

## 6. Behavioral Theories I: Biases and Irrationality

*It is true that from a behavioral economics perspective we are fallible, easily confused, not that smart, and often irrational. We are more like Homer Simpson than Superman. Dan Ariely at danariely.com*

Economic theory has its weaknesses: the theory of approximate Nash equilibrium may be “correct” but it doesn’t always yield strong predictions. Understanding the psychological elements that predominate when economic incentives are weak – understanding the “epsilons” – would be of great value to economics. So you might think that behavioral economics carefully searches through the psychology literature to identify ideas that would help remedy these weaknesses. You would not suppose that behavioral economics was an attempt to remake those areas of economics that are strong and well studied. Nor would you suppose that behavioral economics was an effort to put a mathematical gloss over psychology – perhaps because the salaries for academic economists are much higher than those of psychologists? – in an effort to develop a theory of what goes inside the mind. That, after all, is a topic of little relevance to economics. And given the propensity of behavioral economists to pick on the most trivial deviations from standard theory, you would imagine that behavioral theories are subject to deep and careful scrutiny by behavioral economists. For the most part you would be wrong.

Behavioral economics is hard to define. Because it is a terribly trendy term some research that antedates the invention of the

word and has little to do with psychological theory or data – such as learning theory – is sometimes referred to also as “behavioral.” Sometimes it seems as if anything these days besides the purest of rational models sells itself as “behavioral.”

To get a handle on what behavioral economics is, let’s turn to some self identified behavioral economists. George Akerlof in his 2001 Nobel lecture lists several topics he regards as “behavioral”: reciprocity, fairness, identity, money illusion, loss aversion, herding, and procrastination. A recent 2009 article by Stephano DellaVigna – in the very mainstream *Journal of Economic Literature* – provides a nice outline of the issues examined in behavioral economics as well as some of the evidence. DellaVigna lists three main categories of topics as “behavioral”: nonstandard preferences, incorrect beliefs, and systematic biases in decision making.

Della Vigna lists three types of non-standard preferences: time preferences, risk preferences and social preferences. Akerlof’s procrastination along with what is known as *present bias* fall into the category of time preferences. Akerlof’s loss aversion, the psychological theory of decision making under uncertainty called *prospect theory* along with what are known as the Allais and Rabin paradoxes fall into the category of risk preferences. Akerlof’s reciprocity and fairness are examples of social preferences – it means simply that people care about the fate of other people.

DellaVigna discusses several ways in which people systematically have incorrect beliefs. One is that people are systematically overconfident; that they tend to put too much reliance on small samples, and that they systematically underestimate their

ability to adapt to future circumstances. Akerlof's money illusion, presumably, is also an example of incorrect beliefs.

Finally, DellaVigna lists a number of systematic biases in decision making. None will come as a great shock to anyone with a modicum of common sense. *Framing* refers to the fact that the answer often depends on the way a question is framed. What is 2.2 times 75? How about 2 times 75 plus 10%? I find the latter question much easier to answer than the first, although they are in fact the same question. Additional biases DellaVigna discusses are the fact that we have limited attention, that our current emotions have an impact on our decisions and that we respond to social pressure – the identity and herding that Akerlof refers to.

### Some History

The effort to incorporate more “psychological” elements into economic models is not new. The description of this effort as “behavioral economics” seems to have come into use to describe this sub-genre of economics only in the last decade or so.

To reiterate a point made in the introduction Thorstein Veblen was criticizing economics for excessive use of the notion of rationality in 1898. More recently several Nobel prizes in economics have been given for what can only be described in modern terms as behavioral economics. One – the aforementioned George Akerlof – wasn't awarded the prize for his behavioral research, but rather his research on models of rational agents in “markets where sellers of products have more information than buyers about product quality.” Since “he showed that low-quality products may squeeze out high-quality products in such markets, and that prices of high-quality products may suffer as a result” one might think that he is aware that

traditional economic models can result in market outcomes that appear to be “behavioral” in nature.

Several earlier Nobel Prizes in Economics were for work that was explicitly “behavioral”: that awarded to Herbert Simon in 1978 as well as that awarded to Daniel Kahneman – a psychologist – in 2002. In both cases, of course, the work for which the prize was awarded took place years before. In Kahneman’s case the work was conducted with Amos Tversky who was ineligible for the prize in 2002 on account of his having died in 1996.

I previously discussed the work of Herbert Simon and his invention of the alternative to optimization called satisficing. This supposes that rather than optimizing people simply try to do “reasonably” well. Although the model has never been widely used in economics, I explained how the basic idea has become part of mainstream economics through the notion of approximate optimization. Likewise Simon’s notion of a target that grows and declines based on past experience is also widely used both in learning theory and in preference theory where it reappears in the widely used habit formation model.

