# Behavioral Economics: The Link Between Human Dimensions and Market Transformation

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**ABSTRACT**

In response to California's 2000-2001 energy crisis, households saved more energy than expected, mostly by modifying behavior. In this paper we review some findings from behavioral economics and explore how these findings might help explain aspects of Californians' positive response. Suggestions for improving future energy conservation programs follow this analysis.

## Introduction

Between 2000 and 2001, in response to California's energy crisis, residents reduced electricity usage by almost 7 percent and peak monthly demand by 8 to 14 percent, mostly by voluntarily changing their behavior. Two surveys of California households – in 2001 and 2002 – studied these behavior changes and the motivations for them. Residents revealed a widespread willingness to take voluntary conservation actions, and expressed concern about energy and related environmental issues, but indicated little awareness of energy efficiency programs.

Traditional neoclassical economists attempt to understand aggregate market behavior by assuming that individuals behave "rationally" to changes in price. Because consumers made changes despite mostly frozen retail electric prices, the large 2001 reductions in electricity use are at odds with the expectations from this assumption. Behavioral economists, on the other hand, attempt to translate the consequences of findings from sociology, anthropology, psychology, experimental economics, and other behavioral sciences about individual behavior into a more realistic understanding of aggregate market behavior. They identify a number of widely used mental shortcuts or heuristics that lead to different market-related decisions than assumed by traditional economics. This paper will explore how these more realistic behavioral theories about individual behavior and markets might be used to better understand California's surprising 2001 market behavior and be applied to future program design.

## Behavioral Economics and Other Newer Realms of Economics

Neoclassical economic analysis posits rational man, *homo economicus*, who has a clear hierarchy of preferences between all goods, and the natural ability to always choose the mix of goods that maximizes his satisfaction. Since the 1950's, however, Herbert Simon and others have argued that *rationality is "bounded*." Unable to optimize over all states of nature, people *economize on mental effort* by developing various mental short cuts and *heuristics*, and by considering choices only until they find a satisfactory rather than an optimal solution. Behavioral

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economists and psychologists have studied and observed empirically how people think and behave in economic situations, with Amos Tversky and Daniel Kahneman publishing a wealth of findings in this field beginning in the 1970's. Also since the 1970's, George Akerlof and others have developed theories of market outcomes under more realistic behavioral assumptions where boundedly rational agents cannot know whether their trading partners are *behaving opportunistically* (for example selling them a lemon). In the 1990's, Alan Kirman introduced theories of aggregated individual decision-making that effectively model ant, consumer, and financial market behavior. By using more behaviorally-realistic assumptions, these economists frequently offer perspectives that are distinct from mainstream neoclassical economic analysis.

**Some Findings from Behavioral Economics**

Mainstream economists are aware, of course, that people do not always behave "rationally," and in fact make mistakes. They justify the "rationality" assumption by arguing that people learn from their mistakes and become more rational. They also note that while there are many ways people behave "irrationally," there is only one way to behave rationally. As a consequence, rational behavior is the only component of behavior that can be predicted. (Friedman 1990).

The only practical alternative to assuming "rationality" would be a theory of how people behave systematically in non–rational ways. Behavioral economists are developing such a theory primarily through use of laboratory experiments. They have, to date, found a large number of ways in which people depart from the standard rationality assumptions. This section briefly describes some of these findings.

To quickly illustrate the spirit of these findings, consider the following question: A bat and a ball cost $1.10 in total. The bat costs $1 more than the ball. How much does the ball cost?

**Intuitive vs. rational thought.** Half of the Princeton and University of Michigan students questioned answered ten cents for ball price, rather than checking their math (Shane Frederic, cited in Kahneman 2003). To explain this and other behavior, Kahneman puts forward two systems of thinking: (1) intuitive, rapid, low-effort thought – similar to perception in its immediate nature, and (2) rational, higher-effort thought - a check on intuitive thought but only if the person bothers with it. Half of the students did not.

