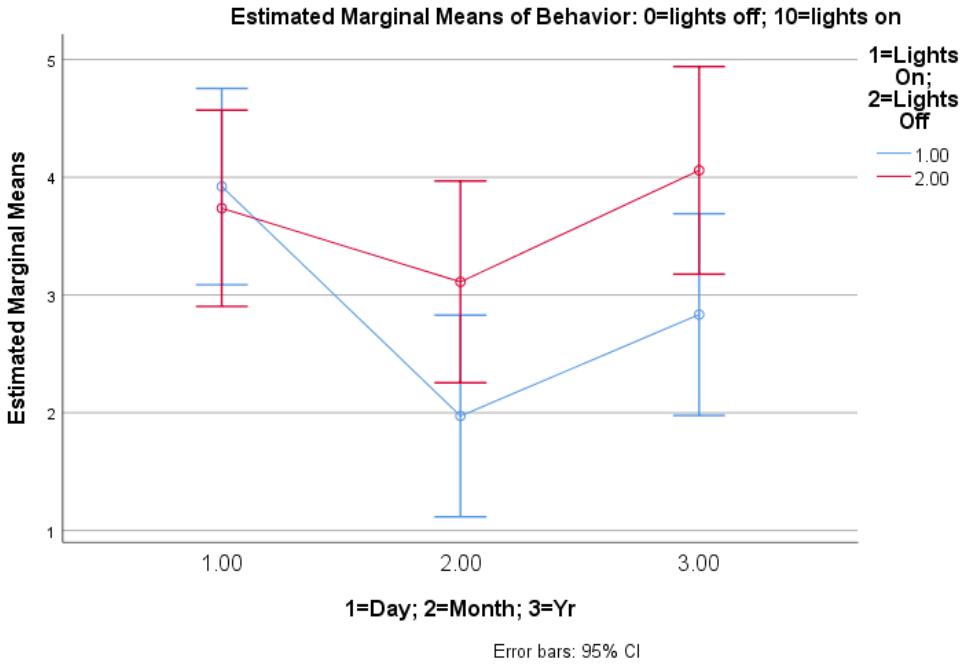
We first conducted a manipulation check to test participants perceptions of their status quo condition. An ANOVA of the manipulation check revealed a significant difference ($F(1, 217) = 11.997$, $p=.000$, $\eta 2= .224$). In addition, an ANOVA revealed that participants' involvement in energy efficient behavior was not significant for the time condition ($p=.186$), or status quo condition ($p=.481$). Similarly, an ANOVA revealed that participants' involvement in cost savings behavior was not significant for the time condition ($p=.537$), or status quo condition ($p=.174$). Based on these results, we did not incorporate either the energy involvement or cost involvement dependent variables in our further analysis.

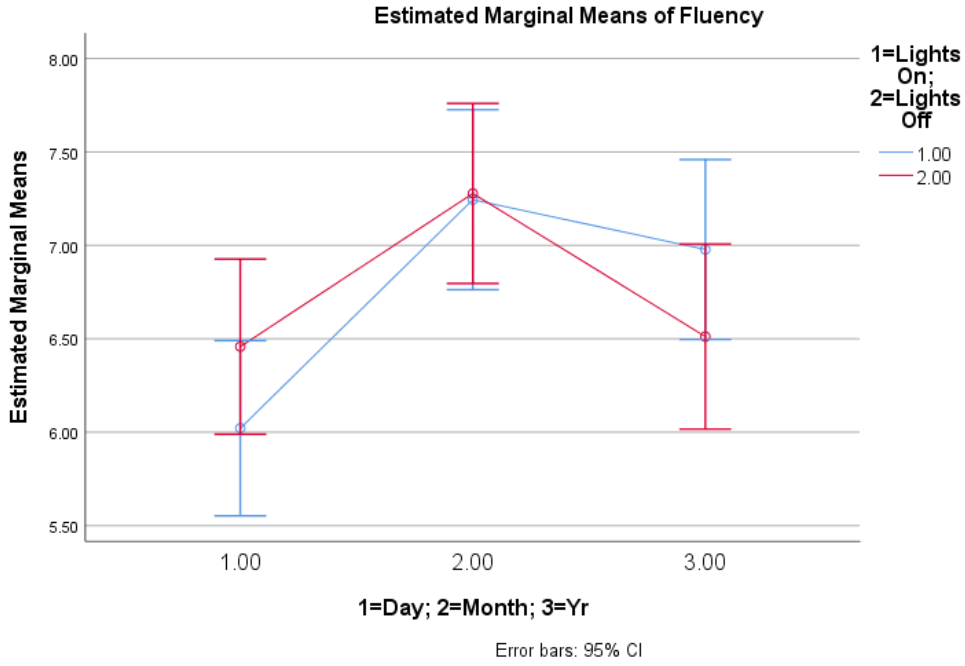
As expected, a univariate analysis on energy efficient behavior revealed a significant result in both the temporal condition ($F(2, 217) = 4.712$, $p=.010$, $\eta 2= .043$) and the status quo condition ($F(1, 217) = 8.976$, $p=.041$, $\eta 2= .020$), although there was no interaction present ($p=.185$). A follow up post hoc analysis on the temporal condition showed that the means score for the energy efficient behavior in the monthly frame ($M=2.54$) was significantly lower from the daily ($M=3.83$, $p=.003$) and from the yearly frame ($M=3.43$, $p=.044$), but the daily and yearly frames were not significantly different from each other ($p=.355$). These results support H_1 as monthly framing drove a more energy efficient choice.

