What's Behavior Got to Do With IT?

4 Ways Understanding People Can Improve Technology

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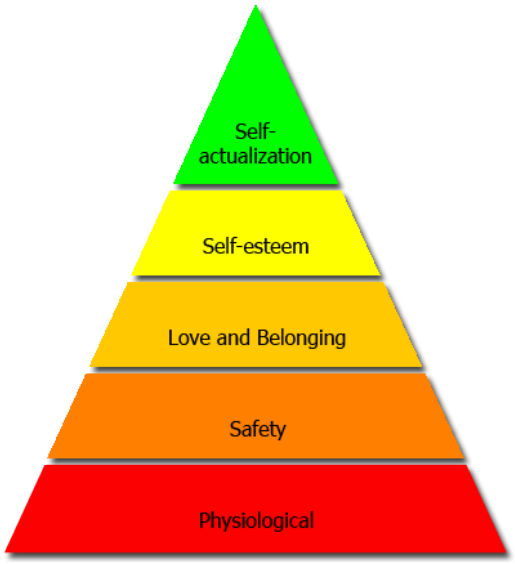
Underlying assumptions

1. **Technology and new media** are significantly changing how we interact with our natural, built & social worlds.
2. There are **potential opportunities** to leverage these changes for pro-social / pro-environmental benefit.
3. A **psychological approach** provides a theoretical base and empirical methods to understand this potential.



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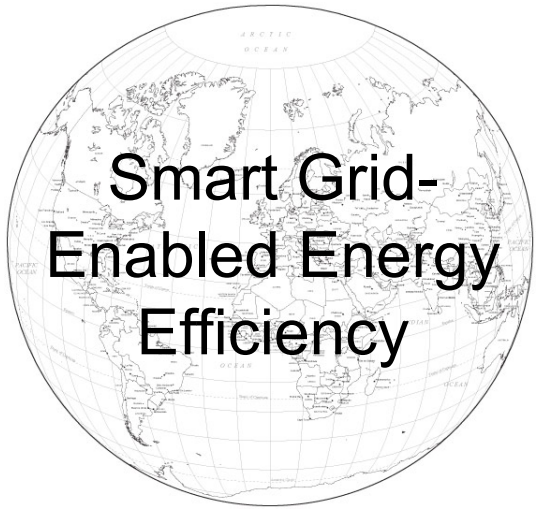
Transformational Media Lab

Mission:

Our lab studies how media is (and can be) used to transform individuals, communities, and systems.



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Four Thoughts on Behavior

1. Look beyond either/or.
2. Seeing can be believing.
3. Ask the right questions.
4. It's not what you say, it's how you say it.

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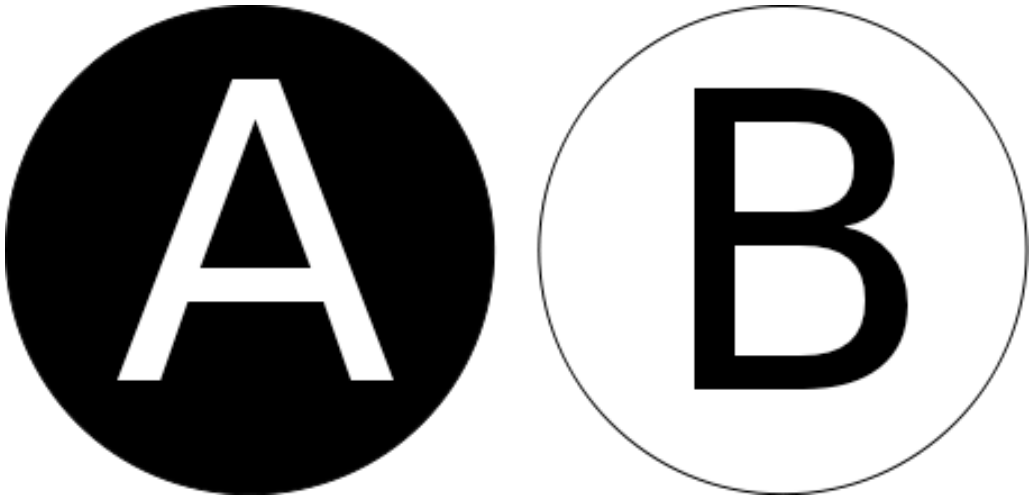
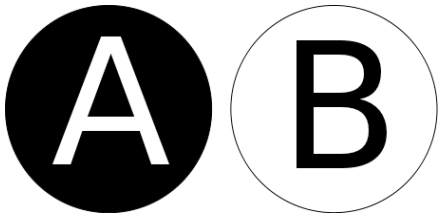
What is a dichotomy?

A pair of categories that are both mutually exclusive & exhaustive.



