

# Human behavior and energy consumption

Understanding decisions about energy

Shahzeen Z. Attari

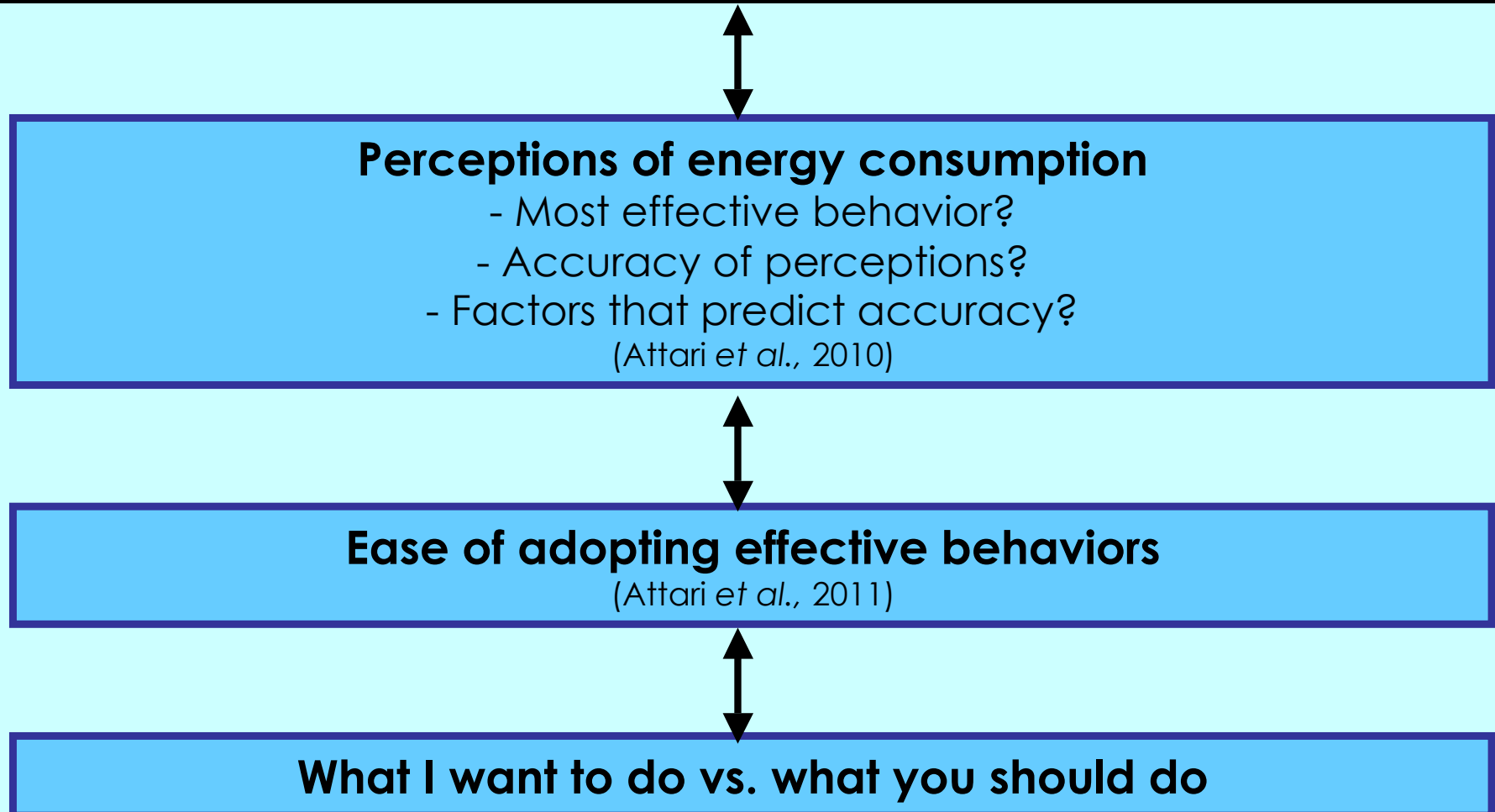
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Columbia University  
Earth Institute & Center for Research on Environmental Decisions

# Overview

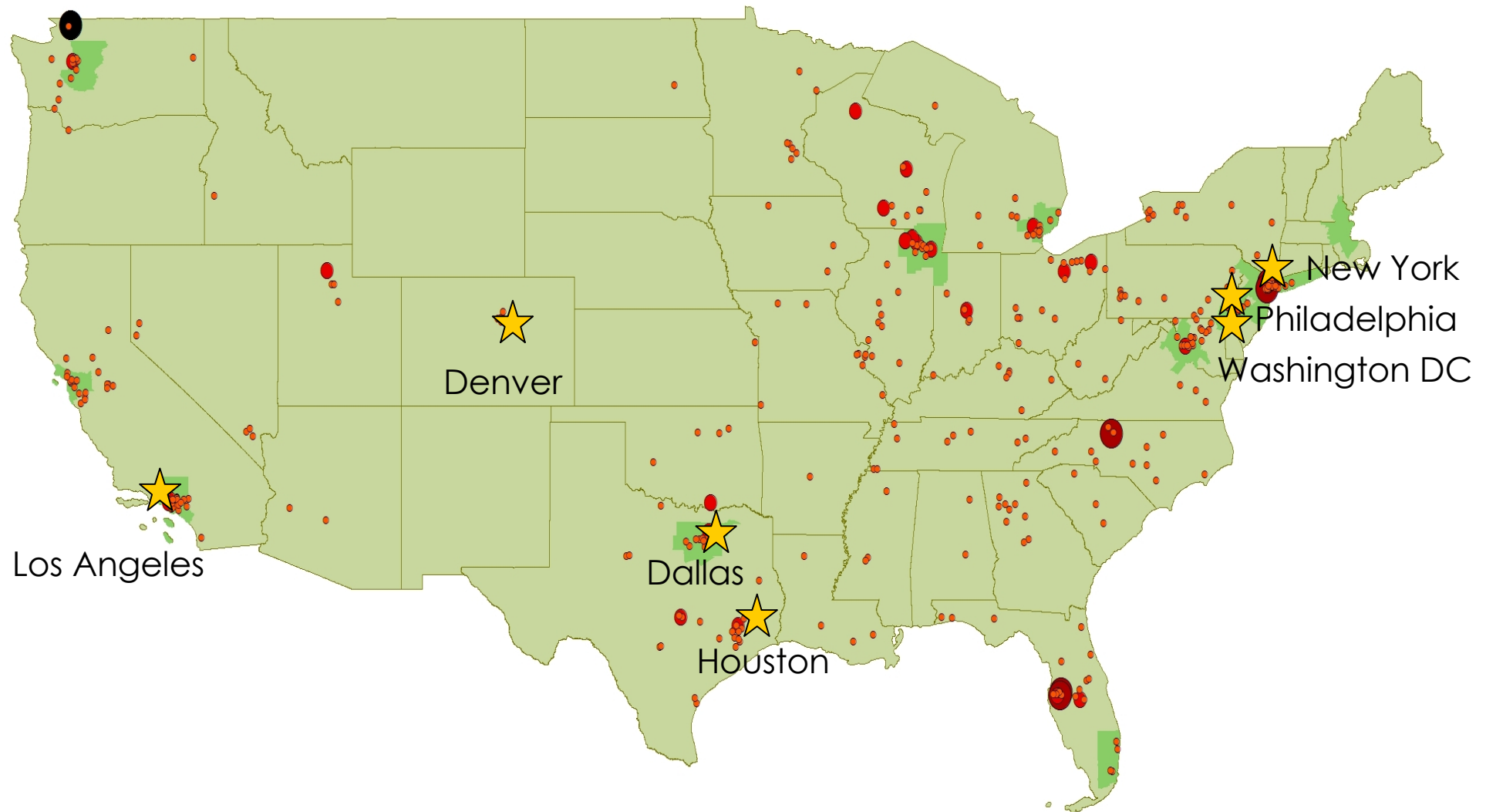
work completed

Understand how people interact with technology and nature



# Perception Study: Participants

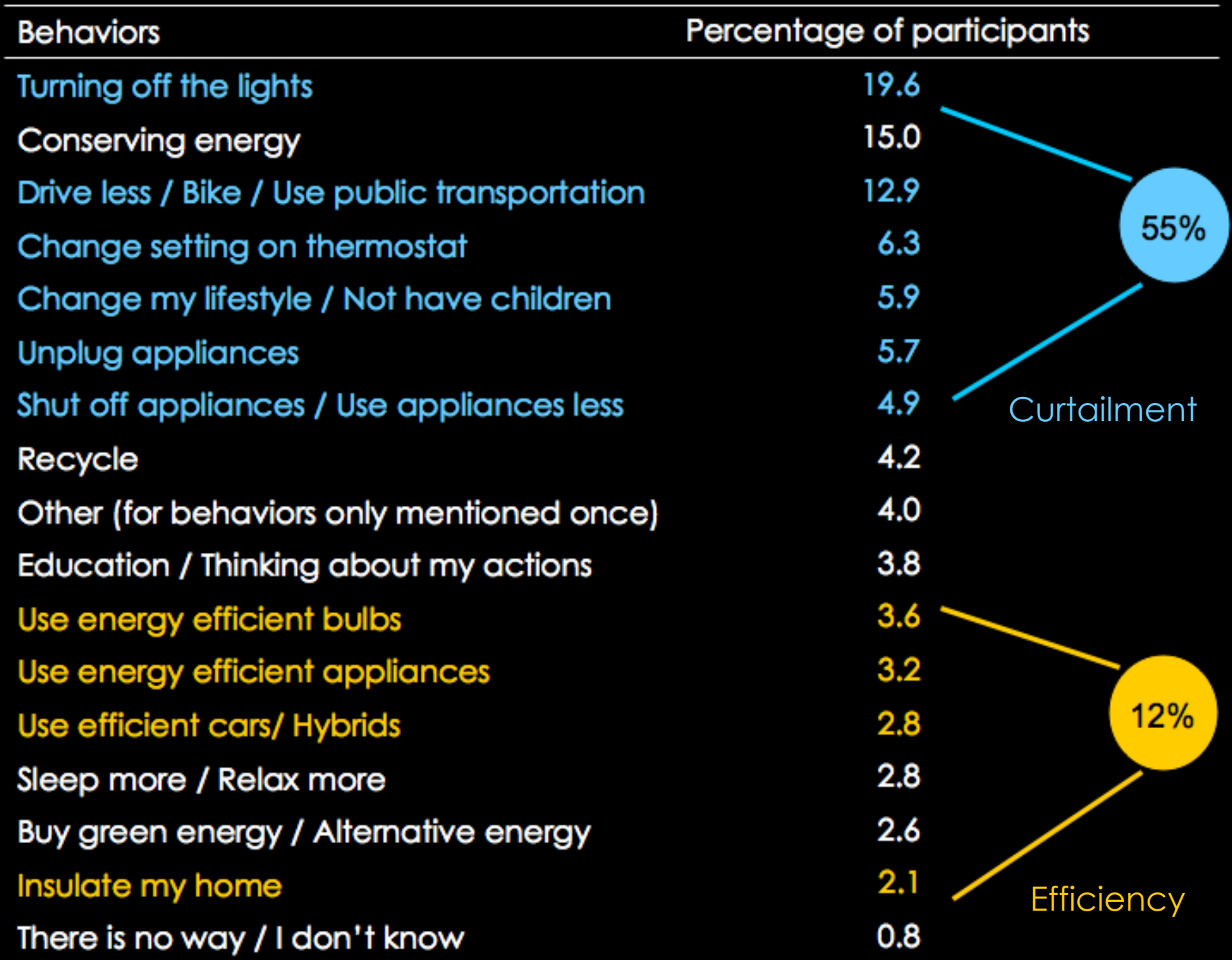
Online survey advertized via Craigslist in seven metropolitan cities ( $n = 505$ )