Intuitive thought predominates, says Kahneman – especially when we're emotional, multitasking, pressed for time, or tired – and probably helped us survive the numerous quick decisions we had to make as we evolved. It can be sophisticated and well learned, as the intuition of fast-playing chess-masters, or it can be misleading. In one well-known example of intuitively considering *relative instead of absolute magnitudes,* people will drive across town to save $15 on one $45 bottle of wine, but not on a $15,000 car.

**Availability.** Continually faced with uncertainty, people adopt simplified heuristics to make judgments. Suppose a prospective buyer wondered how likely a front-loading washer was to need door repairs for water-tightness. She would want to know what proportion of buyers end up with leaky doors, but using an *availability* or *accessibility* heuristic, would instead think about how many door failure anecdotes come readily to mind.

The washing machine customer might be influenced by how vehemently, or how recently, associates had complained about their own machines, because recent and intensely-felt events are most accessible. In experiments, colonoscopy patients reported their pain levels every minute during the procedure and provided a global pain assessment at the procedure's end. Patients who were given an additional minute of uncomfortable, but not too painful, time at the end of the procedure reported significantly less global pain. These patients based their global assessment on a combination of the peak pain and the ending pain, not just the peak pain (Redelmeier & Kahneman 1996, cited in Kahneman 2003).

**Framing and prospect theory.** Because most decisions occur heuristically rather than with full rational attention, the "framing" of a decision importantly affects its outcome. The washing machine will sell better if its vendor advertises "90 percent customer satisfaction" than if it announces, "Only 10 percent of our customers regret their purchase." In one experiment, people hypothetically choosing between surgery and radiation therapy tended toward the choice which offered "90 percent short term survival" over the choice with "10% immediate mortality." (McNeill et al. 1982, cited in Kahneman 2003)

One important application of *framing*, known as *prospect theory*, occurs because of people's systematic tendency to use the status quo as a point of reference in framing their decisions (see Thaler, 1980). Tversky & Kahneman (1981) showed that people become attached to what they have, and regret its loss more than they value equivalent gains. In typical experiments, subjects will require a higher sales price for a decorated mug or interesting marking pen they are given, than they are willing to pay for a similar object they don't yet own. The object has become part of their status quo endowment—they are attached to what they already have.

That attachment falters, however, when people are depressed or disgusted – states experimenters induced by having subjects watch a sad scene from *The Champ*, or the dirty toilet scene from *Trainspotting*, respectively. When sad, people seem to want a change, and their buying price exceeds their selling price for the mugs distributed in the experiment. When disgusted, people also will sell easily, but they won't pay much to buy (Lerner et al. 2004).

**Importance of emotions.** Judgments are subject to an *affect* (emotion) *heuristic*, so that college student responses to "How happy are you with your life in general?" depend heavily on whether the previous question asked is "How many dates did you have last month?" (Strack et al. 1988, cited in Kahneman 2003).

Shame, pride, and status are powerful motivators as well (Jolls et al. 1998), giving people incentive to follow the crowd. Social rejection, it turns out, activates the same brain areas as pain (Eisenberger et al. 2003). In addition; people feel more comfortable when they can *take control* of their situation; this contributes to the lower pain level of patients on self-administered morphine drip (Spillane 2002).

**Uncertainty**. Which of these statements is true? (*A*) In 2003, scientists found that up to 2 percent of rat brain neurons were killed by 2 hours of exposure to radiation from a cell phone, or, (*B*) In 2003, scientists found that up to 2 percent of rat brain neurons were killed by excessive blood flow to the brain in rats hung upside-down for 2 hours.

It turns out that people discount the risk of things they like doing (Kahneman 2003), and the first statement is the true one (Salford et al. 2003). Underestimating the risk of valued

activities, along with people's emotional attachment to what they have, creates a *bias for the status quo*. If you frame a choice as a departure from the usual, you'll find fewer takers.

In addition, people tend to *over-weight small probabilities and under-weight moderate and high probabilities* in making decisions. (Loewenstein & Thaler 1989.)