Also as expected, a univariate analysis on fluency revealed a significant result in the temporal condition ($F(2, 217) = 8.976$, $p=.000$, $\eta 2= .078$), yet the status quo condition ($p=.994$) and interaction ($p=.185$) did not show significant differences. A post hoc follow up on the temporal condition revealed that the means score for fluency in the monthly frame ($M=7.26$) was significantly higher from the daily ($M=6.24$, $p=.000$) and from the yearly frame ($M=6.75$, $p=.036$). In addition, the yearly frame was significantly higher than the daily frame ($p=.040$).

These results support our second hypothesis as monthly framing drive a higher fluency than the daily and monthly framing. Graphs of temporal framing are in figure 2 below.

Figure 2: Means Results from Experiment 2



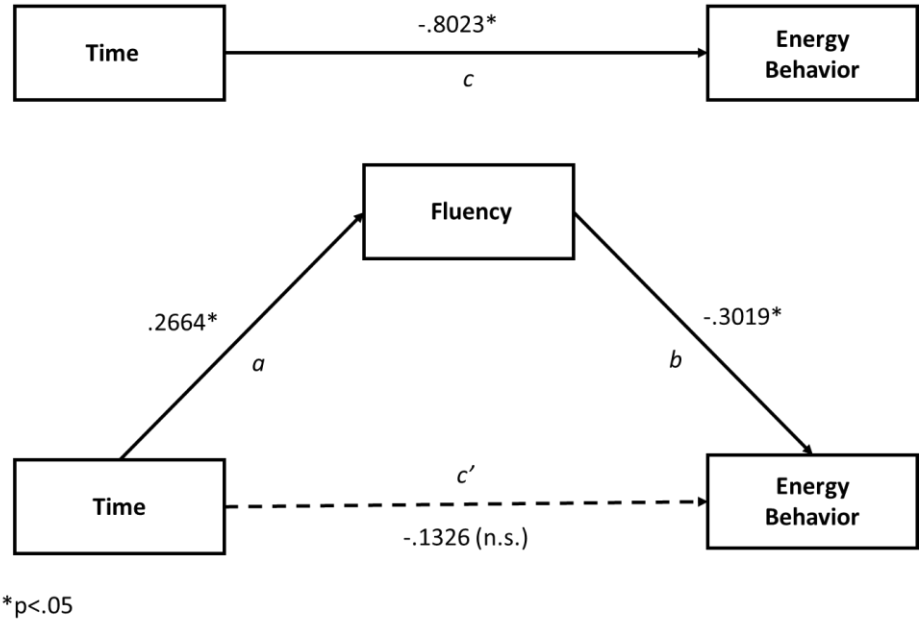


Furthermore, a mediation analysis was conducted (Hayes, 2017, PROCESS 4) which revealed full mediation of the temporal framing on energy efficient behavior through fluency supporting H_3. (see table 2 for mediation results and figure 3 below for mediation model).