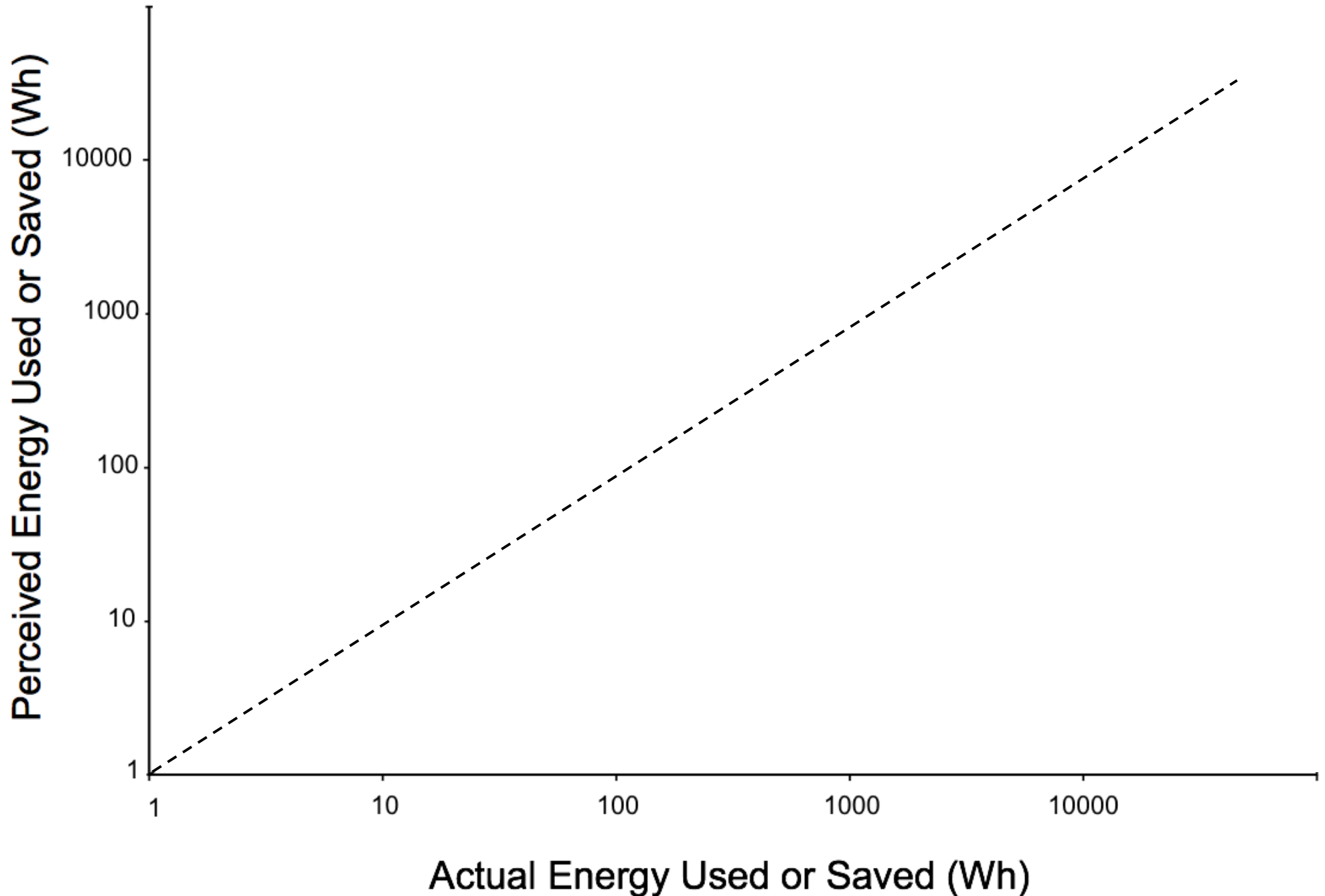
# Behaviors deemed “most effective” by participants

| Behaviors                                     | Percentage of participants |
|---|----------------------------|
| Turning off the lights                        | 19.6                       |
| Conserving energy                             | 15.0                       |
| Drive less / Bike / Use public transportation | 12.9                       |
| Change setting on thermostat                  | 6.3                        |
| Change my lifestyle / Not have children       | 5.9                        |
| Unplug appliances                             | 5.7                        |
| Shut off appliances / Use appliances less     | 4.9                        |
| Recycle                                       | 4.2                        |
| Other (for behaviors only mentioned once)     | 4.0                        |
| Education / Thinking about my actions         | 3.8                        |
| Use energy efficient bulbs                    | 3.6                        |
| Use energy efficient appliances               | 3.2                        |
| Use efficient cars/ Hybrids                   | 2.8                        |
| Sleep more / Relax more                       | 2.8                        |
| Buy green energy / Alternative energy         | 2.6                        |
| Insulate my home                              | 2.1                        |
| There is no way / I don't know                | 0.8                        |

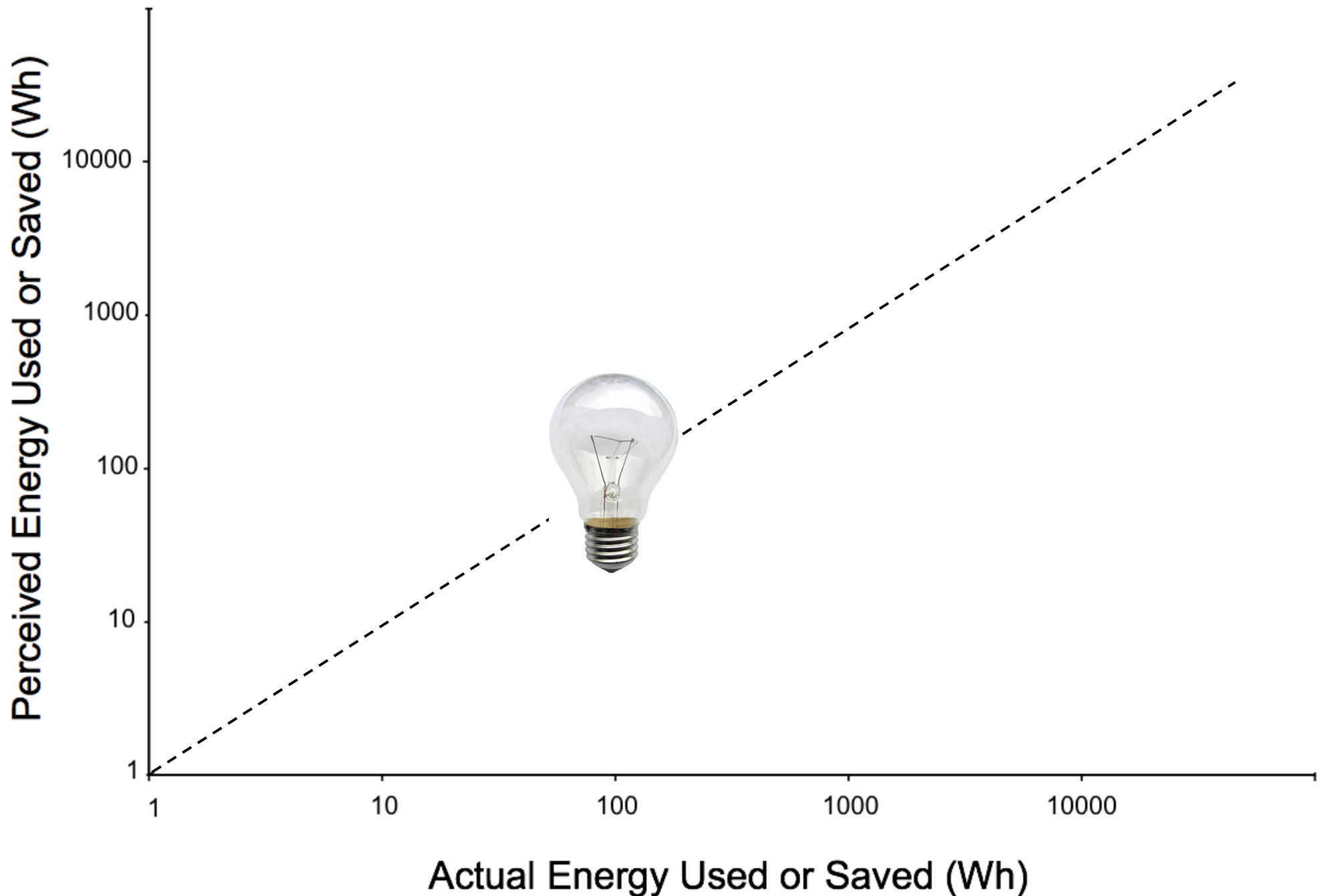
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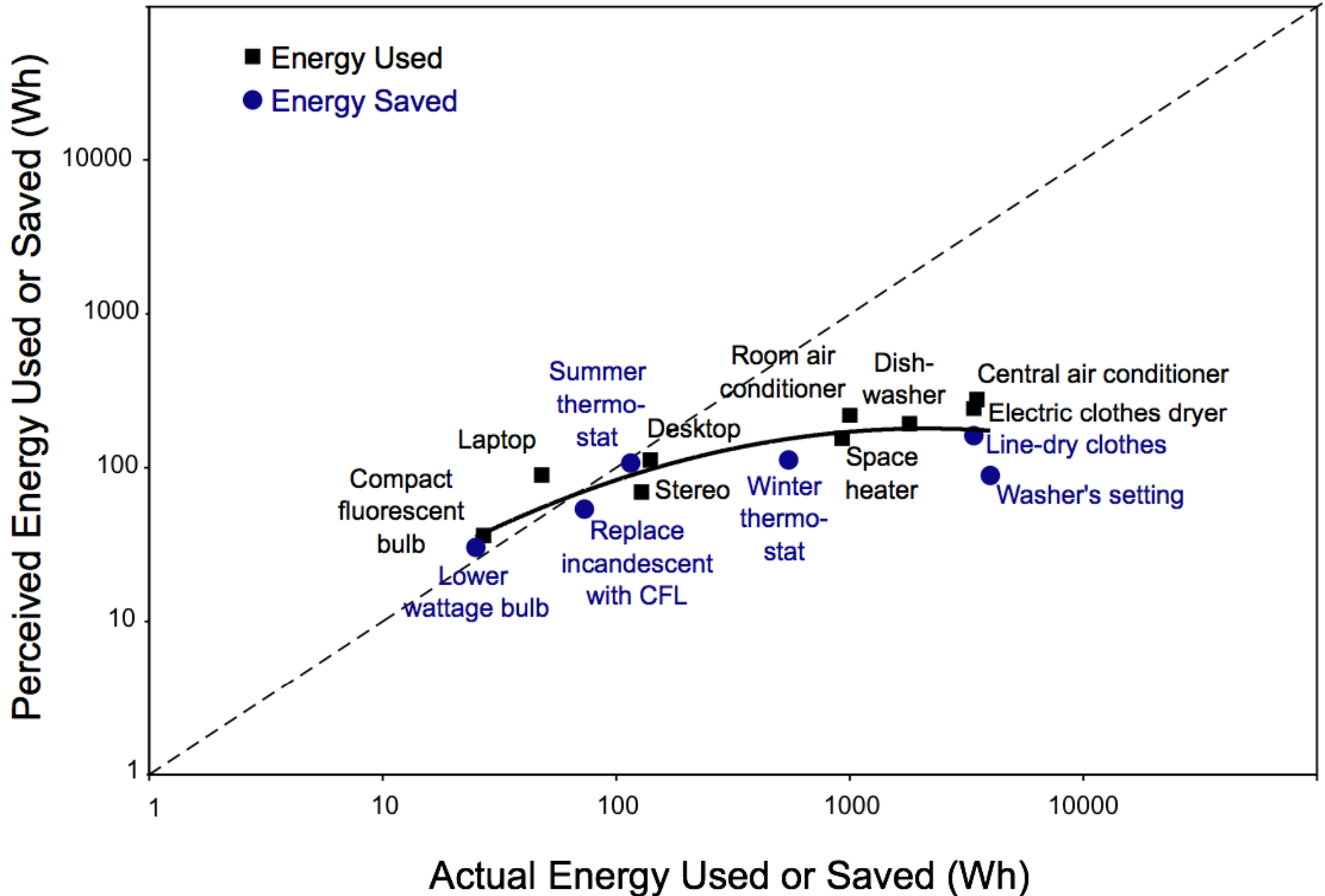
# Actual vs. Perceived Energy Consumption