**Sunk costs.** Unlike *homo economicus*, real people count *sunk costs*, not just the opportunity costs they face, in making decisions. When a random sample of season theatre pass buyers were given a substantial discount, the discount buyers skipped more shows than the full price payers – they had less *sunk cost* to regret (Jolls et al. 1998).

**Fairness.** Reasonably, people insist on *fairness*. In the oft repeated "ultimatum game," subjects are randomly paired, and assigned a sum of money. One subject in each pair is chosen to propose an ultimatum: "I keep $*x* and you get the remainder." The other subject must accept or decline. If he declines, the money is forfeited. Across most cultures, nations, and monetary amounts, people generally offer – and accept – a 50/50 split or something close to it, like 60/40 (Heinrich 2000). People offering more unbalanced ultimatums, such as 90/10, tend to find their "unfair" offer rejected out of spite.

Capuchin monkeys also reject unfair albeit profitable offers. Usually willing to trade a pebble for a cucumber slice, even when the researcher visibly withholds more coveted grapes, the monkeys will refuse the cucumber slice if they see that another monkey gets to trade for a grape. Many throw the proffered cucumber slice at the researcher in anger. Protests are most vigorous when the other monkey gets a grape for free (Brosnan et al. 2003).

**Altruism, free ridership, and public economics.** Economic theory predicts people will fail to chip in for collective *public goods* because self-interest dictates that they *free-ride* on others' contributions. Yet examples of *altruism* abound in society, leading experimental economists to test just how common free ridership really is. Many researchers have tested this by giving subjects endowments to allocate between their own use and a public good. (Typically the public good is a monetary award for everyone in the group, such as double the sum of contributions.) Most subjects contribute about half their endowment to the public good, even if they do not meet their fellow subjects (Kagel & Roth 1995). Note the effectiveness of the idea, common to fundraising campaigns, that "together we can accomplish our goal."

**Following the crowd and force of habit.** People and other social animals also make choices that follow the crowd. Entomologists could not explain the stock-market-like swings in ant foraging choices when the ants were given two equal food sources on opposite sides of their anthill. Then economist Alan Kirman (1993) found he could create graphs resembling ant behavior quite well if he just assigned to the ants three complementary probabilities: a probability an ant would take the path of the preceding ant (*following the crowd*), a probability she would repeat her last forage (*force of habit*), and a probability she would choose anew. Kirman had similar luck modeling human restaurant foraging, with its unpredictable swings in restaurant popularity, and, of course, financial market transactions. Note that people economize on mental effort whenever they follow others, or their own habits, instead of choosing anew. Force of habit creates additional bias for the status quo, and habits create an opportunity for *learning through repeated behavior.*

**Bounded rationality, opportunism, and trust.** Alongside and closely related to behavioral economics, *transaction cost economics* explores how bounded rationality creates incentives for trading partners to opportunistically withhold and misrepresent information. The risk of *opportunism* can make it extremely difficult for trading partners to establish the *trust* necessary to carry out efficient exchange. For example, boundedly rational buyers cannot usually tell whether the used car salesman is withholding information. This makes it difficult for buyers and sellers to negotiate an efficient price for, and may severely limit the market for, high quality used cars (Akerlof 1970). Similarly, the interaction between *bounded rationality* and *opportunism* makes markets very inefficient for the higher quality goods and services so frequently associated with improving energy efficiency (Goldstone. 1996). People will install sub-optimal amounts of insulation, for example, if they cannot be sure the insulation contractor will honestly reveal the quality of his product.

