Matching costs to context:
Status quo bias, temporal framing, and household energy decisions

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Motivation: reduce energy consumption

US residential consumers used 10.2 quadrillion BTU of energy in 2009

- Amounts to nearly $230 billion spent on utility bills
- Negative environmental and health externalities
Status quo bias may lead to inefficiency

Individuals tend to stick with defaults and status quos

Individuals tend to keep contractor’s arbitrary light bulb choice

Dinner et al. 2011
Make costs salient – but how?
This cup of coffee costs $1.80.

This cup of coffee costs 180 pennies.

Framing is important
Cognitive fluency affects decision making

**FLUENCY: The subjective experience of ease of processing information**

Using familiar, easy to read, compare, understand descriptions leads to...
- Product attractiveness
- Intentions to exercise and cook
- Choosing fuel-efficient cars

Difficulty in constructing preferences (e.g. hard to distinguish between attributes) may result in deferred choices

Lembregts and Pandelaere 2013; Song and Schwarz 2008; Camilleri and Larrick 2014; Novemsky et al 2007
Objectives

• Identify which temporal frame of costs/savings reduces status quo bias in energy decisions (Study 1)

• Investigate the role of cognitive fluency (Study 2)

• Explore the effect of providing context for evaluating costs in less-fluent frames (Study 3)
Study 1: Status quo bias and cost frame

Online survey: $N = 353$ MTurkers, between-subjects experiment.

We manipulated status quo behavior (inefficient, efficient) and how the costs or savings of switching behaviors was framed (per day, per month, per year).
When doing the laundry, you can choose what water temperature your washing machine uses.

Some people choose to use warm or hot water because they think warmer water is most effective for cleaning laundry.

However, warm and hot water use more energy than cold water.

Suppose you often use warm water, but you are considering whether to use only cold water for your laundry.

If you only use cold water, you will save 17 cents per day on energy costs.

What do you think you would do? Please answer on the following scale where 10 means that you would definitely only use cold water and 0 means you would definitely use warm water.
Study 1: Example scenario and treatment

When doing the laundry, you can choose what water temperature your washing machine uses.

Some people choose to use warm or hot water because they think warmer water is most effective for cleaning laundry.

However, warm and hot water use more energy than cold water:

Suppose you often use warm water, but you are considering whether to use only cold water for your laundry.

If you only use warm water, you will pay **17 cents more per day** on energy costs.

What do you think you would do? Please answer on the following scale where 10 means that you would definitely only use cold water and 0 means you would definitely use warm water.

<table>
<thead>
<tr>
<th>Definitely warm water</th>
<th></th>
<th>Definitely cold water</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
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<tr>
<td>3</td>
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<td>8</td>
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<tr>
<td>9</td>
<td>10</td>
<td>11</td>
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Study 1: Example scenario and treatment

When doing the laundry, you can choose what water temperature your washing machine uses.

Some people choose to use warm or hot water because they think warmer water is most effective for cleaning laundry.

However, warm and hot water use more energy than cold water:

Suppose you often use warm water, but you are considering whether to use only cold water for your laundry.

If you only use warm water, you will pay $5.25 more per month on energy costs.

What do you think you would do? Please answer on the following scale where 10 means that you would definitely only use cold water and 0 means you would definitely use warm water.

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Study 1: Example scenario and treatment

When doing the laundry, you can choose what water temperature your washing machine uses.

Some people choose to use warm or hot water because they think warmer water is most effective for cleaning laundry.

However, warm and hot water use more energy than cold water.

Suppose you often use warm water, but you are considering whether to use only cold water for your laundry.

If you only use warm water, you will pay $63 more per year on energy costs.

What do you think you would do? Please answer on the following scale where 10 means that you would definitely only use cold water and 0 means you would definitely use warm water.

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<tr>
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<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Definitely cold water</th>
</tr>
</thead>
</table>

Definitely warm water | Not sure | Definitely cold water

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<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
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</tr>
</thead>
</table>

Definitely warm water | Not sure | Definitely cold water
Study 1: Example scenario and treatment

Many homes have a second fridge or freezer. They are typically used for additional food storage or convenience, and are often located in a garage or basement.

Suppose you own a second fridge and are deciding what to do with it?

If it’s plugged in, you can use it to keep things cold, but must pay for its energy costs.