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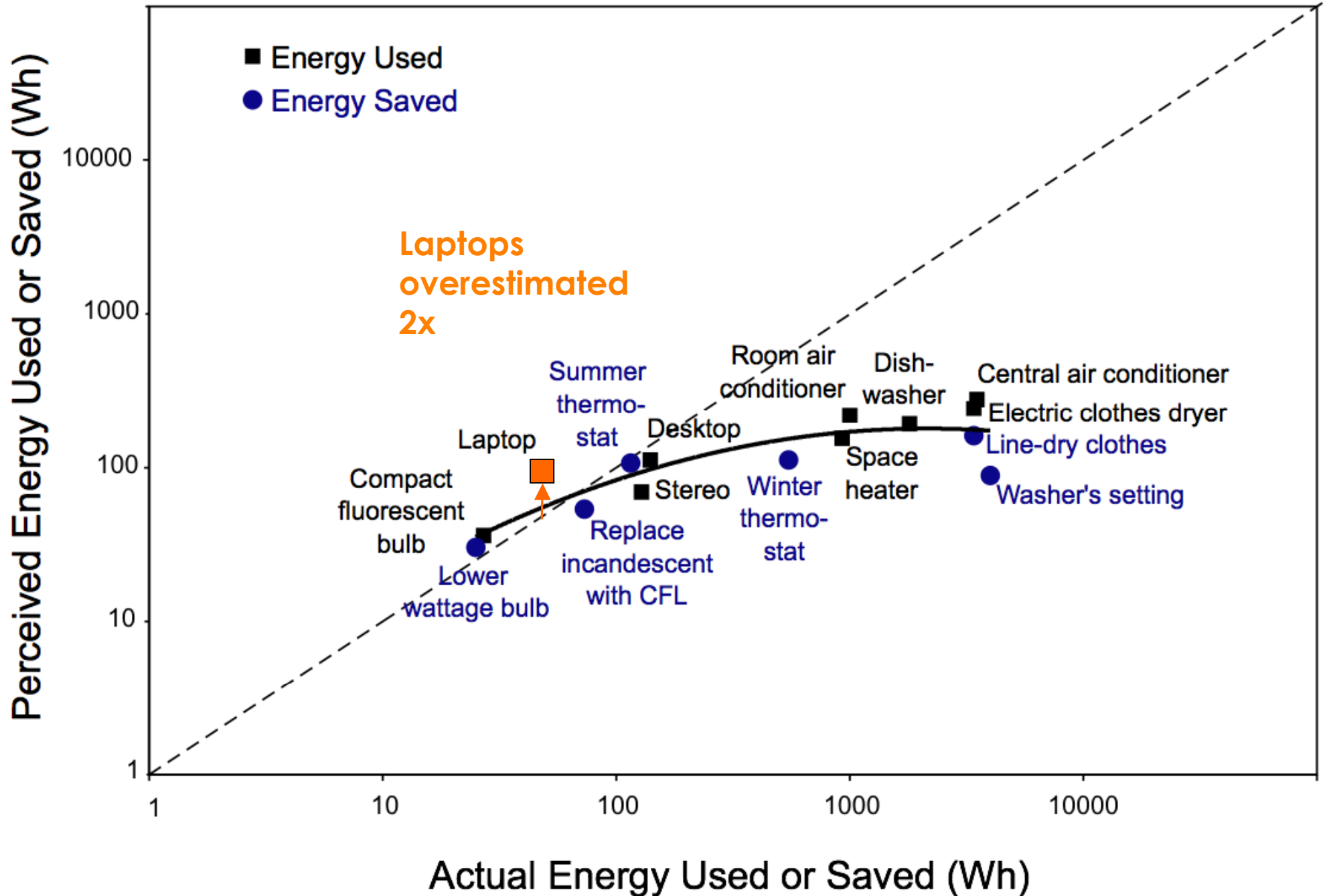


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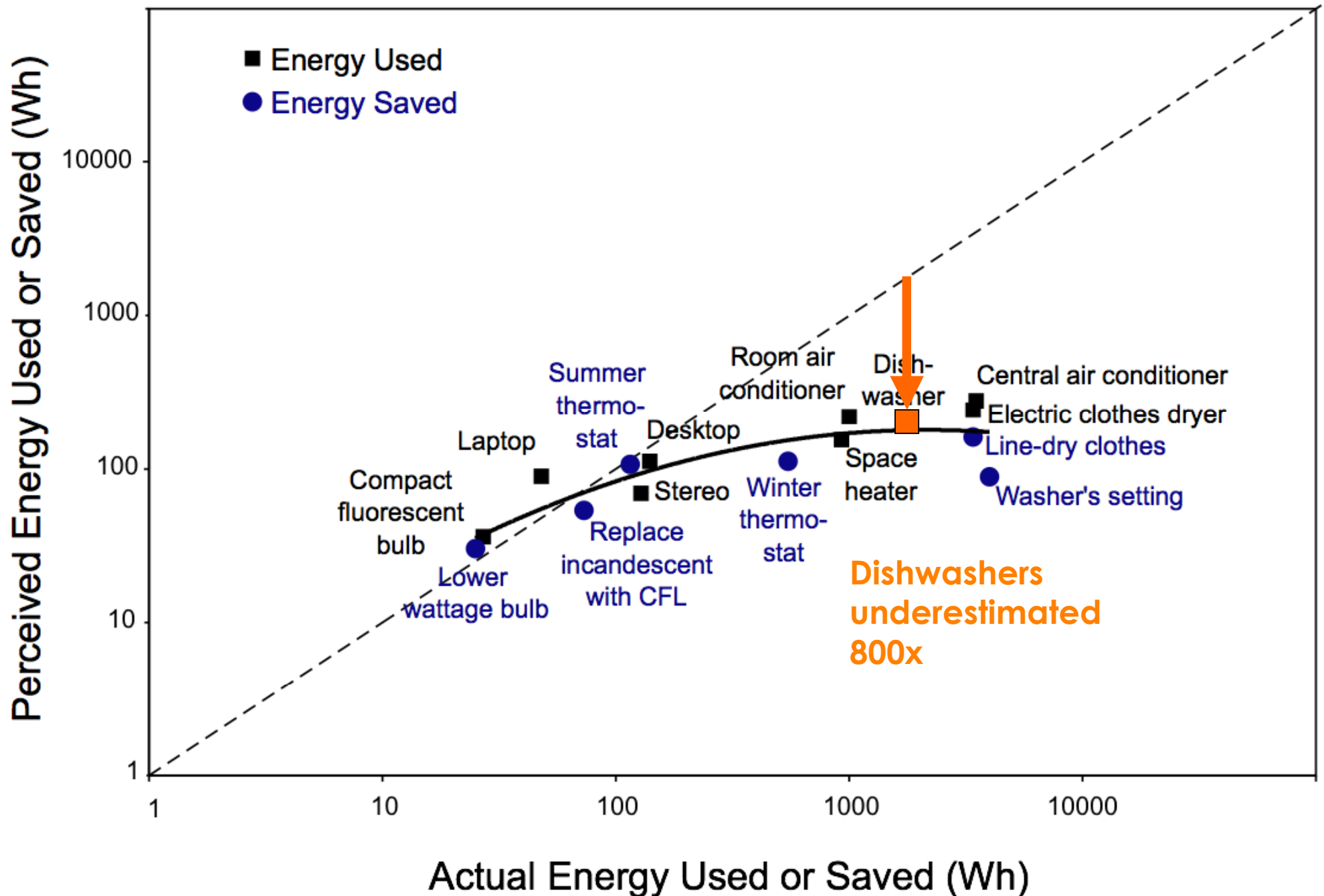