Dichotomies in energy efficiency

Option A	Option B
Supply Side	Demand Side
Adaptation	Mitigation
Technical solutions	Behavioral solutions
Acceptance	Denial
"_____" works	"_____" doesn't work
Environmental	Apathetic



Potential Solutions

Technology

A B

People

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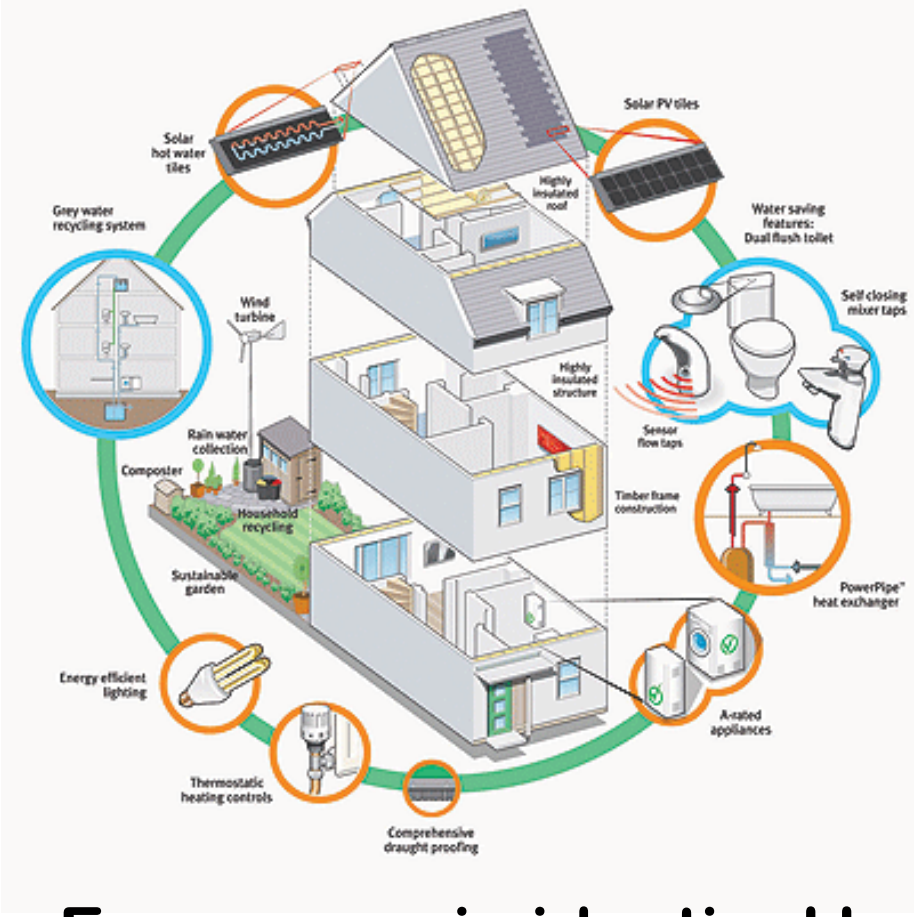
People use technology



Energy use in identical houses has been found to vary by up to 260% (Parker, Mazzara, & Sherwin, 1996)

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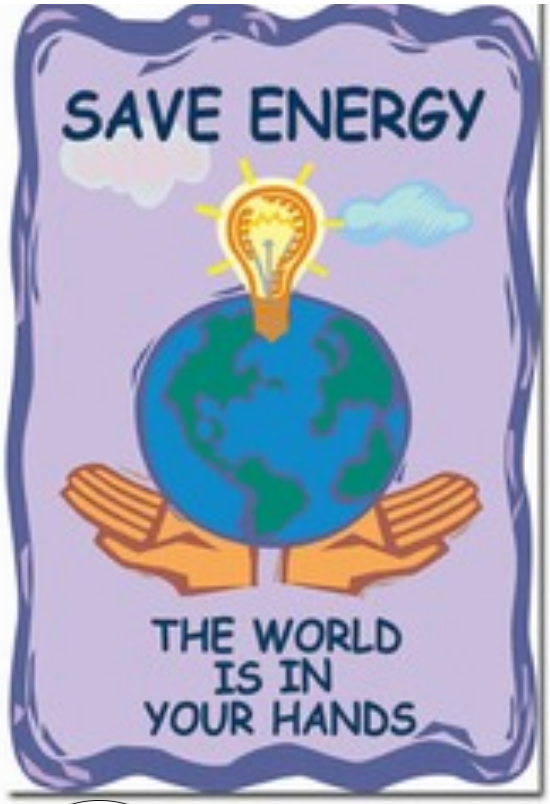
Media approaches