If it’s not plugged in, you can store it in the house, give it away or sell it.

Suppose you are considering whether to disconnect a second fridge in your house.

If you **disconnect the second fridge**, you will **save $10.00 per month** on energy costs.

What do you think you would do? Please answer on the following scale where 10 means that you would definitely disconnect the fridge and 0 means you would definitely connect the fridge.
Study 1: Status quo bias minimized in monthly frame

N=353, +/- 1 standard error shown
### Study 1: ANOVA and regression results

**DV = Behavior Intention [0: inefficient - 10: efficient]**

<table>
<thead>
<tr>
<th></th>
<th>Analysis of Variance</th>
<th>OLS Regression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>df</td>
<td>[1]</td>
</tr>
<tr>
<td><strong>Status Quo</strong></td>
<td>1</td>
<td>$F = 15.93^{***}$</td>
</tr>
<tr>
<td><strong>Efficient</strong></td>
<td></td>
<td>omitted</td>
</tr>
<tr>
<td><strong>Inefficient</strong></td>
<td></td>
<td>-1.827 (0.439)^{***}</td>
</tr>
<tr>
<td><strong>Cost Frame</strong></td>
<td>2</td>
<td>$F = 4.67^{***}$</td>
</tr>
<tr>
<td>Per Day</td>
<td></td>
<td>-0.166 (0.438)</td>
</tr>
<tr>
<td>Per Month</td>
<td></td>
<td>0.541 (0.441)</td>
</tr>
<tr>
<td>Per Year</td>
<td></td>
<td>0.541 (0.441)</td>
</tr>
<tr>
<td><strong>Interaction</strong></td>
<td>2</td>
<td>$F = 4.33^{**}$</td>
</tr>
<tr>
<td>Ineff. x Month</td>
<td></td>
<td>1.793 (0.616)^{***}</td>
</tr>
<tr>
<td>Ineff. x Year</td>
<td></td>
<td>0.684 (0.616)</td>
</tr>
<tr>
<td><strong>Controls</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss Aversion Coef.</td>
<td>1</td>
<td>$F = 1.90$</td>
</tr>
<tr>
<td>Construal Level</td>
<td>1</td>
<td>$F = 1.09$</td>
</tr>
<tr>
<td>Cognitive Reflection</td>
<td>1</td>
<td>$F = 1.52$</td>
</tr>
<tr>
<td>Environmental Concern</td>
<td>1</td>
<td>$F = 24.77^{***}$</td>
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<tr>
<td>Constant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obs</td>
<td></td>
<td>353</td>
</tr>
<tr>
<td>R-squared</td>
<td></td>
<td>0.090</td>
</tr>
</tbody>
</table>

Notes: *, **, and *** represent statistical significance at probabilities < 0.1, 0.05, and 0.01, respectively. $F$ statistics shown for analysis of variance (columns 1 and 2). Regression coefficients with standard errors in parentheses shown for regression analysis (columns 3 and 4).
Study 1: Status quo bias minimized in monthly frame

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N=353, +/- 1 standard error shown
*** and ** indicate significance at the 1% and 5% levels, respectively, using the per family error rate.
Study 1: Status quo bias minimized in monthly frame

→ Monthly framing minimizes status quo bias

Could monthly energy bills provide an implicit context to help evaluate costs?

![Bar chart showing behavior intention.

- **Daily Costs**
  - Efficient Status Quo: 7.02
  - Inefficient Status Quo: 5.19

- **Monthly Costs**
  - Efficient Status Quo: 6.85
  - Inefficient Status Quo: 6.82

- **Yearly Costs**
  - Efficient Status Quo: 7.56
  - Inefficient Status Quo: 6.42

N=353, +/- 1 standard error shown
Study 2: Cognitive fluency across frames

Online survey: $N = 1,199$ MTurkers, between-subjects experiment.

Same scenario set-up as Study 1. We elicited fluency using five measures and compared across cost frames.

