Lay perceptions of energy consumption and savings...

(Published in Proceedings of National Academies of Sciences)

...& some new results

Shahzeen Z. Attari

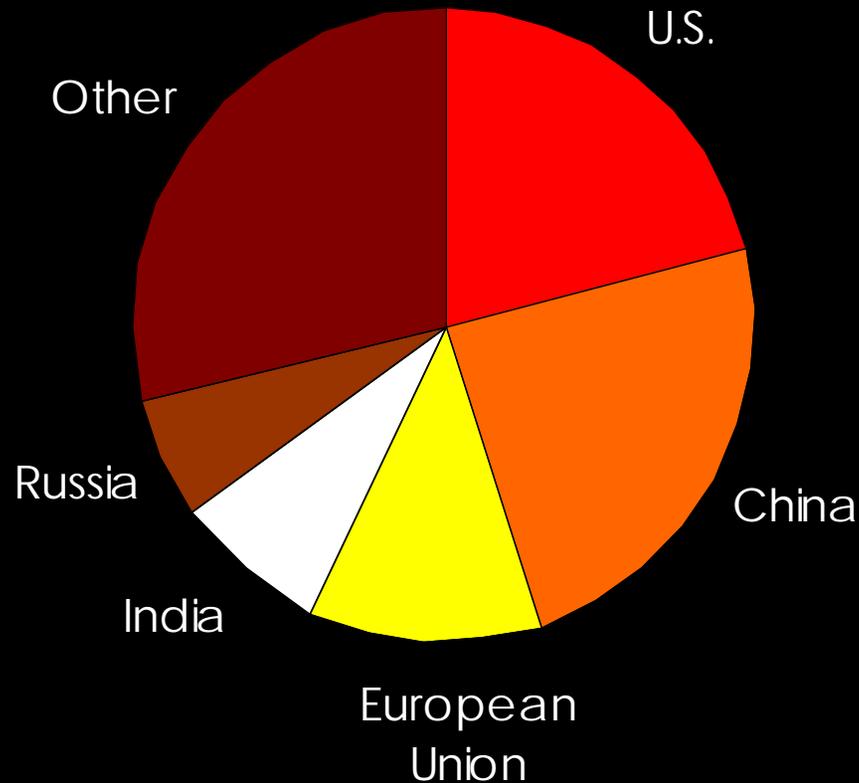shahzeen.attari@gmail.com • www.columbia.edu/~sza2106

EPA Region 2, October 28, 2010
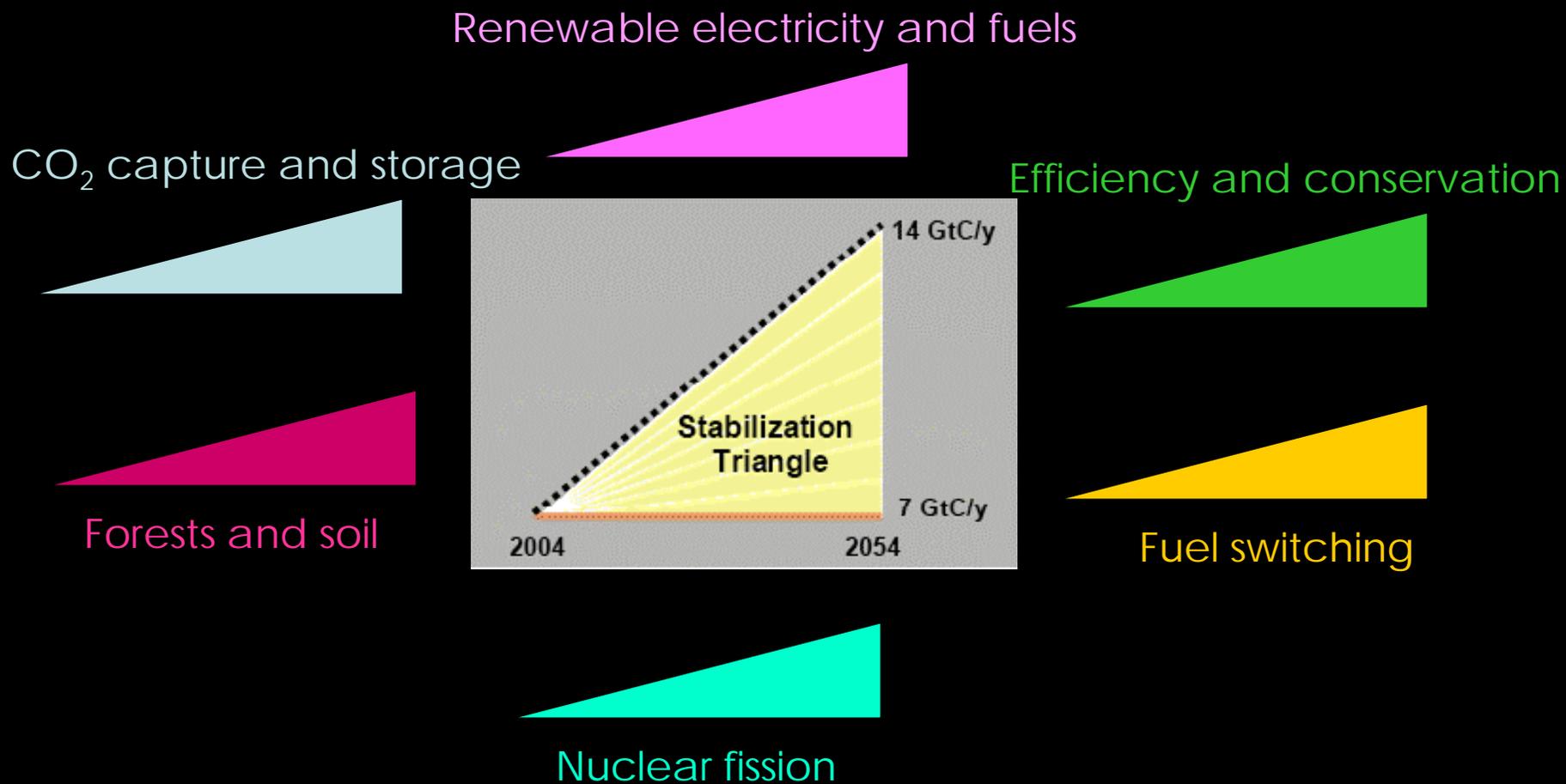
Columbia University
Earth Institute & Center for Research on Environmental Decisions (CRED)