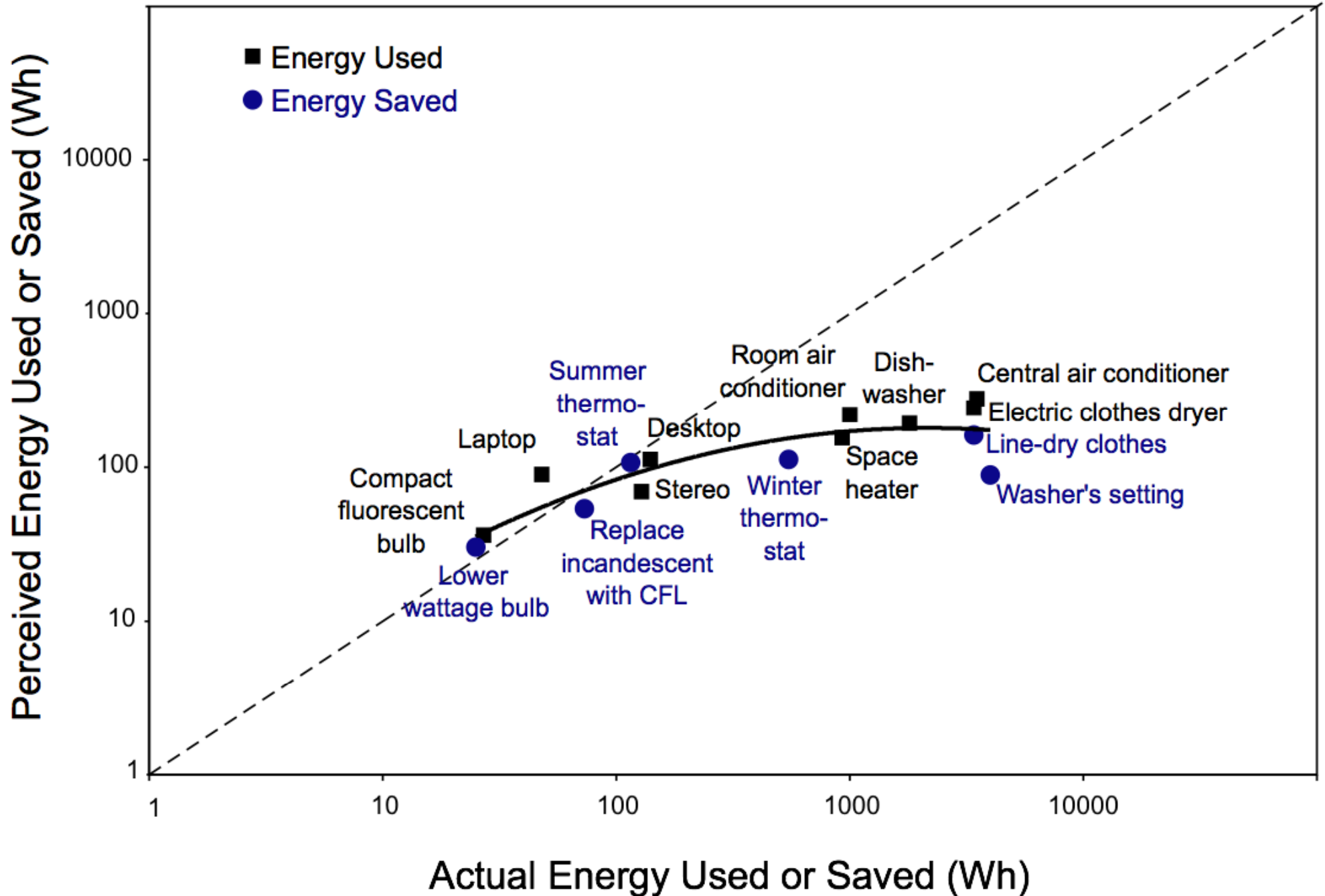
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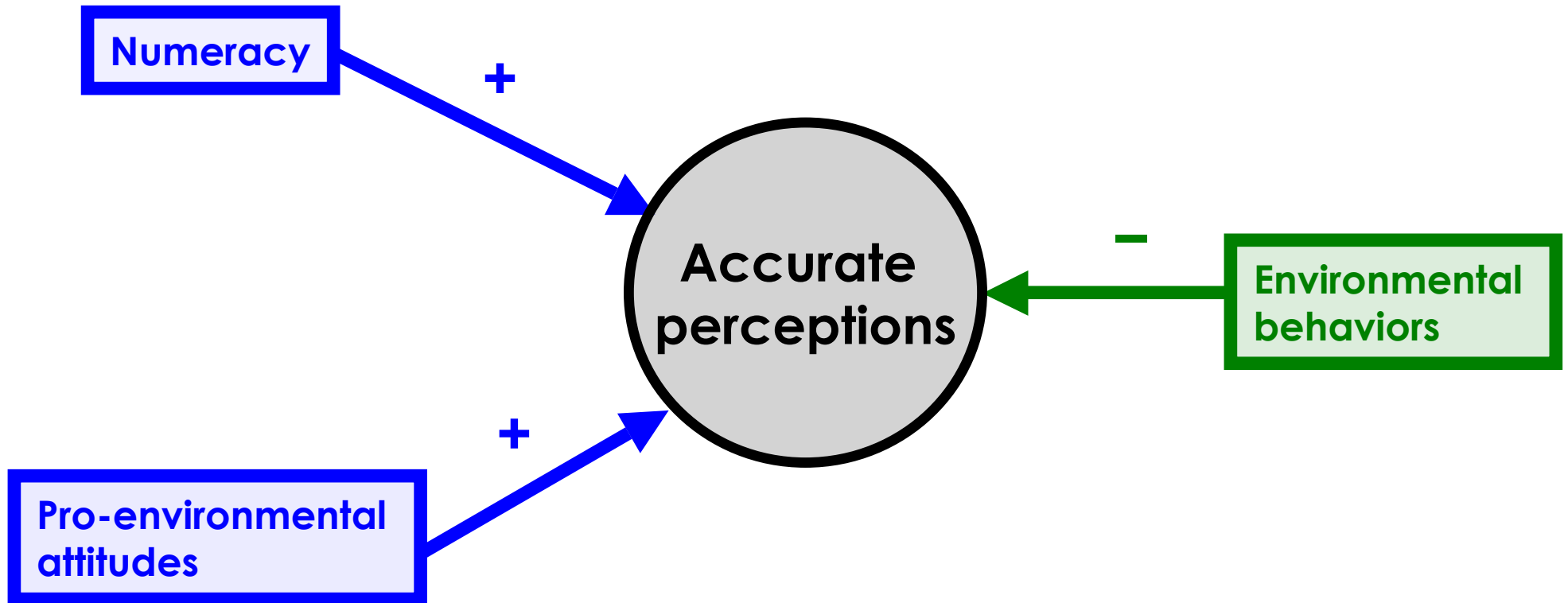
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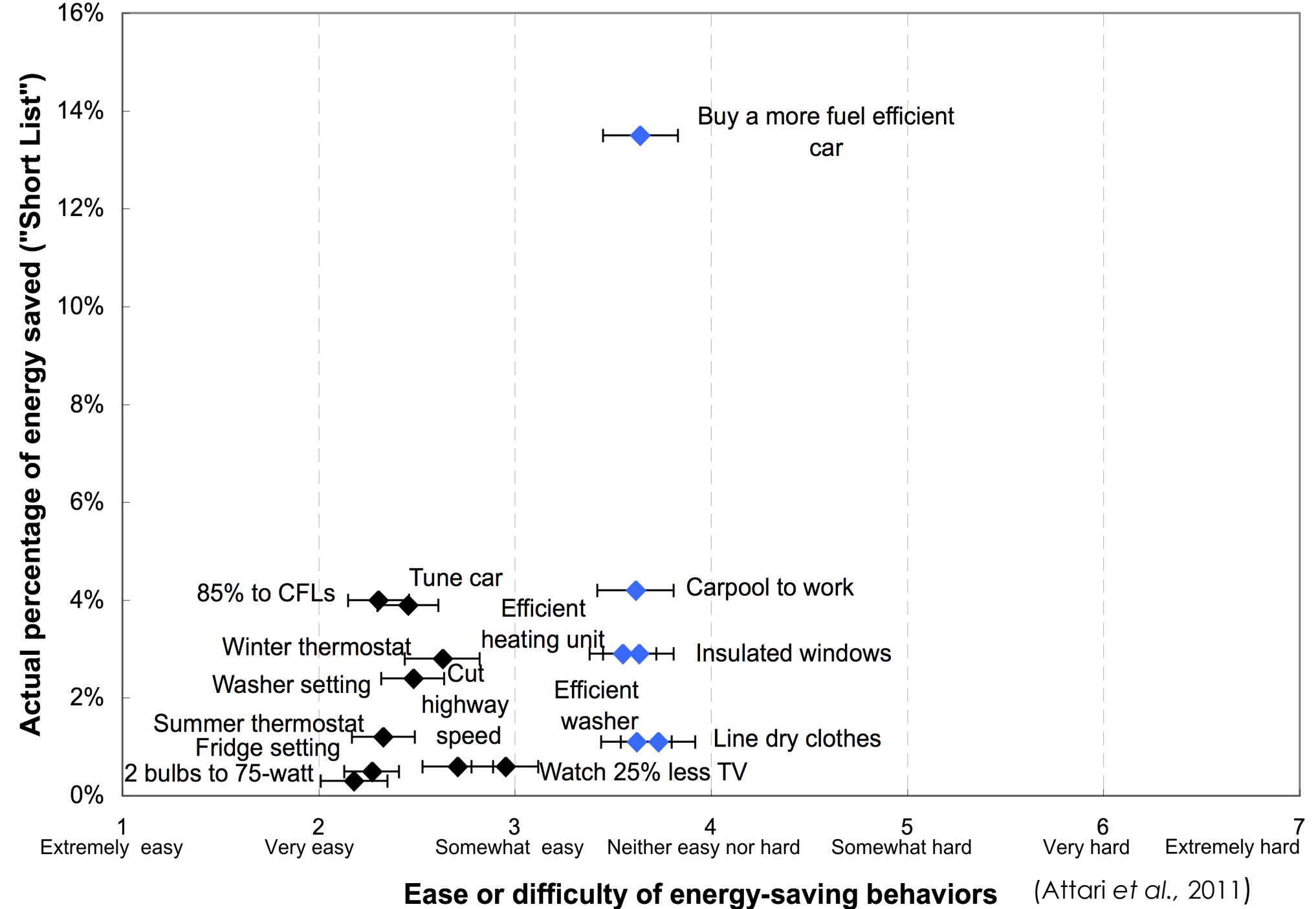
# Predictors of accurate perceptions of energy consumption