## California's Energy Crisis

This brings us to real market applications. Behavioral economists tell us how people behave in laboratory experiments, but what happens in a real market with all of its complexities? Real events can change people's expectations, challenging their previous mental heuristics, create new levels of uncertainty, and raise new implications for fairness. The California energy crisis of 2000-2001 gives us a "natural experiment" in which to explore some of these behavioral economic findings

Beginning in the summer of 2000, California experienced sharp increases in natural gas prices, spikes in electric rates for some customers, and isolated electricity blackouts. In response to the worsening situation, the State and electric utilities undertook a variety of efforts to enhance supply, and to reduce demand and load, especially during peak periods. A large-scale conservation marketing campaign, *Flex Your Power*, and expanded rebate programs encouraged residential customers to improve the efficiency of their energy-using equipment and to change their behavior by using less lighting, turning off unused equipment, adjusting thermostats, and shifting major appliance use to off-peak times. The "20/20" program offered a 20 percent credit to investor-owned utility electric customers who reduced their summer month bills by 20 percent compared to the previous year. Widespread media coverage kept the numerous emergency warnings, isolated blackouts, and the political turmoil and uncertainty surrounding energy supply as a main conversation topic among Californians for nearly 18 months. The situation was unlike anything seen before.

California's efforts in 2001 paid off when the state averted large-scale summer blackouts and widespread economic losses. By December 2001, the "crisis" had passed and the State Christmas tree lights were back on. Relative to 2000, peak demand in 2001 was down an average of 10.4 percent during the critical months of June to September, according to data adjusted for weather and growth from the California Independent System Operator's (CA ISO) control area (84 percent of the state). Annual adjusted energy consumption in the CA ISO area dropped by 6.7 percent in 2001 compared to 2000. A year later, in 2002, adjusted peak demand reduction retained half of its crisis-period drop (California Energy Commission 2003).

## Research into Consumer Behavior during the Crisis Period

The California Energy Commission recognized that the crisis presented a unique opportunity to gather information about how consumers were reacting to the intense media focus on energy, the uncertainty surrounding system reliability, and the various programmatic attempts to reduce peak demand. Washington State University (WSU) researchers conducted two telephone survey waves for the California Energy Commission, one immediately following the crisis and another a year later with the same respondents. WSU researchers surveyed customers of California's five major investor and publicly owned utilities.

In 2001, surveyors completed 1,666 interviews during the months of September-October for a 24 percent response rate and a 40.7 percent completion rate. The second survey, conducted from late October 2002 to early January 2003, targeted 1,432 households from the earlier wave who had agreed to be re-interviewed. A total of 815 surveys were completed in this second wave, yielding a response rate of 55 percent. Utilities provided monthly billing data for survey participants for 1999-2002.

The survey strategy incorporated many open-ended questions in addition to more traditional forced-choice questions as a way of controlling over-reporting of behavior change. Open-ended questions also asked about conservation/efficiency actions planned for the future, knowledge of conservation/efficiency programs, and views on state policies. Findings from this research are available in a variety of reports and papers (Bender et al. 2002, Lutzenhiser et al. 2002, 2003).

## Testing New Behavioral-Market Links Using the 2001-2002 Research

Californians showed remarkable resilience and willingness to make changes in their energy use in response to the uncertainties and threats of the 2001 energy supply crisis. Some of these changes and the reported reasons for taking them seemed to defy traditional theories of economic rational self-interest and expected behavior. In this section, we will explore several of the more surprising findings from the WSU survey data through the lens of behavioral economics.

### Flexibility of Household Demand Proved Greater than Expected

Household energy demands generally are viewed as determined by needs, desires, and comfort requirements that are fixed in building/appliance configurations, social lifestyle, and individual preference. Energy policy analysts tend to consider residential appliance and space conditioning use inflexible, and conservation difficult to obtain. In 2001, however, residential households showed considerably greater flexibility in their electricity demands than had previously been believed possible.

More than 75 percent of households responding to the WSU survey reported taking at least one conservation action. The majority of households reported taking several different sorts of actions, responding with creativity and flexibility. Using less lighting was by far the most common response. This is consistent with the *availability* heuristic since lighting is a particularly visible end-use. Changes in cooling strategies came in as the second most common response. Other actions that were reported by about 20–30 percent of the households included small equipment behaviors, such as turning off equipment when not in use, adding compact

fluorescent or low energy bulbs, and shifting energy use to off-peak hours. Most surprising, nearly 10 percent reported using no air conditioning at all. *Flex Your Power* aired seventeen unique general market 30-second television spots between February 2001 and March 2002. With the exception of turning off air conditioning, all of these actions appeared in the campaign ads.