Who are the major carbon players?

The U.S. emits 22% of the world's carbon emissions, but has only 5% of the world's population.
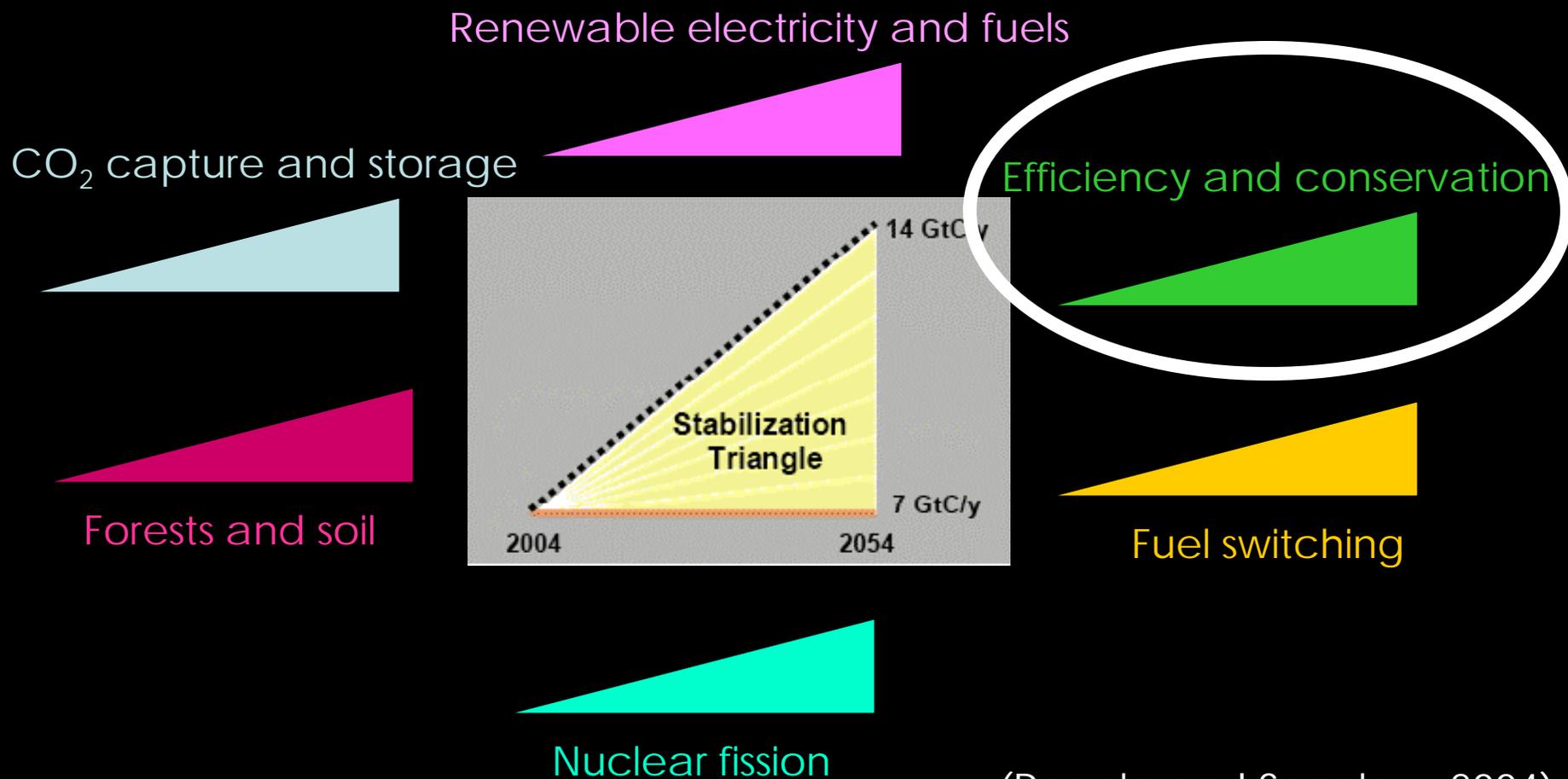

Netherlands Environmental Assessment Agency (2007)

Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies

Renewable electricity and fuels

CO_2 capture and storage

Efficiency and conservation

14 GtC/y

Stabilization Triangle

7 GtC/y

2004   2054

Forests and soil

Fuel switching

Nuclear fission

(Pacala and Socolow, 2004)

3

Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies

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"Improvements in efficiency and conservation offer the *greatest* potential to provide wedges"

Guiding Questions

- Most effective energy conserving behaviors ?