Table 2: Mediation Results from Experiment 2

		95% Confidence Interval			
Dependent Variable	β	Lower Bound	Upper Bound	t	Sig.
Mediation: (H3: Full Mediation)					
Time -> Fluency	0.2664	0.0202	0.5126	2.1326	0.0341
Fluency -> Behavior	-0.3019	-0.5441	-0.0741	-2.5930	0.0102
Direct Effect X on Y: Time -> Behavior	-0.1326	-0.5685	0.3033	-0.5997	0.5494
Indirect Effect	-0.0823	-0.2138	-0.0008		

Figure 3: Mediation Model from Experiment 2



*p<.05

5. Discussion and Conclusion

In our two studies, we investigated how individuals responded to cost frames within the context of energy-related household decisions. Prior literature has mainly focused on longer-term temporal framing of costs, ranging from one year to the life of the product in question (Kaenzig and Wustenhagen, 2010; Hutton and Wilkie, 1980; Hardisty *et al*., 2016; Larrick *et al*., 2015). We found that intentions to engage in energy efficient behaviors were subject to status quo bias

when the costs or savings of behavior change were framed as per day or per year. However, individuals who saw costs and savings framed monthly overcome status quo bias in their behavior intentions. This provides evidence that is potentially inconsistent with current thinking about cost framing, which recommends using longer-term frames to promote product purchase (Hardisty *et al*., 2016) and adds a new reference to the literature.

We also showed that cognitive fluency plays a role in why monthly cost framing minimizes status quo bias. Prior literature on cognitive fluency links easy-to-process attributes to judgments of truth, preference, and ease (Alter and Oppenheimer, 2009). Therefore, a cost frame that is more cognitively fluent may affect individual choices. In study 2, we find evidence that monthly framing is easiest to process and mediates the relationship between temporal frame and energy efficient behavior. Prevalence of monthly energy bills may provide an implicit context against which to evaluate or understand the costs of energy-inefficient behavior alternatives.

Our findings suggest two additional tools that choice architects can consider adding to our contribution. First, we show that cognitively fluent framing can reduce status quo bias. If a policy maker's goal were to encourage some behavior that is hindered by attachment to the status quo, then framing the costs of inaction in a frame that is easier to process could lead to more decisions to act. In relation to energy use, in-home energy displays may be more effective in encouraging efficiency when framing energy costs as per month, rather than showing energy costs per hour or per day. The second tool available to behavioral frame architects is providing a context in order to evaluate disfluent cost frames. We find that providing a context for frames that are relatively difficult to think about increases behavior intention. The PAD literature recommends using narrow framing because doing so elicits comparisons to trivial recurring

purchases. However, we find that framing costs as daily is less easy to process than equivalent monthly costs.

Our findings have important implications from both a behavioral economic and consumer behavior for how to convey information about energy costs of inefficient behaviors to promote energy efficiency. While prior literature offers conflicting advice to describe costs both over longer and shorter time periods, the current study highlights the value of presenting energy cost savings in terms commonly used by a consumer because those frames are easiest to process. In other words, policy makers and energy conservation advocates should consider framing costs of energy-inefficient choices in the frame that is most fluent for the target audience.

Suggestions for Future Research

Given that we showed how cognitively fluent framing can reduce status quo bias, future research should expand on how fluent framing and descriptions might be able to counteract other biases, like default bias and loss aversion (Johnson and Goldstein, 2003, 2013; Jona, 2018; Jachimowicz *et al*., 2019). Also, given that we found that providing a context for complex frames increases behavior intention, future research should investigate how providing explicit contexts could enhance the PAD effect. It is also worth further investigating how fluency with the magnitude of the cost impacts choice. To this point, providing an explicit context against which to compare very small, narrowly framed costs could increase fluency by increasing ease of recall of comparable trivial recurring purchases.