These behaviors fit well with knowledge already held by the target market. According to their self-reports, households relied primarily on past experience and common sense (likely with some prompting from the *Flex Your Power* advertisements) to choose the conservation actions they pursued. Many people, regardless of their present circumstances recall frugal use of energy in earlier periods and previous shortages.

People develop mental models that shape how they process, store, and retrieve information. They like to *economize on mental effort* and thus often resort to *habit*. By communicating a few, simple, easy things to do to conserve electricity visually tied to familiar spaces—laundry room, garage, living room and office—the messages may have triggered latent memories, increased the *accessibility* to these familiar actions (forgotten habits), and kept the level of mental effort needed to take action to a minimum. The media campaign avoided framing actions as departures from household norms, thus preserving a sense of the *status quo*. During the earliest phase of the campaign, ads ended with the phrase, "And it's not even hard."

Still, the people who applied effortful, rational processes may have been the most successful at saving electricity. In the billing analysis portion of this research, those who found it "very important" to "see how low [they] could get [their] energy bill" were much more likely to have saved significant amounts of electricity. Fourteen percent made significant savings compared to 6 percent for the rest of the sample.

**Comfort Proved More Elastic than Predicted**

The willingness of households to not use air conditioners may be the most unexpected finding from this research. The results of the survey show that among households with central air conditioning, 36 percent reported using less or no air conditioning. Among room air conditioner owners, 29 percent reported similar actions. Air conditioning conservation may well deliver the greatest energy and peak demand benefits. Cooling accounts for 35.5 percent of peak megawatt demand and 7.4 percent of annual residential consumption (Lutzenhiser et al. 2003).

The approaches used by households to reduce their air conditioning loads were not recommended by *Flex Your Power* or any of the information made available by state agencies and utilities. Air conditioning is usually targeted through thermostat adjustments, rebates toward purchase of more efficient units, and improved efficiency standards. In addition, air conditioner cycling programs provide monetary incentives for consumers to accept involuntary shut-off during times of system stress.

In their willingness to shut off their air conditioning of their own volition, households may have adopted the *availability heuristic.* Air conditioners, like lights, are a very salient energy use during the summer. They make noise. Like lights, they can be turned off with a switch. Through this action residents also *took control* of their own comfort. Residents may have been more comfortable forgoing air conditioning, and willing to repeat the experience on subsequent days because they knew could turn the air conditioner back on as desired – much as patients in control of their morphine drip find their distress reduced. For some households, this willingness to cut back on comfort resulted in a sufficient reduction in their monthly summer bill

compared to the previous year so that they experienced a gain of another kind—a 20 percent reduction off the electric bill.

Behavioral economics would suggest that a 20/20-style program could be an example of *learning through repeated behavior*. By learning which actions effectively reduce the household's consumption and doing them repeatedly over the summer for an incentive, households should continue efficient behavior even when the incentive is removed. Unfortunately, the 20/20 program provided no feedback for a household to directly connect their actions to a reduction in consumption.

**Motivations Beyond Price Proved Important (Bounded Self-Interest)**

A common expectation has been that conservation will not occur without price increases. Actual price increases during the crisis period, however, were sporadic and unevenly distributed across utilities. Legislative action stabilized the volatile electric retail rates experienced in San Diego in mid-2000.

Consumers reported a number of reasons why they changed their energy use, ranging from self-interest (keep my energy bill down) to civic responsibility (doing my part, avoiding blackouts) and altruistic motives (protecting the environment, using energy resources wisely). These reasons were each reported by between 70-80 percent of all respondents. Qualifying for a utility rebate was the least common motivation, mentioned less than half as frequently as the other reasons. The most frequently cited motivation was to stop energy suppliers from overcharging. Many respondents reported more than one of these views.

Half of households said they had been thinking a lot about the effects of the energy situations on themselves, their friends and their families. Where this motivated cutbacks, people were showing *altruism* and *willingness to chip in for the public good*.