Holistic



A

B

Individual

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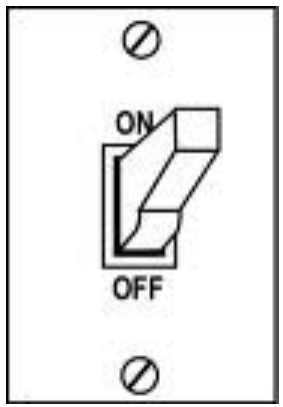
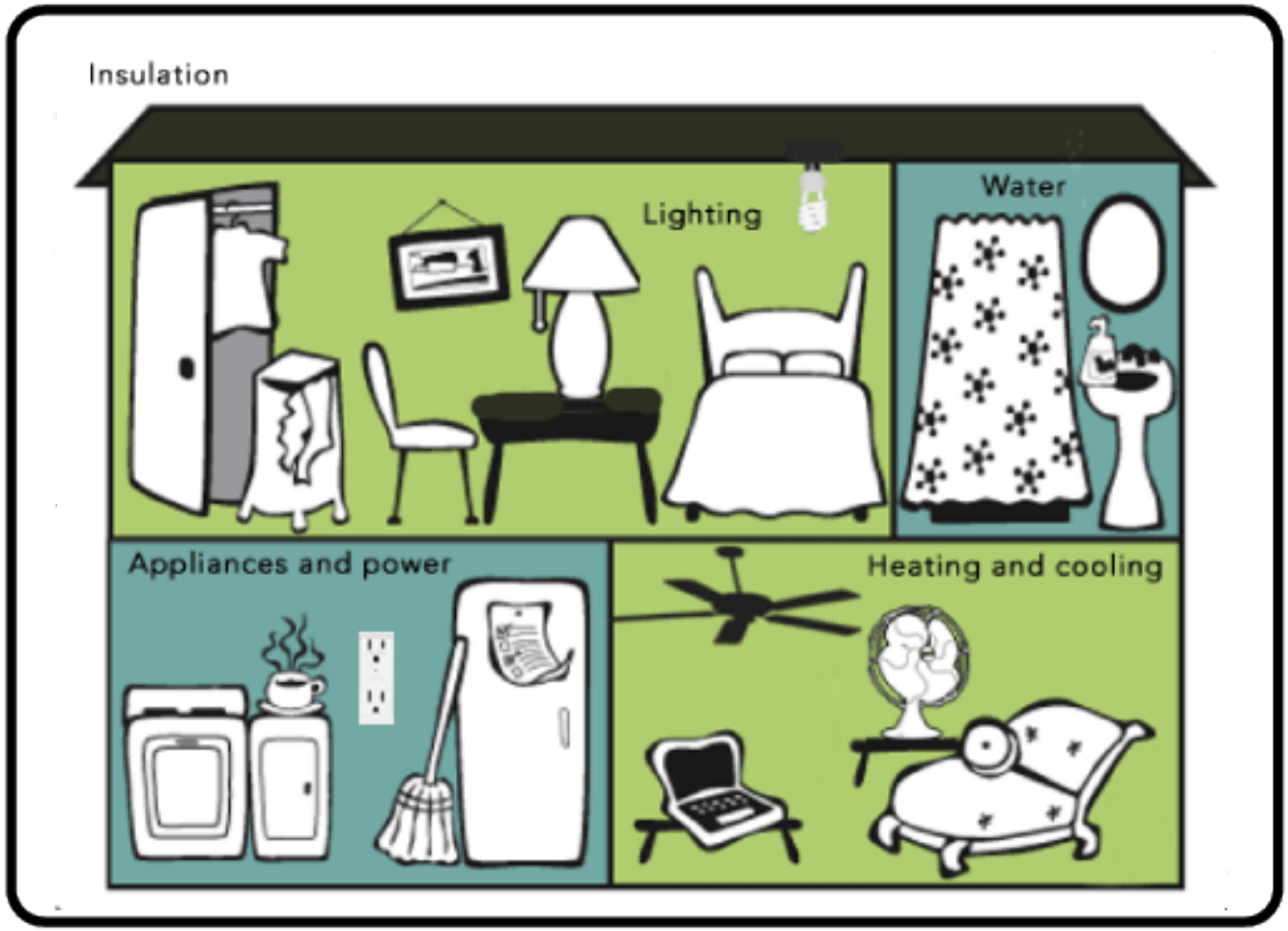
Conservation = many behaviors

Example:

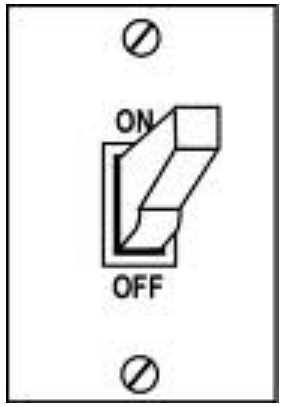




Behavior Dimensions

Curtailment

Suffer



A B

Efficiency

Spend

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Behavior Dimensions

Attribute	Curtailment	Efficiency
COST	No/Low Cost (11)	Require financial outlay (12)
FREQUENCY	Repetitive / Frequent (12)	Infrequent /one-time (15)
LIFESTYLE	Loss of amenities (6)	No lifestyle changes (2)
ACTIONS	Behavior / usage (6)	Structural / purchases (12)
PERMANENCE	Reversible (4)	Durable (7)
MOTIVATION	Saving energy / moral (2)	Saving money / rational (3)
OUTCOME	Less impact/savings (2)	Greater savings (5)

Abrahamse et al., 2005; Attari et al., 2010; Ayres et al., 2009; Barr et al., 2005; Black et al., 1985; Butler & Hope, 1995; Cialdini & Schultz, 2003; Curtis et al., 1984; Dietz et al., 2009; Dillman et al., 1983; Geller et al., 1982; Gardner & Stern, 1996; Kempton et al., 1984; Kempton et al., 1992; Macey & Brown, 1983; Nair et al., 2010; McKenzie Mohr, 1994; Oikonomou et al., 2009; Poortinga et al., 2003; Samuelson, 1990; Stern, 1992; Stern & Gardner, 1981; Van Raaij & Verhallen, 1983

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Behavioral Dimensions

Attribute	Curtailment	Efficiency
COST	No/Low Cost (11)	Require financial outlay (12)
FREQUENCY	Repetitive / Frequent (12)	Infrequent /one-time (15)

Features of a dichotomy:

1. **Exclusive**
2. **Exhaustive**

Behavior Dimensions

	Low Cost	High Cost
Infrequent	Maintenance	Efficiency
Frequent	Curtailment	???