Future research could investigate alternative mechanisms that decrease status quo bias, for example evaluability of the costs or the changes in underlying judgments due to increased fluency. Song and Schwarz (2008) found that individuals were significantly more likely to engage in certain behaviors when the instructions for doing so were cognitively fluent. Lastly,

future research should include an incentive compatible experiment. Our studies relied on hypothetical scenarios, in which hypothetical bias may affect individuals' responses and inflate intentions for energy efficiency. A field experiment would also be beneficial to understand the external validity of our findings, both within an energy conservation context as well as in other decisions.

References

Agarwal, Sumit, Rengarajan, Satyanarain, Sing, Tien Foo, and Yang, Yang (2017). Nudges from school children and electricity conservation: Evidence from the “Project Carbon Zero” campaign in Singapore. *Energy Economics*, *61*, 29-41.

Abrahamse, Wokje, Linda Steg, Charles Vlek, and Talib Rothengatter (2005), "A review of intervention studies aimed at household energy conservation," Journal of environmental psychology, 25 (3), 273-91.

Allcott, Hunt. (2011). Social norms and energy conservation. *Journal of Public Economics*, *95*(9), 1082-1095.

Allcott, Hunt, and Mullainathan, Sendhil. (2010). Behavior and energy policy. *Science*, *327*(5970), 1204-1205.

Allcott, Hunt, and Rogers, Todd. (2014). The short-run and long-run effects of behavioral interventions: Experimental evidence from energy conservation. *The American Economic Review*, *104*(10), 3003-3037.

Alter, Adam L., and Oppenheimer, Daniel M. (2009). Uniting the tribes of fluency to form a metacognitive nation. *Personality and social psychology review*.

Atlas, Stephen, and Bartels, Daniel M., (2018). Periodic pricing and perceived contract benefits. *Journal of Consumer Research*, *45*(2), 350-364.

Becker, Lawrence J. (1978). Joint effect of feedback and goal setting on performance: A field study of residential energy conservation. *Journal of applied psychology*, *63*(4), 428.

Bull, Joe (2012), "Loads of green washing—can behavioural economics increase willingness-to-pay for efficient washing machines in the UK?," Energy policy, 50, 242-52.

Burson, Katherine A., Larrick, Richard P., and Lynch Jr, John G. (2009). Six of one, half dozen of the other: Expanding and contracting numerical dimensions produces preference reversals. *Psychological Science*, *20*(9), 1074-1078.

Camilleri, Adrian R., and Larrick, Richard P. (2014). Metric and scale design as choice architecture tools. *Journal of Public Policy and Marketing*, *33*(1), 108-125.

Carrico, Amanda R., and Riemer, Manuel. (2011). Motivating energy conservation in the workplace: An evaluation of the use of group-level feedback and peer education. *Journal of environmental psychology*, *31*(1), 1-13.

Carroll, J., Aravena, C., Boeri, M., & Denny, E. (2020). " Show Me the Energy Costs": Short and Long-term Energy Cost Disclosure Effects on Willingness-to-pay for Residential Energy Efficiency. *Energy Journal*.

Costa, Dora L., and Kahn, Matthew E. (2013). Energy conservation “nudges” and environmentalist ideology: Evidence from a randomized residential electricity field experiment. *Journal of the European Economic Association*, *11*(3), 680-702.

Coulter, R. A., Price, L. L., & Feick, L. (2003). Rethinking the origins of involvement and brand commitment: Insights from postsocialist central Europe. *Journal of consumer research*, *30*(2), 151-169.

Dietz, Thomas, Gardner, Gerald T., Gilligan, Jonathan, Stern, Paul C., and Vandenbergh, Michael P. (2009). Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions. *Proceedings of the National Academy of Sciences*, *106*(44), 18452-18456.

Dinner, Isaac, Johnson, Eric J., Goldstein, Daniel G., and Liu, Kaiya. (2011). Partitioning default effects: why people choose not to choose. *Journal of Experimental Psychology: Applied*, *17*(4), 332.

Gal, D., and Rucker, D. D. (2018). The loss of loss aversion: will it loom larger than its gain?. *Journal of Consumer Psychology*, *28*(3), 497-516.

Gerarden, T. D., Newell, R. G., and Stavins, R. N. (2017). Assessing the energy-efficiency gap. *Journal of Economic Literature, 55*(4), 1486-1525.