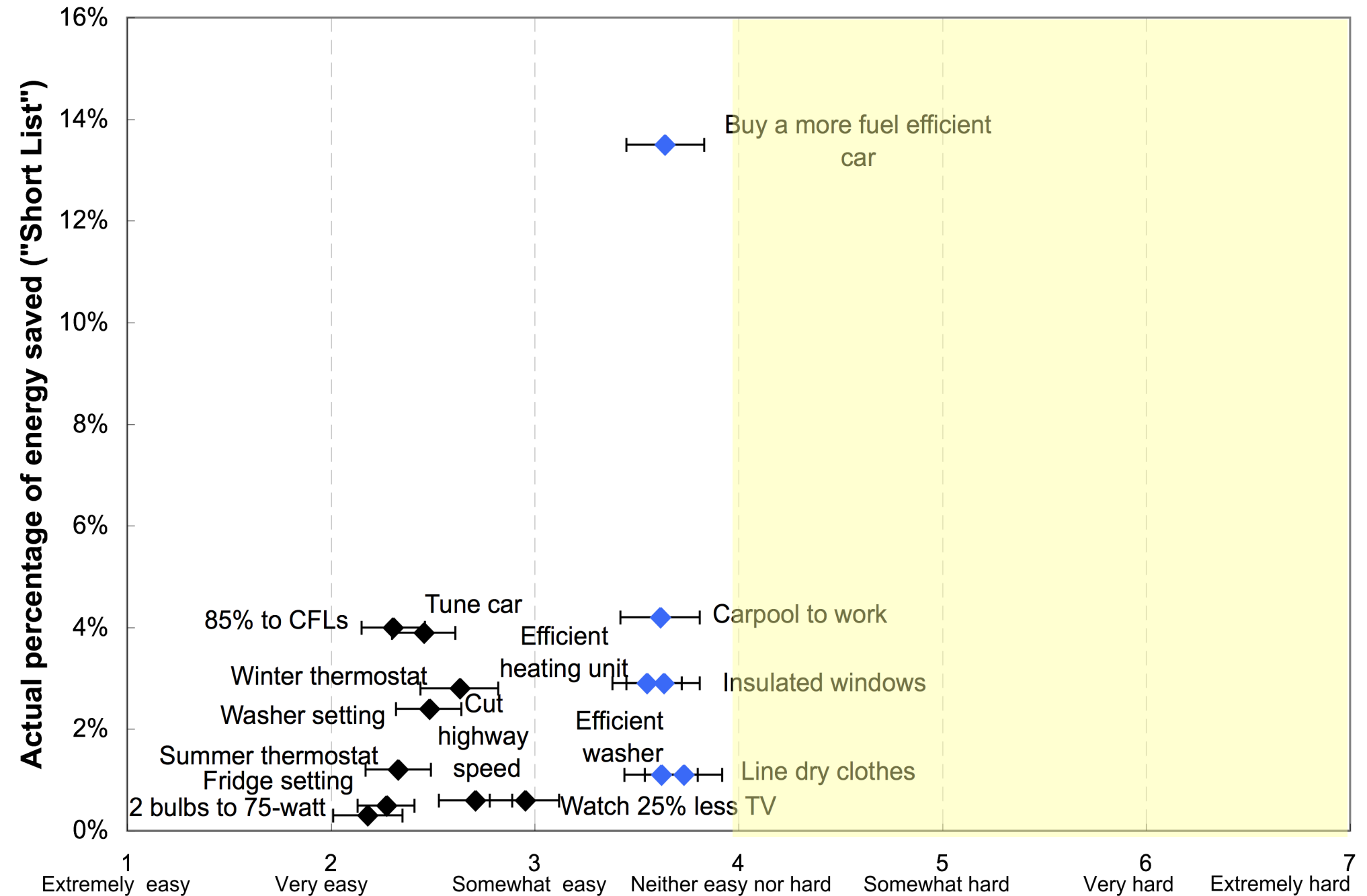
Generally non-significant parameters:

Climate change attitudes, uses more energy than average, owns car, owns home, political views, gender, age, income, and education

# Ease of energy-saving behaviors



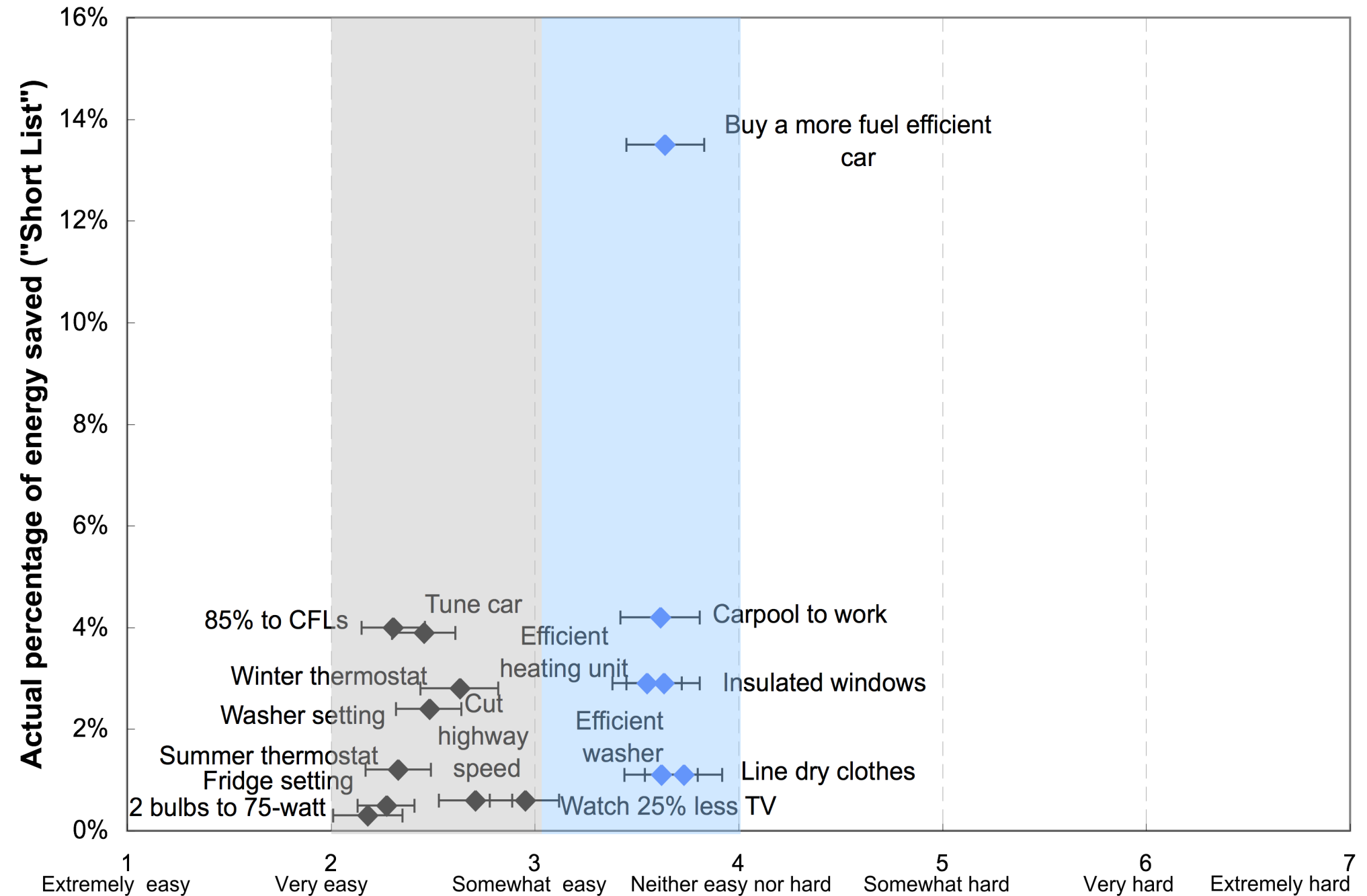
# Ease of energy-saving behaviors



**Ease or difficulty of energy-saving behaviors**

(Attari *et al.*, 2011)