*Flex Your Power framed* its messages in several ways that were atypical of previous energy conservation campaigns. Saving money appeared in only three of the seventeen ads. Instead, messages connected actions of people 'just like themselves' to the powerful impact a group of individuals could achieve in a time of emergency: "It [taking a conservation action] will help us all get through the power emergency," and "Together we can do this." Household behavior became linked to larger social consequences, especially the much publicized and feared specter of rolling blackouts.

Blackouts were expected to be a significant source of concern and motivation for taking conservation action. In fact, "fear of blackouts" was the second most frequently cited motivation by the survey respondents for taking action (82 percent). Only about 32 percent of the survey sample, however, had actually experienced a system-ordered blackout at some during the previous year. Of this group, only 24 percent found their blackout experiences "very inconvenient." The others either found them a "minor inconvenience" (63 percent) or were "not inconvenienced at all" (13 percent). The tendency to *overweight something with a small probability*, but which is uncertain to you, is a prime finding from behavioral economics. In this case, the 82 percent motivated in part by fear of blackouts public may have overweighted the small probability of a blackout being onerous to them, because they were uncertain about the blackout's consequences. Alternatively or additionally, they may have *altruistically* feared the impact of blackouts on others.

An explanation for why people would care about price-gouging even if they personally do not experience it comes from the observations on *fairness* in behavioral economics. In market

settings, people care about being treated fairly and want to treat others fairly. Price-gouging could be viewed as the unfair transaction in this situation.

In other findings, true to *prospect theory*, consumers were paying more attention to a potential loss [higher prices] than to potential gains they could experience through utility rebate programs. Additionally, the desire for changes in currently-owned appliances such as refrigerators or dishwashers was not widely apparent. Less than 20 percent of the reported conservation actions involved purchase of new energy efficiency equipment; households remained attached to what they owned and adapted to the crisis in other ways.

Finally, a reason for reducing comfort, or for not perceiving reduced air conditioning use as reduced comfort, might be that others (including in businesses and state government buildings) were doing the same. Like Kirman's ants, people are influenced by the behavior of others and have some probability of *following the crowd.*

## Putting New Understanding into Future Market Transforming Policies and Programs

By attempting to understand real behavioral market dynamics, behavioral economics can help us design programs that truly transform the market. For example, behavioral economics tells us that faced with the perverse behavioral interaction between *bounded rationality and opportunism,* consumers may mistrust claims about energy savings. Hence they should benefit from *ex post* programs that would compensate them when technologies do not work out as planned – programs such as warranties, leases, or buyback programs. These programs transform the market by reducing the likelihood of bad outcomes, and the effects of uncertainty on consumer behavior. In addition, e*x post* programs would require a smaller outlay per customer than *ex ante* programs such as tax credits and rebates, because outlays would be made only when bad outcomes occurred. Another solution to trust and information problems is to create certification programs, which identify providers such as insulation contractors as acceptable, and provide and summarize customer's evaluations much as *e-Bay* does. By more effectively focusing on perverse but real behavioral market dynamics, these program designs create the possibility of more permanent improvements in market performance (market transformation) than are realizable by the simpler neoclassical "rationality" theory-driven designs.

Attention to behavioral economics findings could also improve *ex ante* efficiency incentive programs. Recall that *relative* magnitudes matter more than *absolute* magnitudes This suggests that when allocating rebate money, one should choose high percent discounts where possible. If you can save similar energy amounts by selling a toaster oven or selling an efficient full-sized oven, allocate your $30 rebate to the lower-cost toaster oven and sales should increase. Program designers should carefully consider the *relative* magnitudes of rebates.

*Sunk costs* matter, and people employ that fact when they use their sunken health club membership cost to force themselves to exercise. Why not create similar incentives for energy efficiency? For example, offer a limited-time conditional promissory note. A consumer pays $25, after which they receive helpful, simplifying information on energy efficient appliance choices, or reliable, certified contractors. Then, when they buy an appliance or contracting services, they get back the $25 plus a $100 rebate. Time limits could further induce people to hurry up and commit; Katona & Mueller (1954) report that people move quickly to buy major appliances and homes when the prices look to be rising.