- Accuracy of perceptions ?

- Characteristics that predict accuracy?

- How easy are these behaviors to implement?

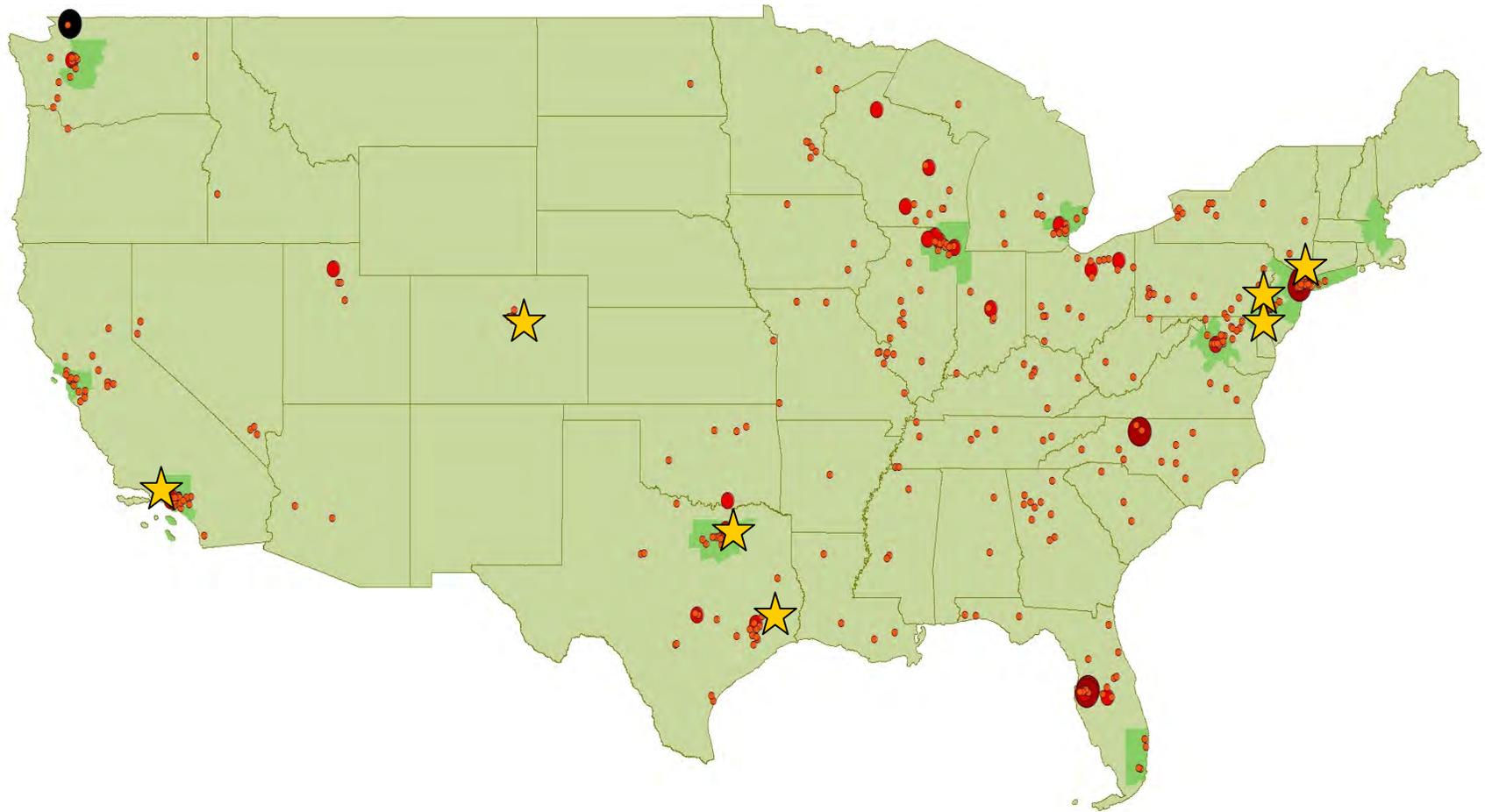- Energy savings: differences for self vs. other Americans?