Van Raaij & Verhallen, 1983; Kempton et. al., 1984;
Kempton et al., 1992; McKenzie Mohr 1994; Stern, 1992

What's the third option?

Curtailment	Efficiency	Maintenance

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Are there more?

- **High- vs. Low- cost** (Black et al., 1985)
- **Building Envelope** (Nair et al., 2010)
- **WEMAD: Weatherization, Equipment, Maintenance, Adjustments, and Daily behavior** (Dietz et al., 2009)
- **Energy behavior clusters** (Flora et al., in preparation)

Can we test them?

- **Curtailment**

Turn off/unplug

Run full loads

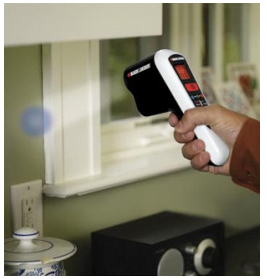
Turn off lights

- **Efficiency**

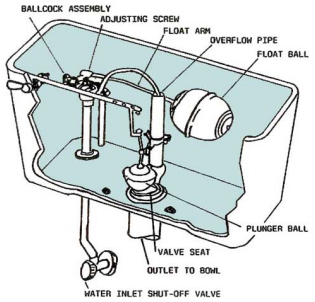
Insulate home

Efficient Appliances

Change light bulb



Check for thermal leaks



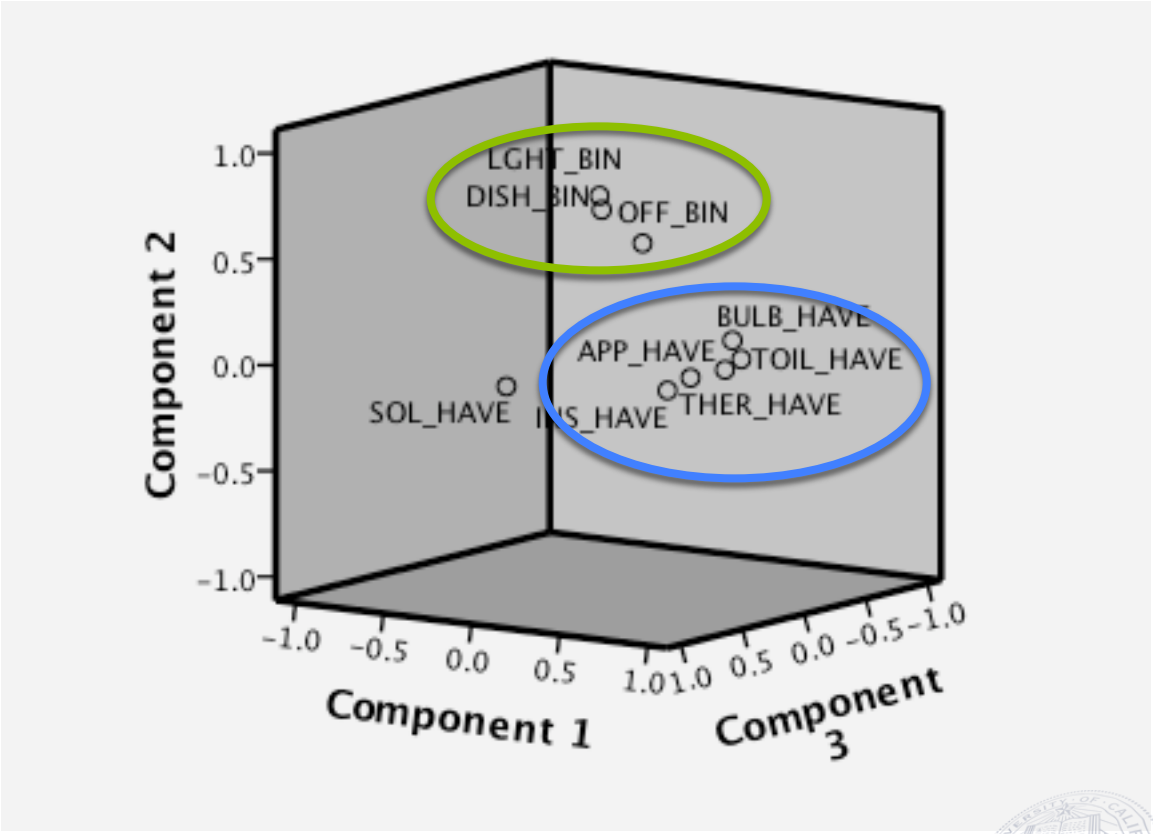
Check toilet for leaks

What did people do?