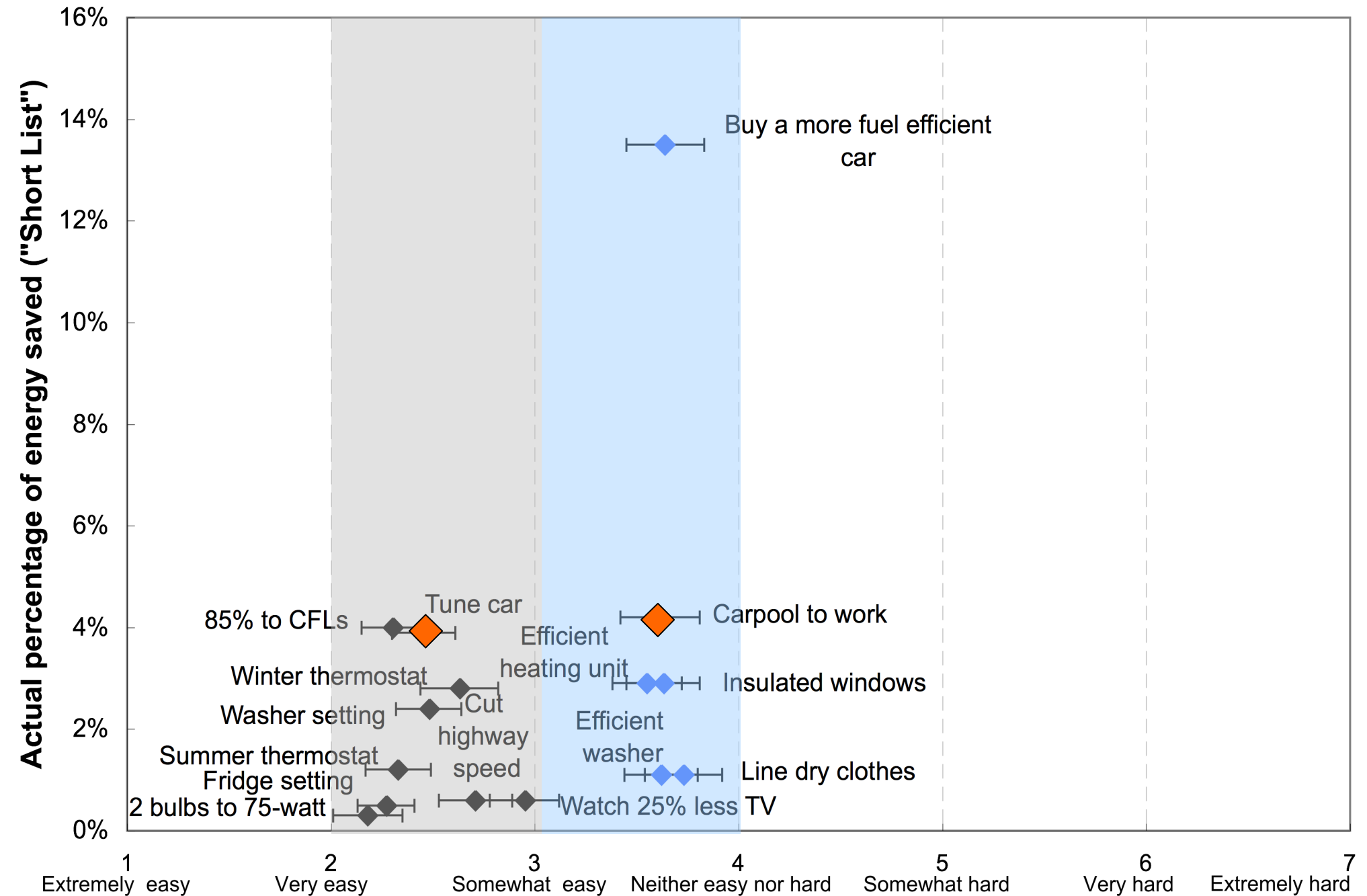
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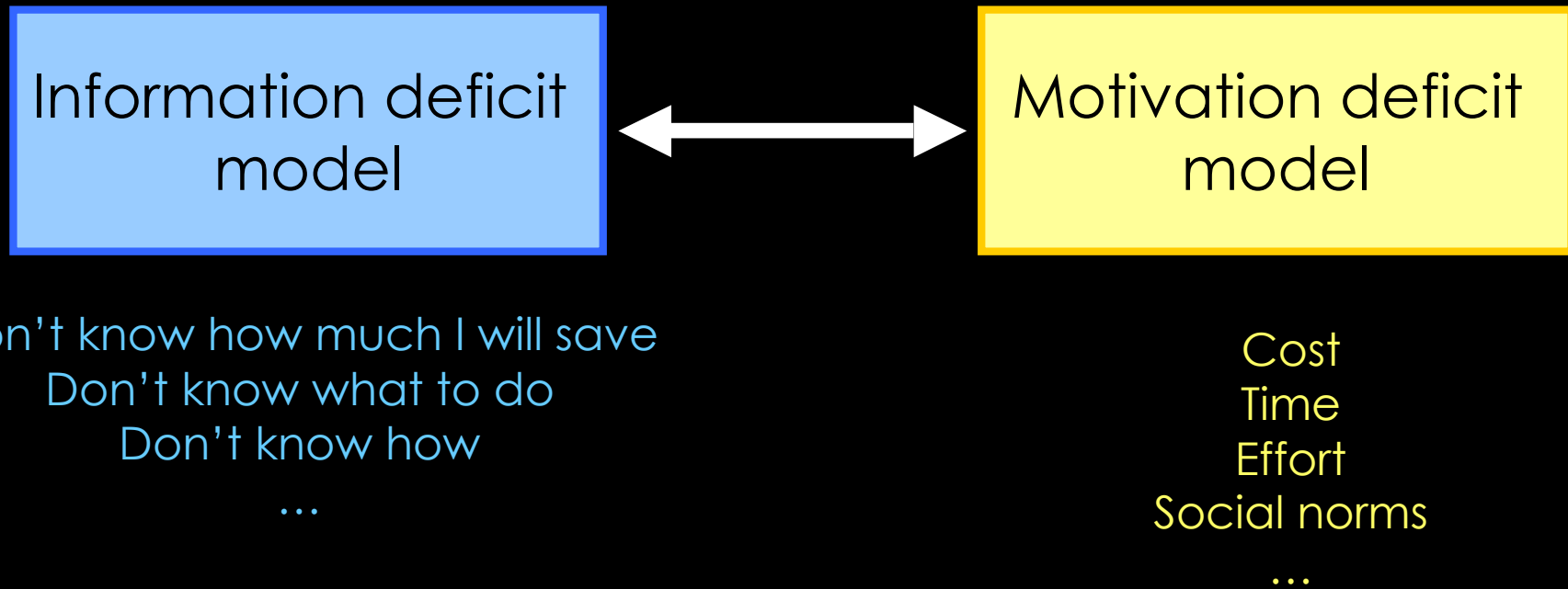


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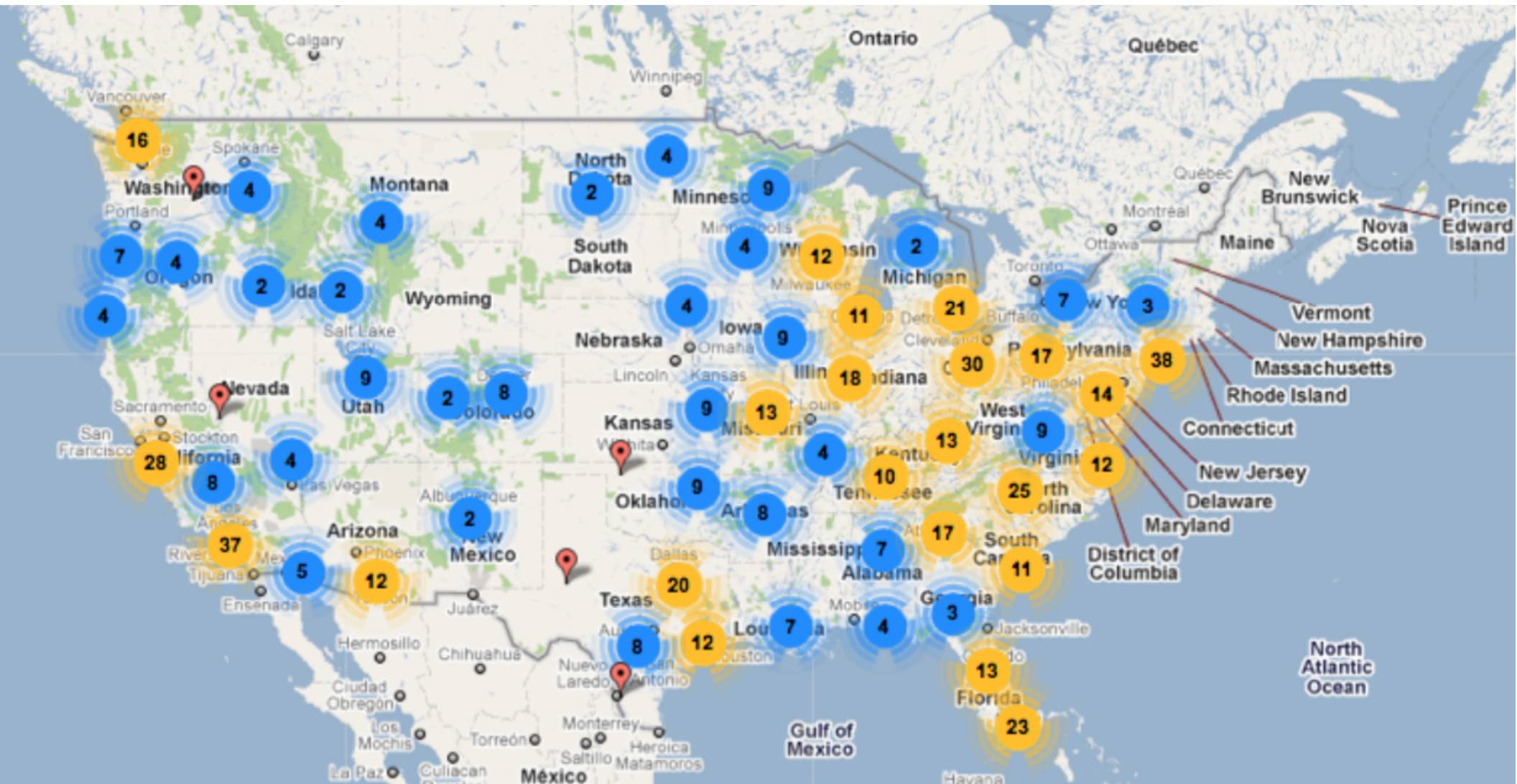


# On why people do not act



# Participants for self vs. others study

Online survey via Amazon Mechanical Turk -- an online marketplace for work ( $n = 760$ )



# Most effective behavior: Self vs. others

| Behavior Category                           | Percentage of Answers |                 |
|---|-----------------------|-----------------|
|   | Self                  | Other Americans |
| Turn off lights                             | 19.5                  | 13.0            |
| Drive less/public transit/carpool/bike/walk | 19.3                  | 31.8            |
| Turn off appliances                         | 10.8                  | 7.7             |
| Change setting on the thermostat            | 9.0                   | 4.6             |
| Sleep/relax more                            | 7.5                   | 4.6             |
| Use appliances less                         | 5.4                   | 4.6             |
| Unplug appliances                           | 5.0                   | 2.8             |
| Conserve water/energy                       | 4.7                   | 4.5             |
| Use energy efficient bulbs                  | 2.8                   | 3.6             |
| Consume less                                | 2.6                   | 4.1             |
| Other (each mentioned only once)            | 2.4                   | 1.8             |
| Use efficient cars/hybrids                  | 2.2                   | 2.2             |
| Use efficient appliances                    | 1.8                   | 2.9             |
| Change my lifestyle                         | 1.8                   | 2.5             |
| Buy green energy                            | 1.3                   | 3.2             |
| Buy green products                          | 1.1                   | 1.0             |
| Eat green                                   | 1.0                   | 1.0             |
| Recycle                                     | 0.7                   | 1.4             |
| Insulate my home/weatherize                 | 0.4                   | 0.4             |
| There is no way/I don't know                | 0.4                   | 0.4             |
| Awareness/education; more attention         | 0.1                   | 1.4             |
| Phase out inefficient technologies          | 0.1                   | 0.4             |