Gill, Carrie, and Lang, Corey. (2018). Learn to conserve: The effects of in-school energy education on at-home electricity consumption. *Energy Policy, 118*, 88-96.

Gourville, John. T. (1998). Pennies-a-day: The effect of temporal reframing on transaction evaluation. *Journal of Consumer Research*, *24*(4), 395-408.

Gourville, John. T. (2003). The effects of monetary magnitude and level of aggregation on the temporal framing of price. *Marketing Letters, 14*(2), 125-135.

Harding, Matthew, and Hsiaw, Alice. (2014). Goal setting and energy conservation. *Journal of Economic Behavior and Organization*, *107*, 209-227.

Hardisty, David, Shim, Yoonji, Sun, Daniel, and Griffin, Dale. (2016). Encouraging energy efficiency: Product labels activate temporal tradeoffs. *ACR North American Advances*.

Hardisty, D. J., Shim, Y., Sun, D., & Griffin, D. W. (2020). Encouraging energy efficiency: Product labels activate temporal tradeoffs. *Available at SSRN 3576266*

Heinzle, Stefanie Lena. (2012). Disclosure of energy operating cost information: A silver bullet for overcoming the energy-efficiency gap?. *Journal of Consumer Policy*, *35*(1), 43-64.

Hutton, R. Bruce, and Wilkie, William L. (1980). Life cycle cost: A new form of consumer information. *Journal of Consumer Research, 6*(4), 349-360.

Ingendahl, M., Hummel, D., Maedche, A., & Vogel, T. (2021). Who can be nudged? Examining nudging effectiveness in the context of need for cognition and need for uniqueness. *Journal of Consumer Behaviour*, *20*(2), 324-336.

Jachimowicz, J. M., Duncan, S., Weber, E. U., & Johnson, E. J. (2019). When and why defaults influence decisions: A meta-analysis of default effects. *Behavioural Public Policy*, *3*(2), 159-186.

Jaffe, Adam B., and Stavins, Robert N. (1994). The energy paradox and the diffusion of conservation technology. *Resource and Energy Economics*, *16*(2), 91-122.

Jansson, J., Marell, A., and Nordlund, A. (2010). Green consumer behavior: determinants of curtailment and eco-innovation adoption. *Journal of consumer marketing*, *27*(4), 358-370.

Jessoe, Katrina, and Rapson, David. (2014). Knowledge is (less) power: Experimental evidence from residential energy use. *The American Economic Review*, *104*(4), 1417-1438.

Johnson, Eric J., and Goldstein, Daniel. (2003). Do defaults save lives?. *Science*, *302*(5649), 1338-1339.

Johnson, E. J., & Goldstein, D. G. (2013). Decisions by default. In *The behavioral foundations of public policy* (pp. 417-427). Princeton University Press.

Johnson, E. J., Shu, S. B., Dellaert, B. G., Fox, C., Goldstein, D. G., Häubl, G., ... & Weber, E. U. (2012). Beyond nudges: Tools of a choice architecture. *Marketing Letters*, *23*(2), 487-504.

Jona, L. (2018). 'Good Nudge Lullaby': Choice Architecture and Default Bias Reinforcement. *The Economic Journal*, *128*(610), 1180-1206.

Kaenzig, Josef, and Wüstenhagen, Rolf. (2010). The effect of life cycle cost information on consumer investment decisions regarding eco-innovation. *Journal of Industrial Ecology*, *14*(1), 121-136.

Kahneman, Daniel, Knetsch, Jack L., and Thaler, Richard H. (1990). Experimental tests of the endowment effect and the Coase theorem. *Journal of political Economy*, *98*(6), 1325-1348.

Larrick, R. P., & Soll, J. B. (2008). The MPG illusion. Science, 320, 1593–1594.

Larrick, Richard P., Soll, Jack B., and Keeney, Ralph L. (2015). Designing better energy metrics for consumers. *Behavioral Science and Policy*, *1*(1), 63-75.

Lee, A. Y., & Aaker, J. L. (2004). Bringing the frame into focus: the influence of regulatory fit on processing fluency and persuasion. *Journal of personality and social psychology*, *86*(2), 205.