Risk Perception
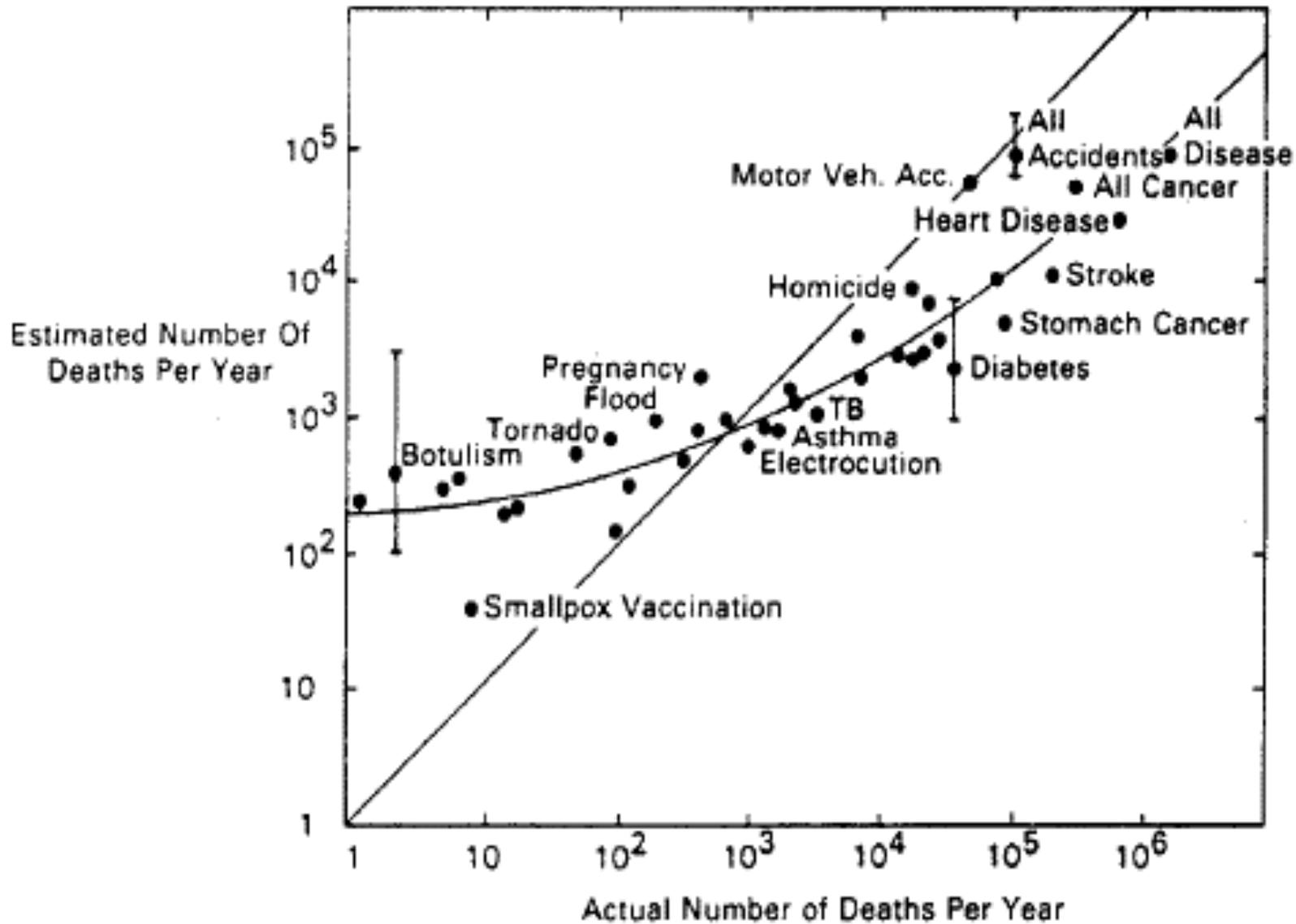
Perception Study: Participants

Online survey advertized via Craigslist to seven metropolitan cities (*n* =505)

Behaviors deemed "most effective"

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

Behaviors deemed "most effective"