# Most effective behavior: Self vs. others

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| Buy green energy                            | 1.3                   | 3.2             |
| Buy green products                          | 1.1                   | 1.0             |
| Eat green                                   | 1.0                   | 1.0             |
| Recycle                                     | 0.7                   | 1.4             |
| Insulate my home/weatherize                 | 0.4                   | 0.4             |
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# Most effective action for self and other Americans

## Other Americans

|             |                   | <i>Turn off</i> | <i>Drive less</i> |
|-------------|-------------------|-----------------|-------------------|
| <b>Self</b> | <i>Turn off</i>   | 85              | 41                |
|             | <i>Drive less</i> | 6               | 92                |

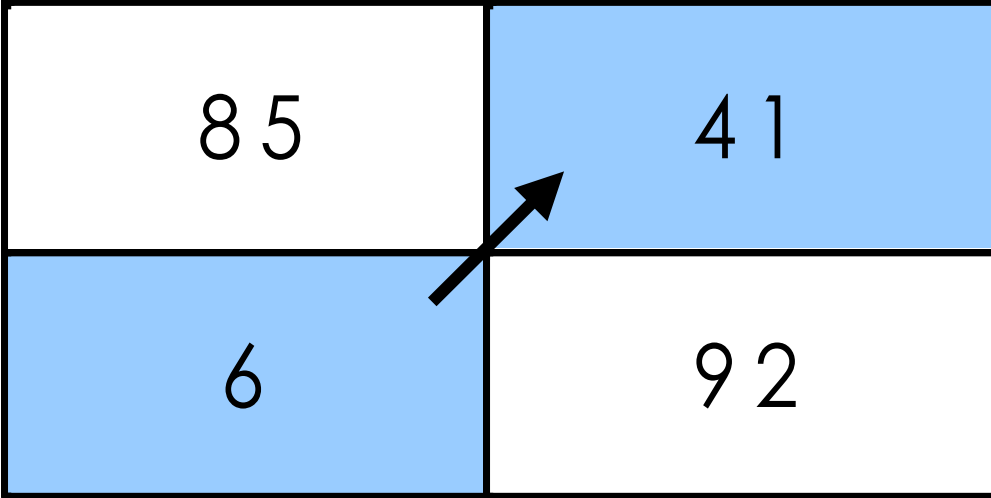
**Turn off** (appliances and lights)

**Drive less** (drive less, carpool, use public transportation, bike, and walk)

I'll do the easy thing, you do the hard thing

## Other Americans

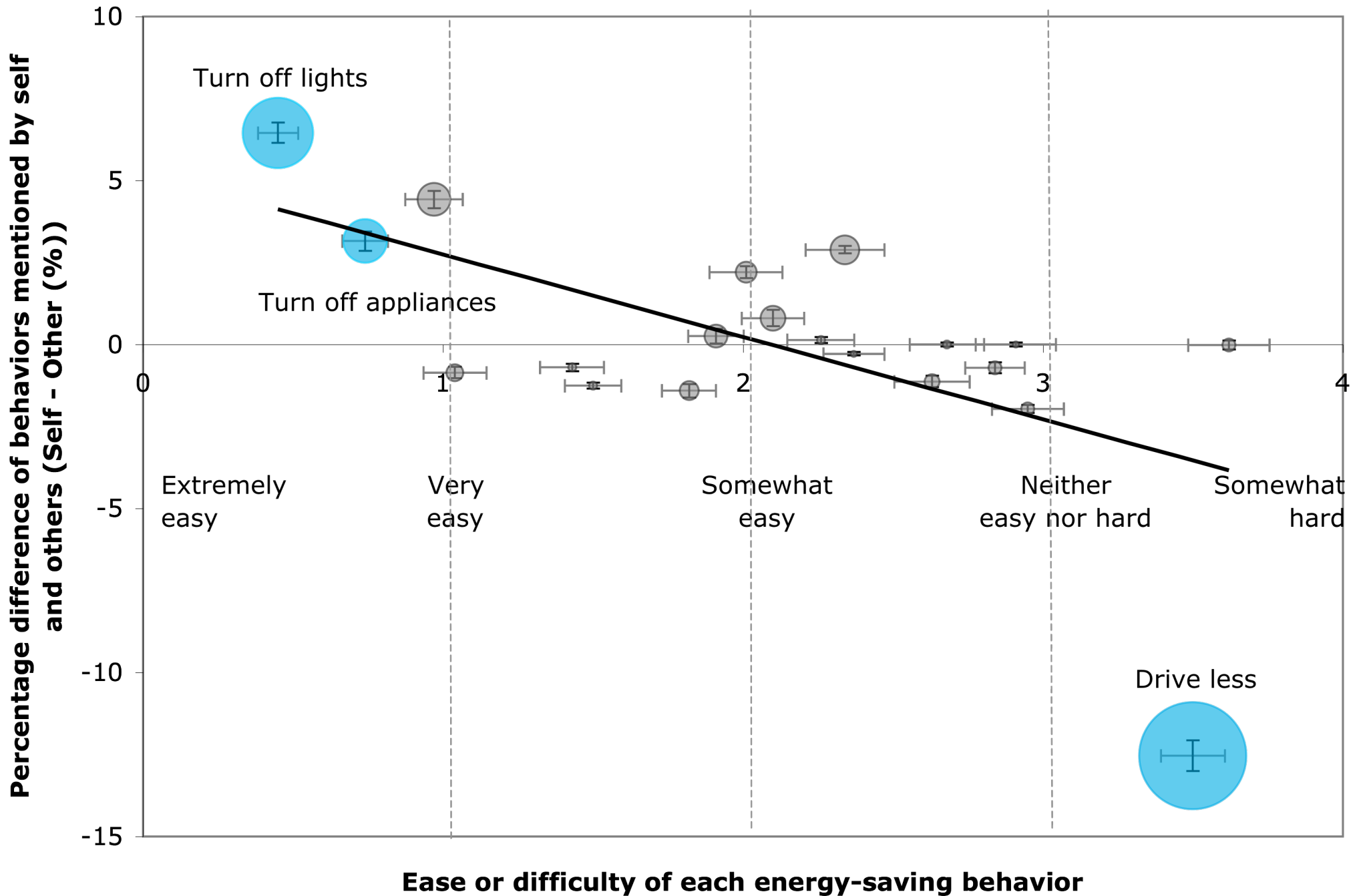
|             |                   | <i>Turn off</i> | <i>Drive less</i> |
|-------------|-------------------|-----------------|-------------------|
| <b>Self</b> | <i>Turn off</i>   | 85              | 41                |
|             | <i>Drive less</i> | 6               | 92                |



Individuals who choose the easier option for themselves are likely to ask others to do the harder thing.

McNemar chi-square statistic for asymmetry 26.1,  $p < 0.0001$

# I'll do the easy thing, you do the hard thing



## Findings:

“In your opinion, what is the most effective thing that you could do to conserve energy in your life?”

- Participants state:

55% “curtailment”

12% “efficiency”

Gardener and Stern (2008):

“efficiency saves more energy than curtailment”



## Findings:

### Major misperceptions in energy consumption

- People have small overestimates for low-energy behaviors and large **underestimates** for high-energy behaviors
  - ➔ many implications for technology, education, and policy

# Findings:

## Predictors of perceptions

- Participants who are numerate and pro-environmental → accurate perceptions
- Participants who engage in environmental behaviors → inaccurate perceptions  
Possible reason: **focusing effect**

# Findings:

## Ease of behavior adoption

- Most participants found the 15 'short list' behaviors relatively easy to do
- Should focus on behaviors that are easier than others and also save the most energy

## Findings:

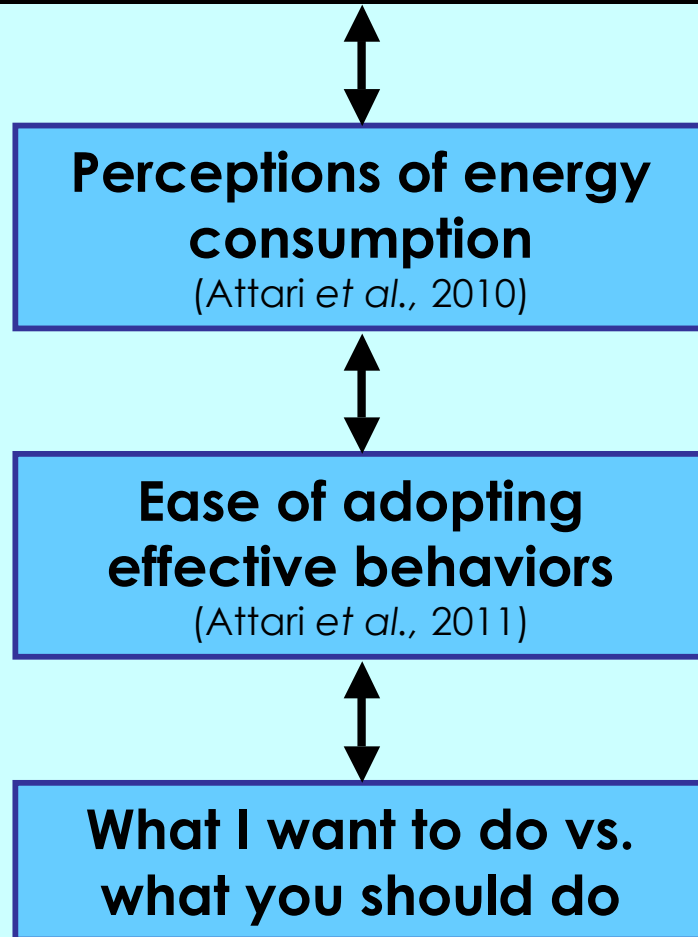
I'll do the easy thing,  
you do the hard thing

- People are motivated to list easier behaviors for themselves and harder behaviors for others
- Reasons may include: cost  
time  
effort...