Fluency measures on 7-point Likert scale:

- Estimating how the energy decision would financially impact me was...
- Understanding what the energy decision meant was...
- The description of the financial impact seemed...
- The description of the energy decision seemed...
- How involved were you in the energy decision?
Study 2: Fluency is highest in the monthly frame

Cronbach’s $\alpha = 0.790$
## Study 2: Fluency is highest in the monthly frame

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</tr>
<tr>
<td>df</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Cost Frame</td>
<td></td>
<td>$F = 3.48^{**}$</td>
</tr>
<tr>
<td>Per Day</td>
<td></td>
<td>$F = 3.99^{**}$</td>
</tr>
<tr>
<td>Per Month</td>
<td></td>
<td></td>
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<tr>
<td>Per Year</td>
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<td></td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Care about saving money</td>
<td>1</td>
<td>$F = 17.08^{***}$</td>
</tr>
<tr>
<td>Care about environment</td>
<td>1</td>
<td>$F = 7.82^{***}$</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obs</td>
<td>1,199</td>
<td>1,199</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.006</td>
<td>0.035</td>
</tr>
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</table>

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Study 2: Fluency is highest in the monthly frame

 Individuals are most fluent with monthly costs

Fluency Index

N=1,199 +/- 1 SE
Study 3: Provide context for unfamiliar frames

Online survey: $N = 132$ Qualtrics recruits, between-subjects experiment

We provide an explicit context for total energy spending (left fig.) and costs of engaging in energy-inefficient behaviors (right fig.)
Study 3: Provide context for unfamiliar frames

Online survey: $N = 132$ Qualtrics recruits, between-subjects experiment

We provide an explicit context for total energy spending (left fig.) and costs of engaging in energy-inefficient behaviors (right fig.)
Study 3: Provide context for unfamiliar frames

- Behavior Intention: [0: inefficient - 10: efficient]
  - Daily Spending: 7.70
  - Yearly Spending: 7.58
  - Daily Costs: 6.73
  - Yearly Costs: 8.01

N=132, +/- 1 standard error shown
Study 3: Provide context for unfamiliar frames

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<td>[2]</td>
</tr>
<tr>
<td>Per Year Cost Frame</td>
<td>$F = 0.82$</td>
<td>$F = 2.38$</td>
</tr>
<tr>
<td>Per Year Spending Frame</td>
<td>$F = 3.70^*$</td>
<td>$F = 2.61$</td>
</tr>
<tr>
<td>Interaction</td>
<td>$F = 5.47^{**}$</td>
<td>$F = 6.97^{***}$</td>
</tr>
</tbody>
</table>

Controls

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Construal Level</td>
<td>$F = 0.29$</td>
<td>-0.062 (0.115)</td>
</tr>
<tr>
<td>Math Ability</td>
<td>$F = 0.00$</td>
<td>0.009 (0.953)</td>
</tr>
<tr>
<td>Environmental Concern</td>
<td>$F = 9.15^{***}$</td>
<td>-0.575 (0.190)**</td>
</tr>
<tr>
<td>Care about Saving Money</td>
<td>$F = 1.26$</td>
<td>0.293 (0.261)</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td>7.705 (0.290)**</td>
</tr>
</tbody>
</table>

Obs | 132 | 132 | 132 | 132
R-squared | 0.070 | 0.160 | 0.070 | 0.160

Notes: *, **, and *** represent statistical significance at probabilities < 0.1, 0.05, and 0.01, respectively. $F$ statistics shown for analysis of variance (columns 1 and 2). Regression coefficients with standard errors in parentheses shown for regression analysis (columns 3 and 4).
Study 3: Provide context for unfamiliar frames

Simple Main Effect of Cost Frame at Spending Frame

Behavior Intention: [0: inefficient - 10: efficient]

N=132, +/- 1 standard error shown

** indicates significance at the 5% level using the per family error rate.
Study 3: Provide context for unfamiliar frames

Behavior Intention: [0: inefficient - 10: efficient]

Daily Spending: 7.70
Yearly Spending: 6.73
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Yearly Costs: 8.01

→ Supplementing cost info with a spending context in the same frame can increase efficiency intentions

N=132, +/- 1 standard error shown
Conclusions

When targeting an energy-inefficient audience without an explicit spending context – **consider framing costs as per month.**

Providing a **context for total energy spending in the same frame as costs** of energy inefficiency may help reduce resistance to adopting energy-efficient behaviors.

Yearly framing of costs/savings coupled with annual total energy spending may encourage the most energy efficient behavior intentions. Future research will investigate when aggregating costs broadly is most effective.

Future research will apply findings to improve Energy Guide labels and translate intentions of energy efficiency to electricity and monetary savings.
Acknowledgements

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Select References