Behavior	% reported
Insulation	33.1%
New Appliance	61.3%
Replace Light Bulbs	80.9%
Check for Toilet Leaks	47.8%
Check for Thermal Leaks	21.1%
Turn off Lights	49.1%
Run Full Loads	77.6%
Shut Down Appliances	30.7%

Did they cluster in dimensions?

- **Two primary components found:**
  - **Efficiency**
  - **Curtailment**



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How were they different?

Variable	Curtailment	Efficiency
Gender	.031	-.099*
Age	-.012	.370***
Race	-.086*	.028
Married	-.077	.272***
Education	-.019	.107*
Income	-.052	.172***
Home Type	-.021	.284***
Homeowner	.004	.425***
Home Size	-.030	.281***

How were they different?

Variable	Curtailment	Efficiency
Self-Efficacy	.162***	.028
Social Motivation	.079	.026
Price Consciousness	.134**	.192***
Financial Motivation	.038	.030
Environmental Attitudes	.165***	.056
Environmental Norm	.232***	.101*
Environmental Motivation	.196***	.074

How were they different?

A four-step regression model was run for curtailment and efficiency. Significant predictors in the final models for each dimension were:

Efficiency

- Gender
- Age
- Marital Status
- Homeownership*
- Bill Consciousness

Curtailment

- Race
- # of people in home
- Bill Consciousness
- Environmental Norm*
- Environmental Motivation*

** Indicates strongest predictor in model*

What does it mean?

Curtailment	Efficiency
Predicted by environmental attitudes	**Predicted by home ownership**

Bill consciousness predicts both –
could providing improved feedback help?

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What is Feedback?

"Information about the result of a process or action that can be used in modification or control of a process or system"

Oxford English Dictionary

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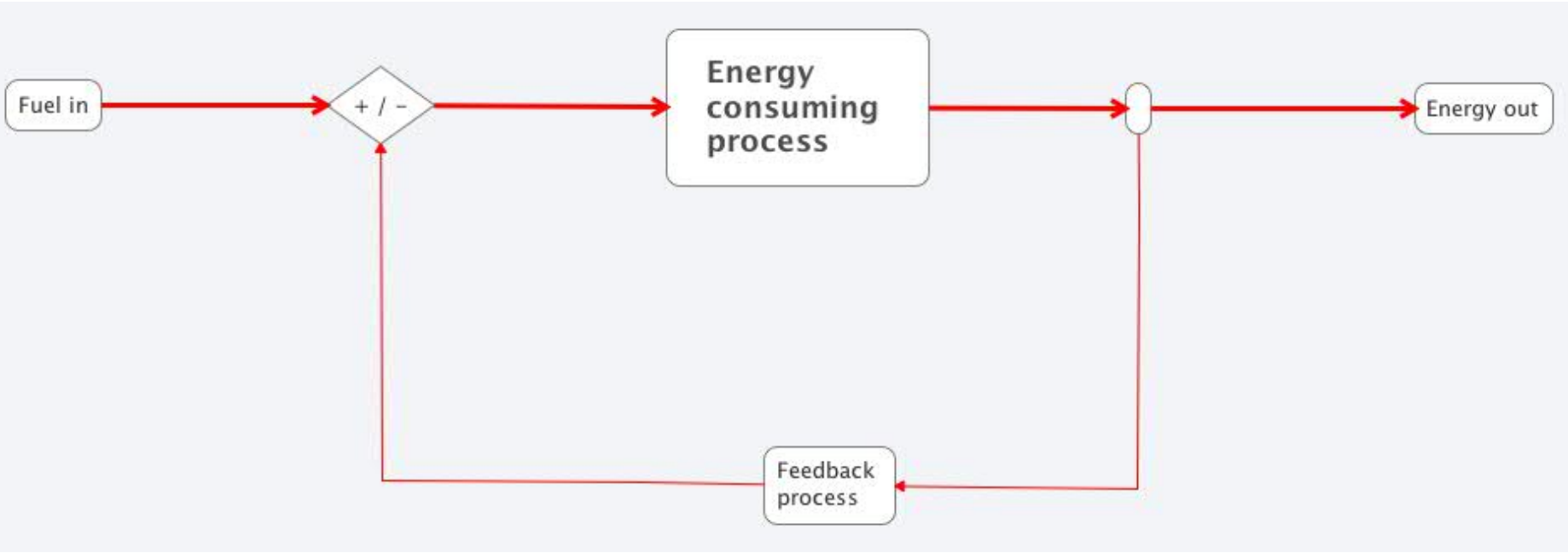

Law of Effect (Behaviorism)

- Behavior depends on its effect
- Knowledge of results (KR) is required for behavior change.
- A positive response to behavior serves as reinforcement
- A negative response serves as punishment

Thorndike, 1927

How much energy does your washer use?