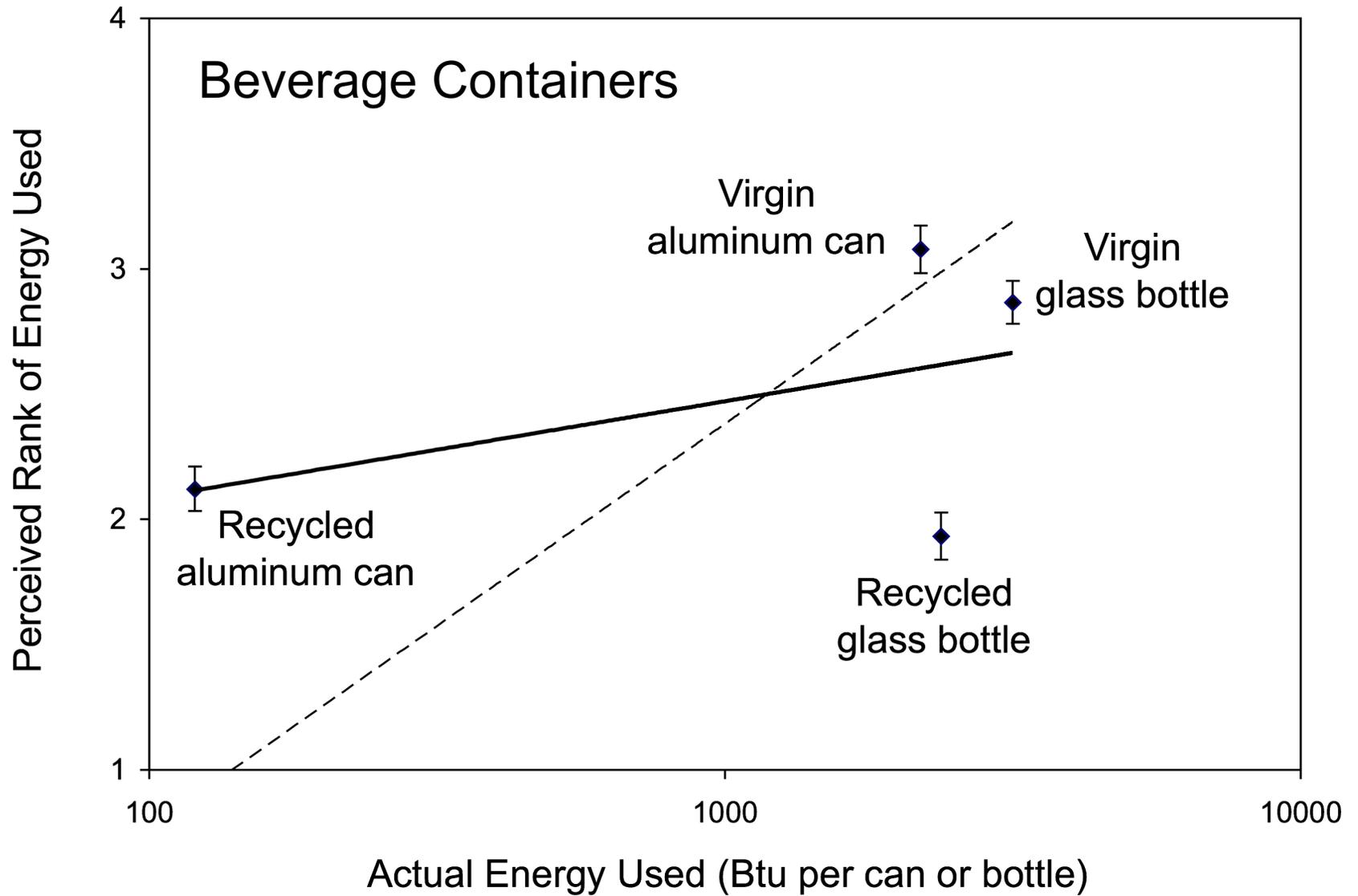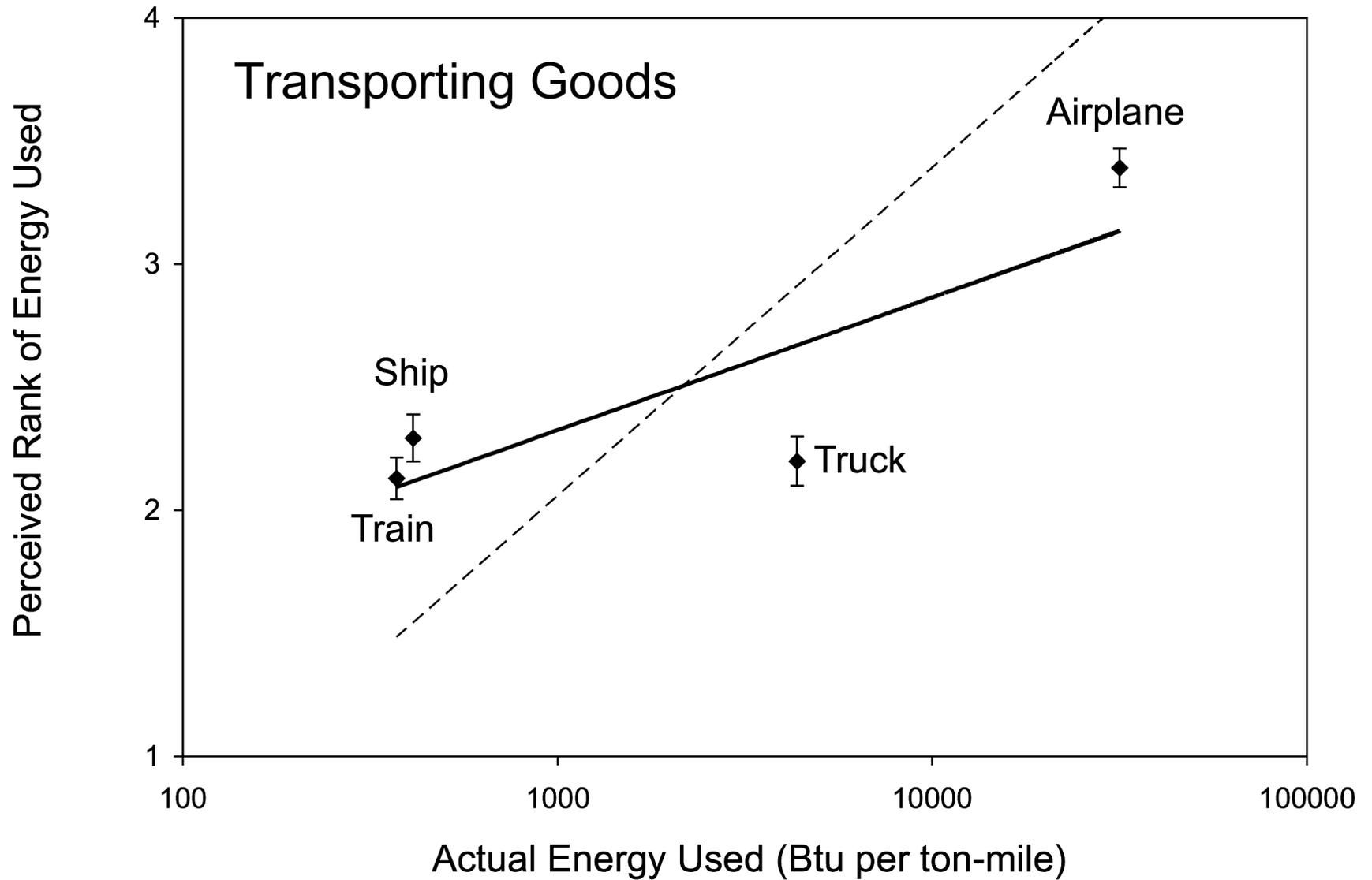| Behaviors	Percentage of participants
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55%