*Altruism, fairness, and willingness to chip in* are real, as we saw in people's energy use reduction. Many people dropped the call for "conservation: with the end of the Jimmy Carter presidency, calling instead for more comfortable "efficiency." Yet we have just learned that in a crunch, people will voluntarily forego the comfort associated with air conditioning.

The findings about unexpected demand flexibility despite relatively little price motivation could inform efforts to make electricity markets more responsive to extreme stresses. Interestingly, the findings challenge two kinds of conventional wisdom. One, from mainstream economists, holds that demand response depends almost exclusively on time-related pricing. The other, from mainstream energy efficiency proponents, implies that conservation depends mostly on more efficient equipment. More effective transformation of the demand side of electricity markets may depend on a more systematic exploitation of newer behavioral economic insights.

More generally, in view of these findings, we might reconsider promoting "efficiency" before "conservation." When we subsidize and give an Energy Star™ label to a big, energy-hungry side-by-side refrigerator because the competitors' similar models use even more electricity, we likely are moving some purchases away from smaller, bottom-freezer refrigerators that use less energy. Samiullah et al. (2002) found that air conditioning rebates caused some adoption of air conditioning in houses that previously had none. A more precise and effective label would say "Efficient in its Class" for the big refrigerator and "Energy Star" for the smaller one.

## Conclusion

We have attempted to show the promise of more systematic application of a growing body of insights from behavioral economics to energy policy and program design. Behavioral economics clearly builds on the kinds of insights from psychobiology and sociology that have long been the staple of energy efficiency "human dimensions" research. Despite having been around for a while, behavioral economists are just now, it seems, gaining wider respect in their own discipline of economics. Particularly germane, their need to challenge the economic orthodoxy drives them to show the implication of "human dimension" insights to the operation of markets. Their focus on gaining a more realistic understanding of the micro-behavioral dynamics of markets makes them a potentially valuable source of knowledge for improving our understanding and ultimately, transforming energy efficiency, energy conservation, and energy markets.

## References


Akerlof, George. 1970. "Market for Lemons." *Quarterly Journal of Economics*" 84: 488-500.

Bender, S., M. Moezzi, M H. Gossard, and L. Lutzenhiser. 2002. "Using Mass Media to Influence Energy Consumption Behavior: California's 2001 Flex Your Power Campaign as a Case Study." In *Proceedings of the 2002 ACEEE Summer Study on Energy Efficiency in Buildings.* 8:15-28. Washington D.C.: American Council for an Energy Efficient-Economy.

Brosnan, Sarah F., and Frans B.M. de Waal. 2003. "Monkeys reject unequal pay." *Nature* 425 (Sept. 18):297-299.

California Energy Commission. 2003. *Public Interest Energy Strategies Report*. Publication 100-03-012F.

Eisenberger, N.I., M.D. Lieberman, and K.D. Williams. 2003. "Does Rejection Hurt? An fMRI Study of Social Exclusion." *Science* 302:290-292

Friedman, David. 1990. *Price Theory: An Intermediate Text*. Cincinnati: South-Western Publishing Company.

Goldstone, S. 1996. *Appendix A: The Assumption of Consumer Rationality: A Methodological Fork-In-the-Road.* Testimony in support of the October 22, 1996 ER 96 Committee Hearing, Consumer Choice and Retail Issues. California Energy Commission.

Heinrich, Joseph. 2000. "Does Culture Matter in Economic Behavior? Ultimatum Game Bargaining Among the Machiguenga of the Peruvian Amazon." *The American Economic Review*. 90(4):973-979.

Jolls, Christine, Cass R. Sunstein, and Richard Thaler. 1998. "A Behavioral Approach to Law and Economics." *Stanford Law Review.* 50 STNLR 1471 (May): 2-71.