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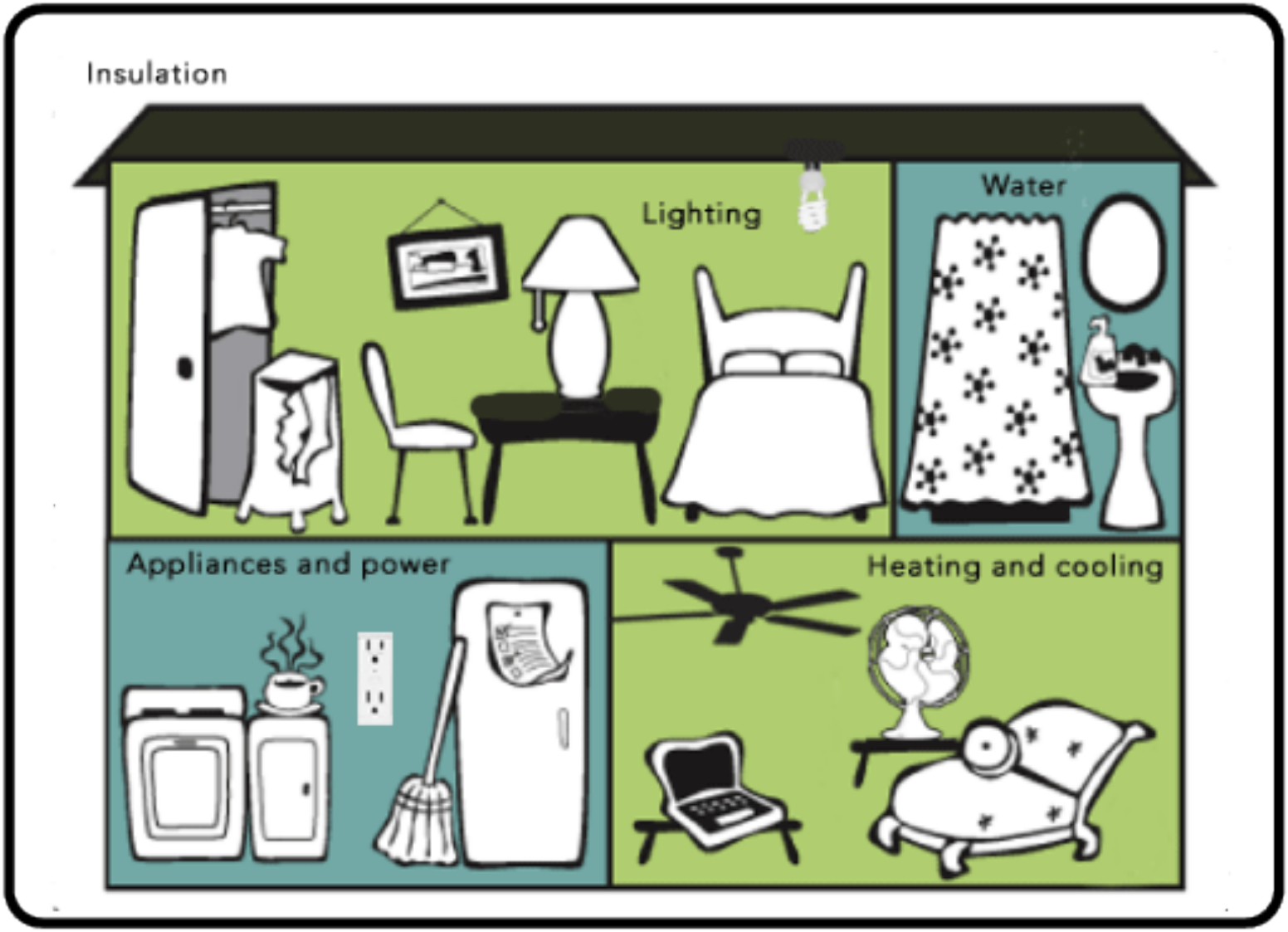
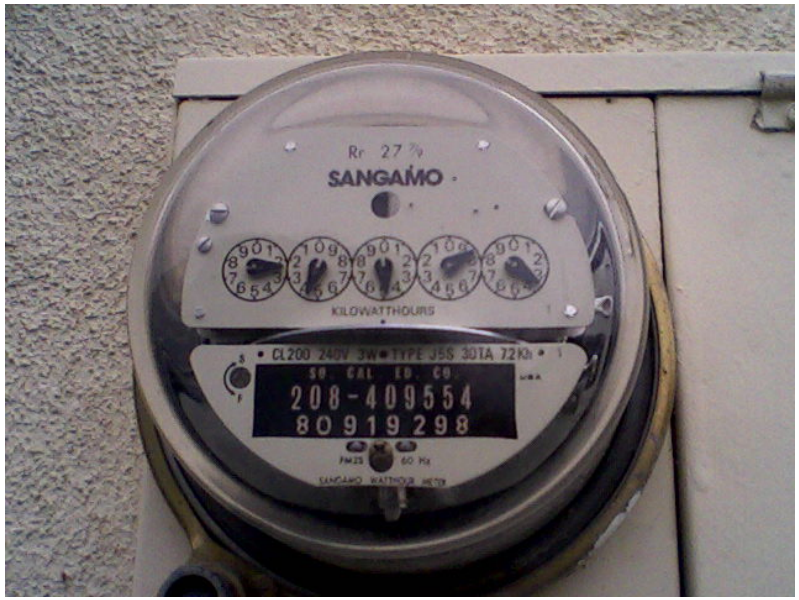
How about your whole house?