12%
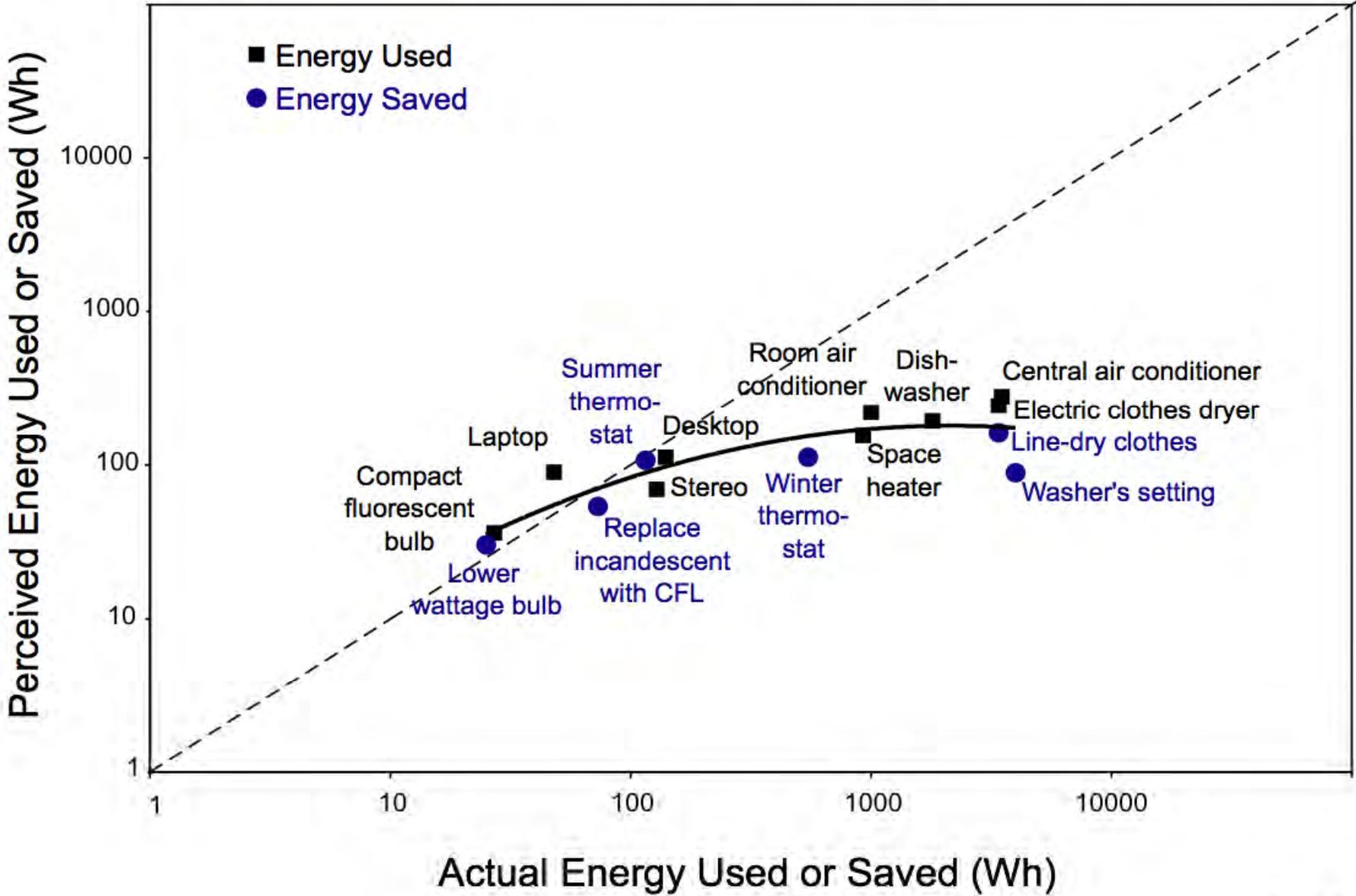
9

Perceptions of Energy Consumption

Actual vs. Perceived Energy Consumption
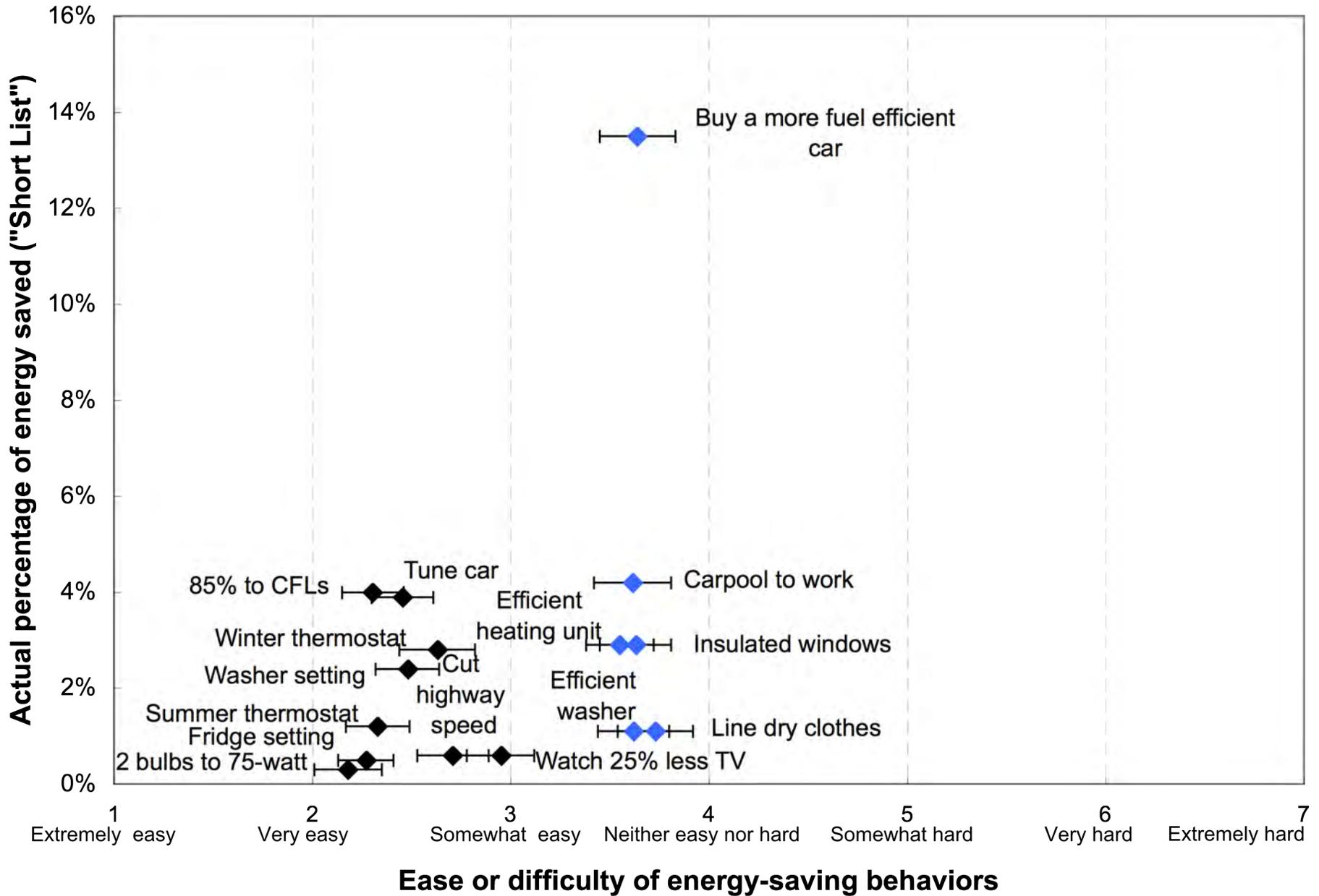
(PNAS, 2010)

Regression Results	Estimates for household behaviors	Ranks for Transportation modes	Ranks for aluminum and glass
Predictor			
Intercept	0.20	0.48	0.25
Numeracy	0.046	0.086	0.02
Pro-environmental attitude	0.055	0.13	0.17
Climate change attitude	-0.016	0.093	0.053
Environmental behaviors	-0.0076	-0.060	-0.12
Uses more energy than average	-0.017	-0.039	-0.12
Owns car	0.033	0.051	0.10
Owns home	0.014	0.10	0.24
Democrat	-0.029	-0.13	-0.039
Republican	-0.016	-0.17	0.12
Chose not to vote	-0.055	-0.33	0.056
Could not vote	-0.079	0.046	-0.42
Political views	0.0031	0.015	0.017
Male	0.0070	-0.022	-0.026
Age	0.0016	0.0065	-0.0039
Income	0.0036	-0.051	-0.024
Education	0.0095	0.054	-0.0046
Adjusted R^2 ($p < 0.05$; $p < 0.01$; $p < 0.001$)	0.17	0.11	0.10

New Results

Ease of energy conserving behaviors

Actual percentage of energy saved ("Short List") (y-axis)

16%
14% — Buy a more fuel efficient car
12%
10%
8%
6%
4% — 85% to CFLs · Tune car · Carpool to work · Efficient heating unit · Insulated windows
2% — Winter thermostat · Washer setting · Cut highway speed · Efficient washer · Line dry clothes
0% — Summer thermostat · Fridge setting · 2 bulbs to 75-watt · Watch 25% less TV

Ease or difficulty of energy-saving behaviors (x-axis)

1 Extremely easy · 2 Very easy · 3 Somewhat easy · 4 Neither easy nor hard · 5 Somewhat hard · 6 Very hard · 7 Extremely hard

Most effective behavior: Self vs. others

Behavior category	Percentage of participants	
	self	**other Americans**
Turn off lights	19.5	13.0
Drive less	19.3	31.8
Shut 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

Percentage of participants

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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
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

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

Other Americans

		Turn off	*Drive less*	*Other*	Total
	Turn off	85	41	92	218
Self	*Drive less*	6	92	40	138
	Other	58	95	251	404
	Total	149	228	383	760

Individuals who choose the harder behavior for themselves are likely to choose the same for others. However, individuals who choose the easier option for self are more likely to ask others to do the harder thing.