# Overview

work completed

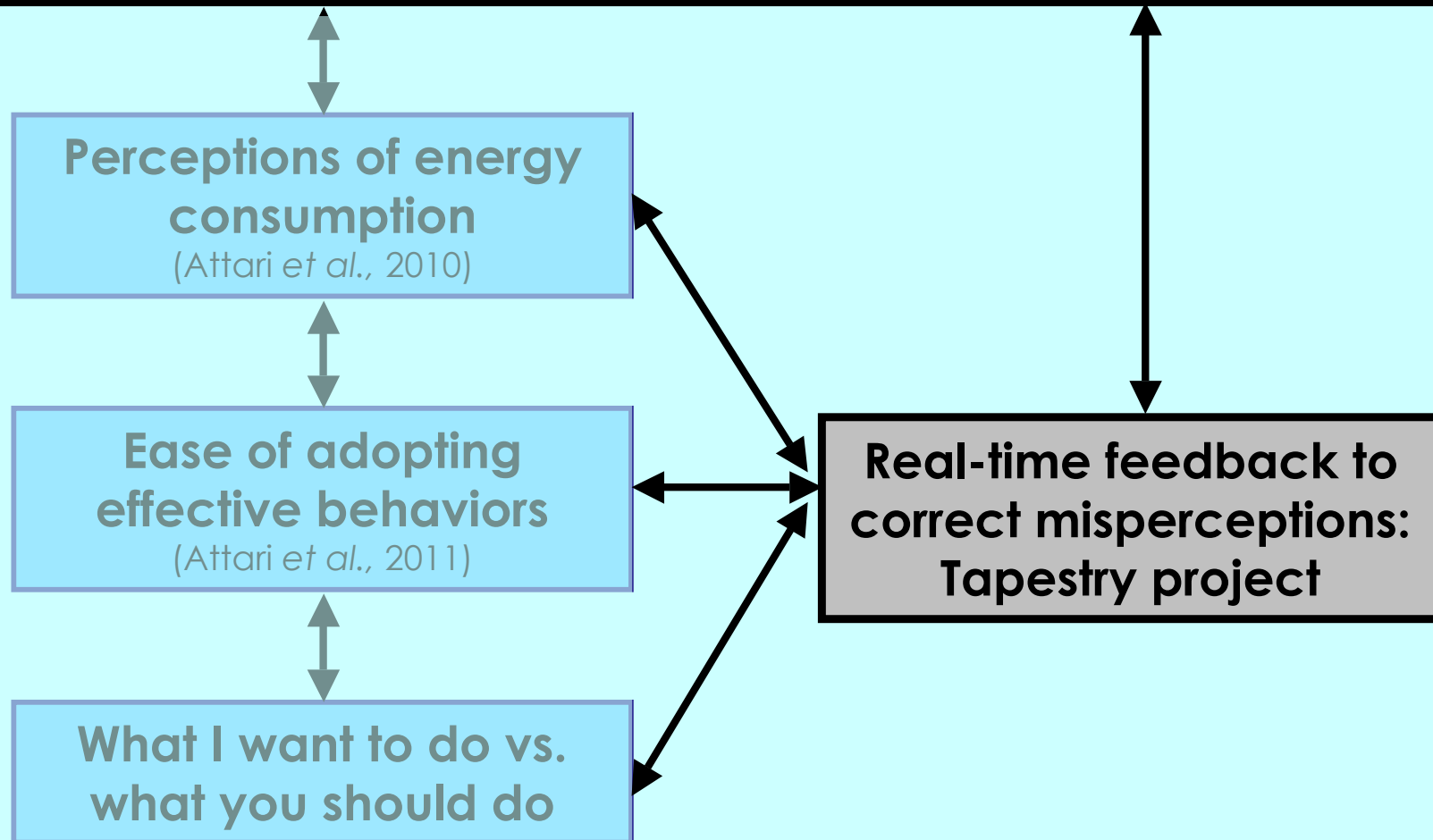
Understand how people interact with technology and nature



# Overview

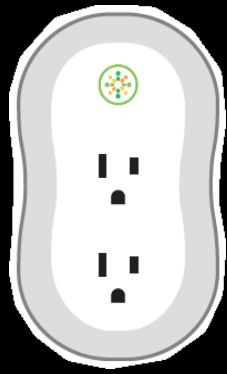
## current and future work

Understand how people interact with technology and nature

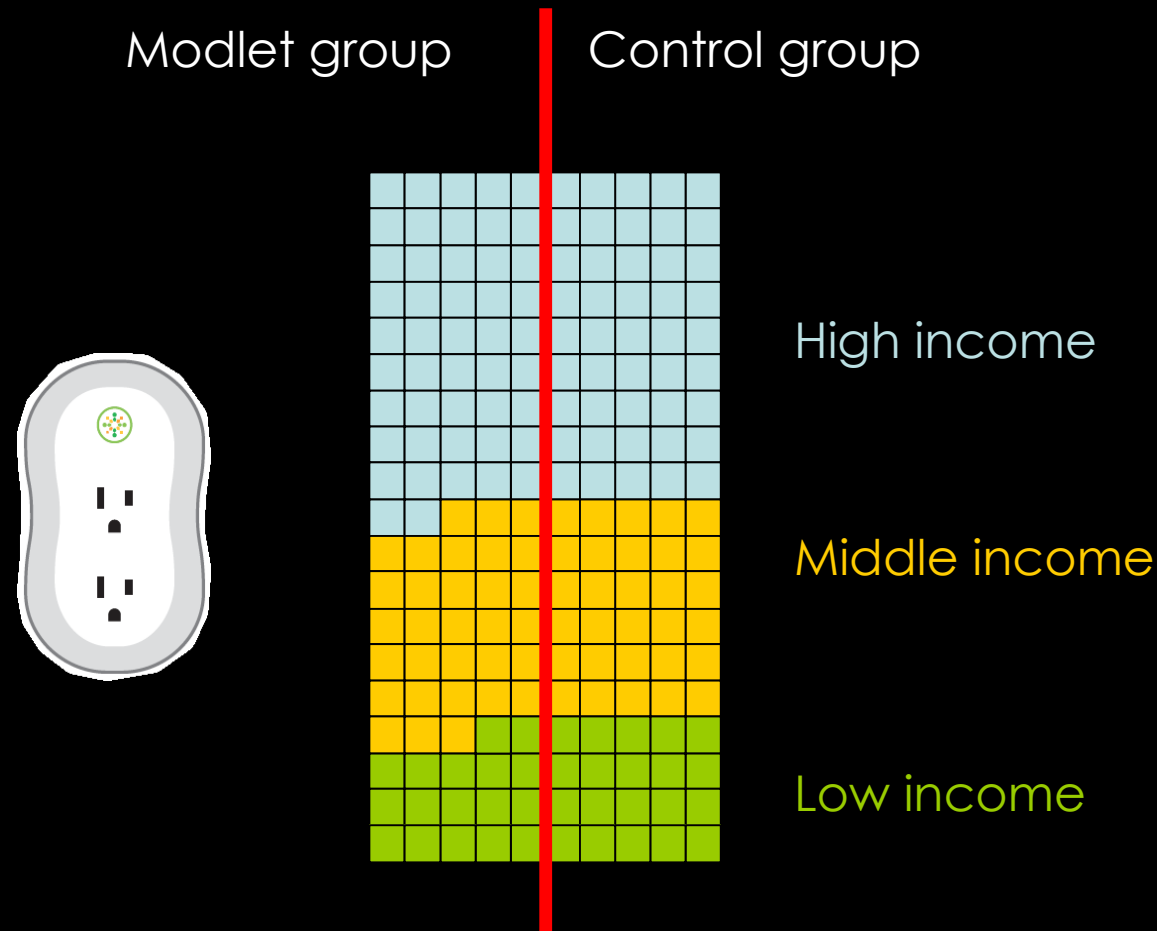


# Current work: Real-time energy feedback

## Tapestry building study



# One year monitoring of plug load

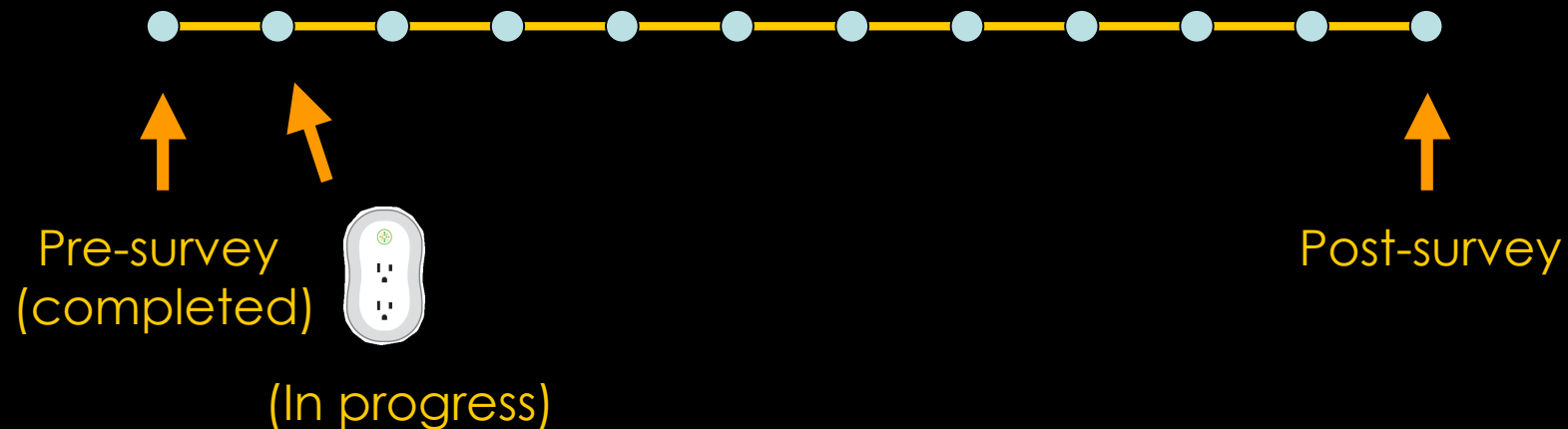


- Do perceptions of energy consumption improve?
- Elasticity of consumption based on income group?
- What types of feedback to people respond to?  
\$ saved, kWh, acres planted, bulbs turned on..



# Investigating perceptions of standby energy consumption and behavior change

One year of monitoring and feedback



Standby energy is used by devices while they are switched off or not performing their primary function (LBNL, 2011)

e.g., microwave, computer, cable box, TV with projector, DVR, etc.

# Investigating perceptions of standby energy consumption and behavior change

- Perceptions of standby energy consumption?
- Which groups buy efficient appliances?  
Many efficient devices are more expensive in the short-term (e.g., CFLs v. incandescent bulbs)
- Are there rebound effects of conservation?
- Is behavior change maintained?

# Preliminary pre-survey results

(N = 129)

- 96% would use an energy monitoring system if free
- 73% would buy such a device (modal price: \$100)
- Residents want to get feedback in financial savings (\$ saved) rather than comparisons to their neighbors
- Only 2% of the participants know how to dispose of spent CFL bulbs

# Acknowledgments

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