Kagel, J.H., and A.E. Roth, eds. 1995. *The Handbook of Experimental Economics.* Princeton University Press.

Kahneman, Daniel. 2003. "Maps of Bounded Rationality: Psychology for Behavioral Economics." *American Economic Review.* 93(5): 1449-1475. Revised from 2002 Nobel Prize Lecture. http://www.nobel.se/economics/laureates/2002/kahnemann-lecture. pdf

Katona George, and Eva Mueller. 1954. "A Study of Purchase Decisions": in L. Clark, ed., *Consumer Behavior*. New York University Press.

Kirman, Alan. 1993. "Ants, Rationality and Recruitment." *Quarterly Journal of Economics* 108:137-56.

Lerner, Jennifer S., Deborah A. Small, and George Loewenstein. 2004. "Heart Strings and Purse Strings: Carryover Effects on Economic Decisions." *Psychological Science***.** 15(5):337.

Loewenstein, George, and Richard Thaler. 1989. "Anomalies: Intertemporal Choice." *The Journal of Economic Perspectives*. 3(4):181-193.

Lutzenhiser, L., M. Gossard, and S. Bender. 2002. "Crisis in Paradise: Understanding the Household Conservation Response to California's 2001 Energy Crisis." In *Proceedings of the 2002 ACEEE Summer Study on Energy Efficiency in Buildings.* 8:153-166. Washington D.C.: American Council for an Energy-Efficient Economy.

Lutzenhiser, Loren, Richard Kunkle, James Woods, and Susan Lutzenhiser. 2003. *Conservation Behavior by Residential Consumers During and After the 2000-2001 California Energy Crisis*. Report prepared for the California Energy Commission as part of the *Public Interest Energy Strategies Report*. Publication 100-03-015F. Appendix A.

McNeil, B.J., S. G. Pauker, H. C. Sox, and A. Tversky. 1982. On the elicitation of preferences for alternative therapies. *New England Journal of Medicine.* 306: 1259–1262.

Redelmeier, D. and D. Kahneman. 1996. "Patients' memories of painful medical treatments: real-time and retrospective evaluations of two minimally invasive procedures." *Pain*, 66z; 3-8

Spillane, Janice. 2002. PCA Pumps a Standard in the SICU. *Nursing Spectrum*.15 July 2002. http://community.nursingspectrum.com/MagazineArticles/article.cfm?AID=7231

Salford, L. G., A. E. Brun, J. L. Eberhardt, L. Malmgren, and B. R. R. Persson. 2003. "Nerve Cell Damage in Mammalian Brain after Exposure to Microwaves from GSM Mobile Phones. *Environmental Health Perspectives.* 111:881-883. < http://ehp.niehs.nih.gov/members/2003 /6039/6039.pdf>

Samiullah, Shahana, David Hungerford, and Adrienne Vayssières Kandel. 2002. "Do Central Air Conditioner Rebates Encourage Adoption of Air Conditioning?" In *Proceedings of 2002 ACEEE Summer Study on Energy Efficiency in Buildings.* 8:253-264. Washington D.C.: American Council for an Energy-Efficient Economy

Simon, Herbert A. 1978. "Rational Decision-Making in Business Organizations." Nobel Prize Lecture. 8 Dec. http://www.nobel.se/economics/laureates/1978/simon-lecture.pdf

Spillane, J. 2002. "Pumps a Common Practice in the SICU." *Nursing Spectrum*. July 15, 2002 http://community.nursingspectrum.com/MagazineArticles/article.cfm?AID=7231

Strack, F., L.L. Martin, and N. Schwarz. 1988. "Priming and Communication: The Social Determinants of Information Use in Judgments of Life-satisfaction." *European Journal of Social Psychology*, 18: 429–442.

Thaler, Richard. 1980. "Toward a Positive Theory of Consumer Choice." *Journal of Economic Behavior and Organization* 1: 39-60.

Tversky, Amos, and Daniel Kahneman. 1981. "The Framing of Decisions and the Psychology of Choice." *Science.* 211: 453–458.