What people care about now vs. the future
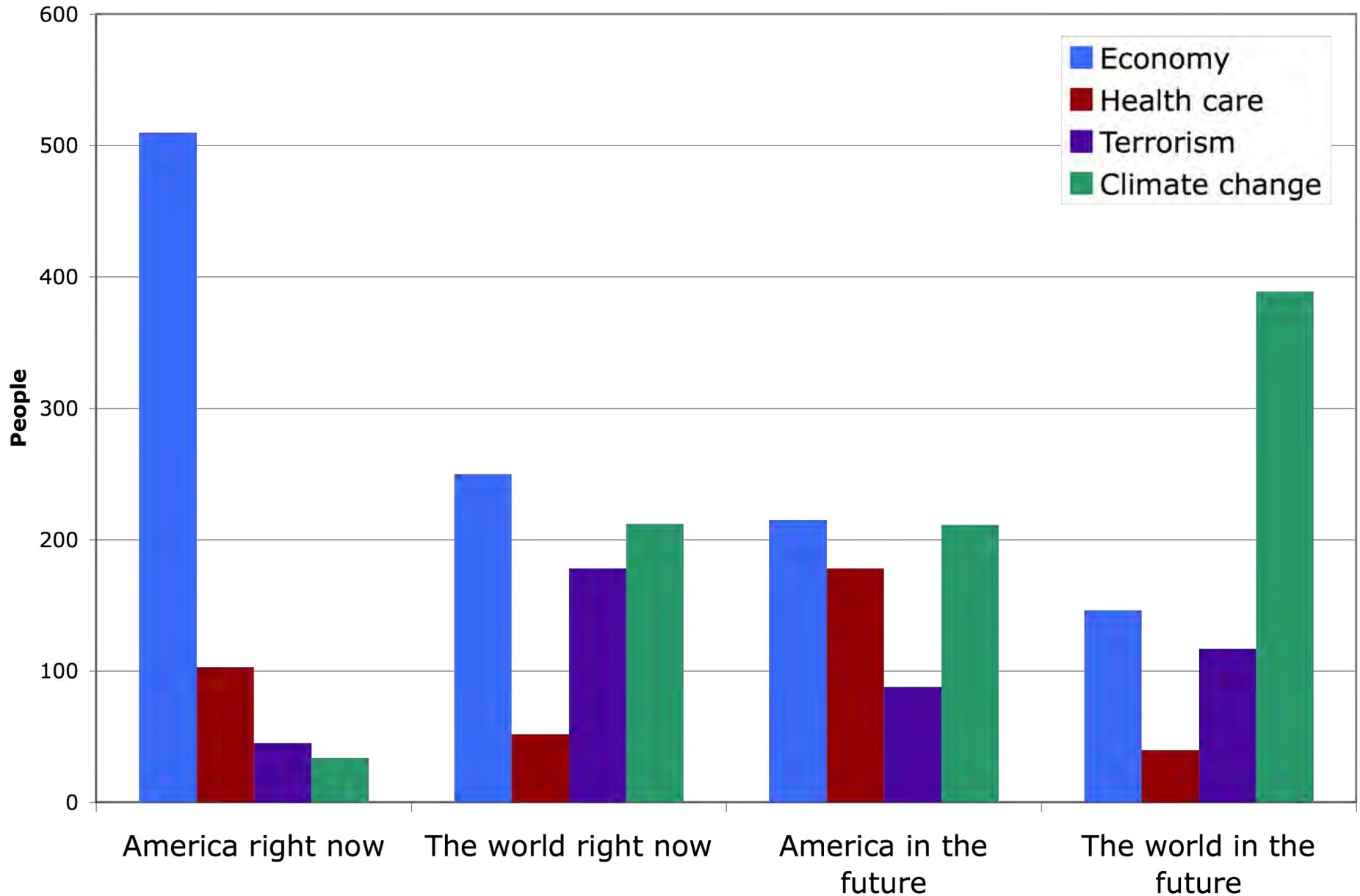
Future Work:
Compressing time, the case for VR

- Have one physical world to experiment with, VR allows us to create a copy and speed up time to make impacts visible

- Q: Will visualizing and virtually experiencing impacts of climate change lead to changes in beliefs, attitudes, behaviors, and social norms?

Conclusions:

"Most effective action"
Participants state:

12% "efficiency"

55% "curtailment"

Gardener and Stern (2008):

**"efficiency saves more
energy than curtailment"**

Conclusions:

Major misperceptions in energy consumption

- People have small overestimate low-energy
  behaviors, and large underestimate
  high-energy behaviors
  Similar biases as Lichtenstein *et al.* (1978)

- People think: Train = Ship = Truck
  Reality: Truck = 10 x Ship,10 x Train

- People think: recycled bottle = recycled can
  Reality: recycled bottle = 20 x recycled can

Conclusions:
Predictors of perceptions

- Participants who are numerate and pro-environmental ➔ accurate perceptions

- Participants who engage in environmental behaviors ➔ inaccurate perceptions
  Possible reason: focusing effect

Conclusions:
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

Conclusions:
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: costs, effort, time etc.)

Future Work

How can we improve lay perceptions of energy consumption to facilitate energy conservation ?

Real time energy feedback via smart meters coupled with behavioral interventions

Ways to facilitate conservation

Frequency

Duration

Content

Comparisons

Commitment

Goal-setting

Information

(Abrahamse et al. 2005)

Real-time meters: OPOWER

- Using social comparisons, a company called OPOWER was able to reduce electricity use in households by 2%

- 2% reduction in energy in the nation
= 0.5% CO_2 reduction from power plants
= 11 MMT CO_2 annually
= 2.2 million cars off the streets per year

How can we increase
the 2% savings
and sustain the change?

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30