Our Window of Opportunity



RIP
Traditional Meter
Circa 1880 –2020

Automatic transmission to utilities
Feedback to consumers

Feedback is Effective

- 100+ studies conducted since 1976
- Reviews found average 10% savings
- Mean r-effect size = .1174 ($p < .001$)

I had no idea how much energy computers used

We installed power strips to easily power off all high energy items

Darby, 2006; Ehrhardt-Martinez et al., 2010; Fischer, 2008; Karlin & Zinger, in preparation

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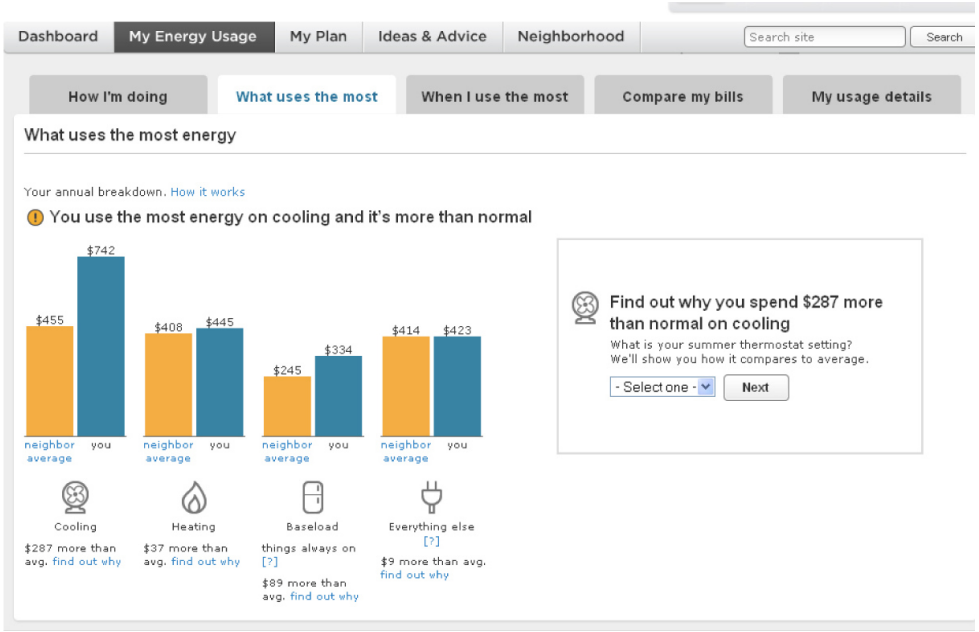
Feedback ~~is~~ *can be* effective…

- Effect sizes from -.0830 to .4803
- Moderator Analysis
  - Study population
  - Home similarity (marginally significant)
  - Study duration
  - Frequency of feedback
  - Feedback medium
  - Disaggregation by appliance
  - Comparison message (marginally significant)

Karlin & Zinger, in preparation

Many Kinds of Feedback



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Improving Studies

- Not naturalistic
  - Participants recruited to participate
  - May be different from “active adopters”
- Not comparative
  - Most studies tests one type of feedback (vs. control)
  - Very few commercial products in studies
- Not testing mediation
  - DV is energy use, but studies rarely test possible mediators to explain effectiveness

HOW Is Feedback Effective?

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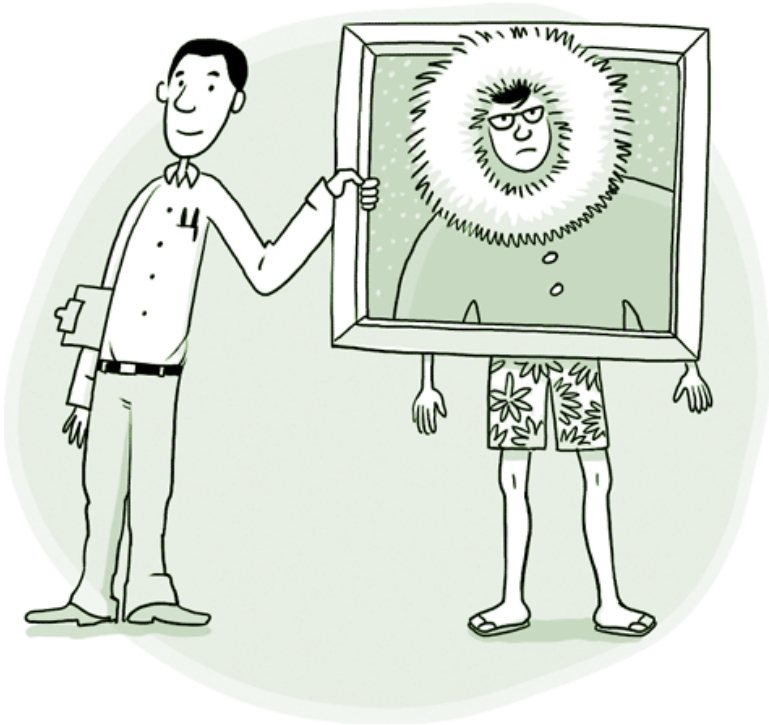
What is Framing?