Lembregts, Christophe, and Pandelaere, Mario. (2013). Are all units created equal? The effect of default units on product evaluations. *Journal of Consumer Research, 39*(6), 1275-1289.

Lin, Ying-Ching and Chang, Chiu-chi Angela. 2012. Double Standard: The Role of Environmental Consciousness in Green Product Usage. *Journal of Marketing*. 125-134.

Linville, Patricia W., and Fischer, Gregory W. (1991). Preferences for separating or combining events. *Journal of personality and social psychology*, *60*(1), 5.

Min, Jihoon, Inês L Azevedo, Jeremy Michalek, and Wändi Bruine de Bruin (2014), "Labeling energy cost on light bulbs lowers implicit discount rates," Ecological Economics, 97, 42-50.

McKenzie, C. R., Sher, S., Leong, L. M., & Müller-Trede, J. (2018). Constructed preferences, rationality, and choice architecture. *Review of Behavioral Economics*, *5*(3-4), 337-360.

McNeill, Dennis L., and Wilkie, William L. (1979). Public policy and consumer information: Impact of the new energy labels. *Journal of Consumer Research*, *6*(1), 1-11.

Newell, Richard G., and Siikamäki, Juha. (2014). Nudging energy efficiency behavior: The role of information labels. *Journal of the Association of Environmental and Resource Economists*, *1*(4), 555-598.

Novemsky, N., and Kahneman, D. (2005). The boundaries of loss aversion. *Journal of Marketing research*, *42*(2), 119-128.

Novemsky, Nathan, Dhar, Ravi, Schwarz, Norbert, and Simonson, Itamar. (2007). Preference fluency in choice. *Journal of Marketing Research*, *44*(3), 347-356.

Pandelaere, Mario, Briers, Barbara, and Lembregts, Christophe. (2011). How to make a 29% increase look bigger: The unit effect in option comparisons. *Journal of Consumer Research*, *38*(2), 308-322.

Samuelson, William, and Zeckhauser, Richard. (1988). Status quo bias in decision making. *Journal of risk and uncertainty*, *1*(1), 7-59. Schrift, R. Y., Netzer, O., and Kivetz, R. (2011). Complicating choice. *Journal of Marketing Research*, *48*(2), 308-326.

Schrift, R. Y., Netzer, O., & Kivetz, R. (2011). Complicating choice. *Journal of Marketing Research*, *48*(2), 308-326.

Schultz, P. W., Nolan, J. M., Cialdini, R. B., Goldstein, N. J., and Griskevicius, V. (2007). The constructive, destructive, and reconstructive power of social norms. *Psychological science*, *18*(5), 429-434.

Song, Hyunjin, and Schwarz, Norbert. (2008). If it's hard to read, it's hard to do processing fluency affects effort prediction and motivation. *Psychological Science*, *19*(10), 986-988.

Thaler, Richard H. (1985). Mental accounting and consumer choice. *Marketing Science*, *4*(3), 199-214.

Thaler, Richard H., Sunstein, Cass R., and Balz, John P., Choice Architecture (December 10, 2014). The Behavioral Foundations of Public Policy, Ch. 25, E. Shafir, ed. (2012). Available at SSRN: https://ssrn.com/abstract=2536504. or http://dx.doi.org/10.2139/ssrn.2536504.

Tversky, A., & Kahneman, D. (1991). Loss aversion in riskless choice: A reference-dependent model. *The quarterly journal of economics*, *106*(4), 1039-1061.

Ungemach, Christoph, Camilleri, Adrian R., Johnson, Eric J., Larrick, Richard P., and Weber, Elke U. (2017). Translated Attributes as Choice Architecture: Aligning Objectives and Choices Through Decision Signposts. *Management Science, 64*(5), 2445-2459.

US Department of Energy. (2021, May). *Residential Sector Energy Consumption*. Monthly Energy Review . https://www.eia.gov/totalenergy/data/monthly/pdf/sec2_5.pdf.

Weber, Martin, Eisenführ, Franz, and Von Winterfeldt, Detlof. (1988). The effects of splitting attributes on weights in multiattribute utility measurement. *Management Science*, *34*(4), 431-445.