Presentation of information in a way that encourages certain interpretations & discourages others.



"There is no value neutral way of presenting people with information."

- Elke Weber, APA 2012

How much energy does your washer use?

1079 KwH/year

65.9 Billion

$$$

$.25/load

$85/year

5.8% of average home

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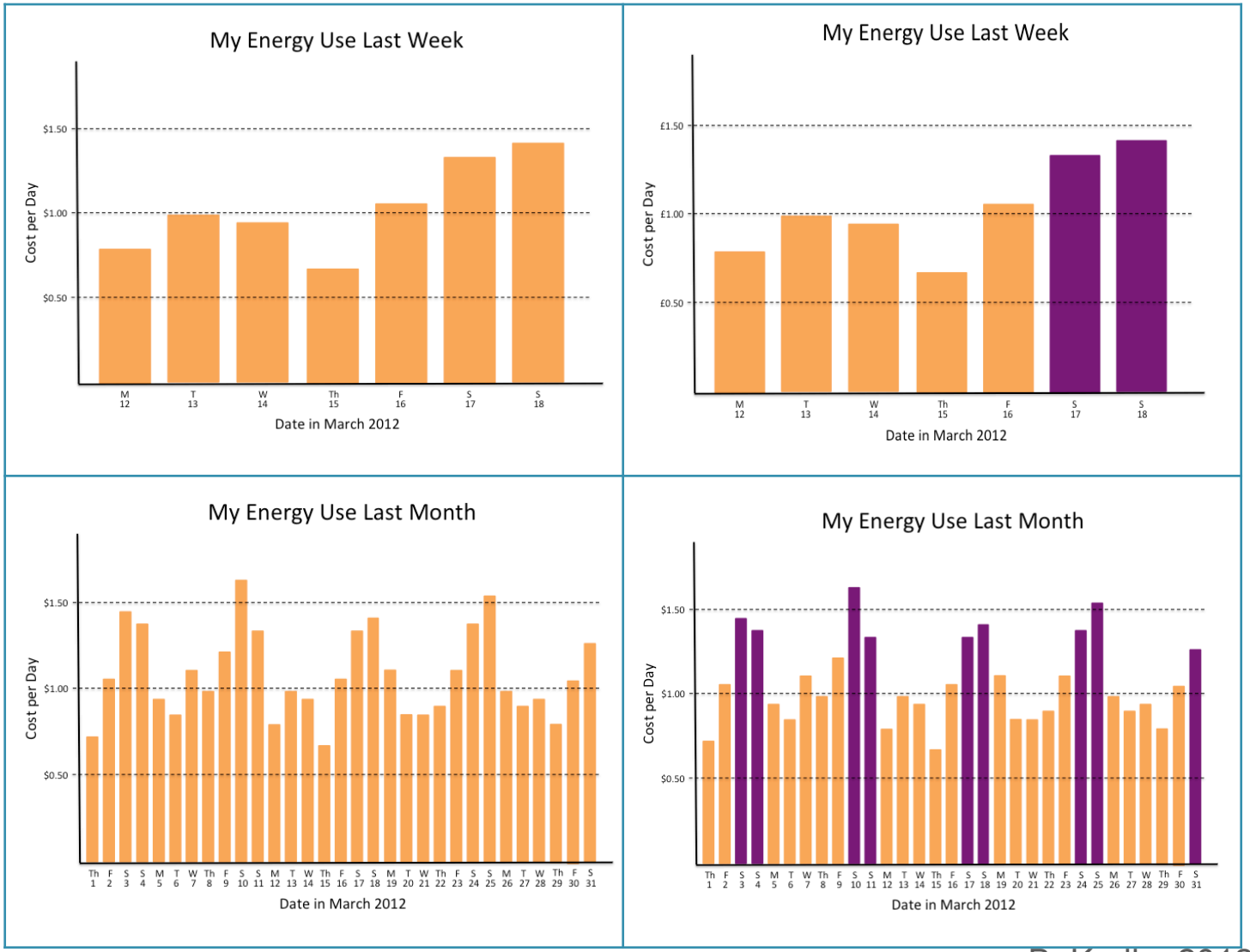
Message Framing

Impacts of leaving your router on when not in use	
1	Turning your router off when not in use saves energy.
2	A router left on all day uses .07 kWh of electricity.
3	A router left on all day costs $.06.
4	A router left on all day uses the equivalent of 37 AA batteries.
5	If all Americans switched off their router when not in use, we could save $2.8 billion a year.

Framing in Visualizations



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Closing Thoughts

"It is far better to adapt the technology to the user than to force the user to adapt to the technology."

– Larry Marine

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