Kahneman and Tversky, along with Richard Thaler, pointed out a wide variety of psychological paradoxes with standard decision theory. One of them – the Allais paradox – was first pointed out by Maurice Allais in 1953. They have also pointed out a wide range of other anomalies or supposed anomalies most of which emerge in an experimental setting. This includes framing – people making different choices based on how the problem is presented, as well as systematic biases in decision-making. Kahneman and Tversky are also responsible for a theoretical effort to remedy some

of these problems – a decision-making theory called prospect theory. This differs from the standard economic theory of expected utility in two ways. It supposes *loss aversion* – that people care about gains and losses relative to some (unspecified) starting point. It also supposes that people systematically overestimate low probabilities and underestimate high probabilities. This theory has had no impact on economics whatsoever but has become the gold-standard for psychologists.

More recently Matt Rabin, an economist and winner of the highest award given by the American Economic Association – the John Bates Clarke medal – has explored the fact that people are not always selfish, but often altruistic or spiteful, and in many instances care about fairness. He also pointed out a considerably bigger problem with expected utility theory than the Allais paradox, a problem now called the Rabin paradox .

Notice that there is a sense in which behavioral economics *is* mainstream: many of the critics of existing theory and practice have had their work recognized by traditional honors such as the Nobel prize and the John Bates Clarke medal.

### Framing and Anchoring

Are preferences unstable as some behavioral economists such as Dan Ariely would have us believe? One of the driving paradoxes that drives behavioral economics is what is called the *framing effect*. DellaVigna, for example, lists this as an important systematic bias in decision making. Framing refers to the fact that the answer to a question often depends on the way the question is framed. As I pointed out above 2.2 times 75 is a more difficult question than what is 2 times 75 plus 10% although they are in fact

the same question. Similarly if I ask you whether you would prefer to vote for the candidate who dropped out of Harvard or the one who founded Microsoft, you will probably choose the latter, even though both are Bill Gates. Put this way, framing is hardly controversial. As always the devil is in the details.

Closely connected to the framing effect is the idea in prospect theory of loss aversion – that losses relative to the status quo are what matters. One variation on this theme is what is called the *endowment effect*. This asserts that the way in which you value an item depends on whether you are buying it or selling it. Specifically, we can try to determine what is called *willingness to pay* for an item, which is just what it sounds like, and *willingness to accept* payment for an item, which is the opposite. For example, if we ask people how much they are willing to pay for a coffee cup they will state a relatively low value; if we give them a coffee cup and ask how much they will sell it for they will state a relatively high value.

On the surface this is not much of a paradox: we all know to buy low and sell high. However: the elicitation of values is done using a method called the Becker Marschak DeGroot [1964] elicitation procedure. A willingness to pay or accept payment is stated, then a random draw is made. If the random draw is lower than the stated value (in the willingness to pay case) then the item is sold at the randomly drawn price. If the draw is higher than the stated value then no transaction takes place.

Is it obvious to you that when this procedure is used that the unambiguously best course of action is to bid your true value and not buy low and sell high? It is true, and subjects are often informed

of this fact. So: is there a paradox here, as some behavioral economists and psychologists would argue, or, returning to the theme of which kinds of mistakes are most likely, is it simply the case that people have trouble understanding a complex and unfamiliar procedure?

The answer is that people don't understand the procedure: Zeiler and Plott [2004] show that if subjects are well trained in understanding the elicitation procedure – so they clearly understand that the best thing to do is to state their true value – then there is no difference between willingness to pay and willingness to accept payment. If the observation that people have trouble understanding complex decisions and sometimes make mistakes is “behavioral” then we scarcely need experimental evidence to prove the point – the fact that students get exam questions wrong should be proof enough that people fall short of complete and total rationality.

Another case in point is the *anchoring effect*. This says that we can get people to bid pretty much anything by telling them an irrelevant number before they submit their bid. This was documented in an experiment of Ariely, Lowenstein and Prelec (2003). They first asked people to record the final digits of their social security number, then solicited their willingness-to-pay for various items. They discovered that people who recorded high numbers bid high, and vice versa. The only problem with this experiment is appears to be an artifact that can't be replicated. Fudenberg, Levine and Maniadis [2011] carried out a similar experiment in which subjects were asked to record random numbers then solicited their willingness to accept. The table below reports

their findings which reports the median willingness to accept for those who recorded the lowest and highest random numbers.

			<b>Academic Planner</b>	<b>Cordless Keyboard</b>	<b>Financial Calculator</b>	<b>Designer Book</b>	<b>Milk Chocolates</b>	<b>Cordless Mouse</b>
Lowest	20%	of	5	35	10	10	4	25
random numbers								
Highest	20%	of	7.5	30	24	15	6.5	20
random numbers								

The magnitudes are far less than found in Ariely, Lowenstein and Prelec (2003), and for the cordless keyboard and cordless mouse go in the wrong direction. They are also quite robust, for example if willingness-to-pay is elicited, rather than willingness to accept.

### A Short History of Social Preferences in Economics

I’m not going to talk extensively about social preferences – I’ve talked about it already and there isn’t anything particularly “non-standard” about it. “Externalities” in preferences, meaning that people care about other people’s consumption is hardly new in economics, nor is the assumption that people are selfish a core precept of modern economic theory.

So let me instead give an extremely brief history of social preferences in economic thought. We can start with Edgeworth’s theory of competitive equilibrium in 1881. He explicitly allowed for the possibility that consumers might have preferences over each other’s consumption. Moving ahead to 1978, Goldman wrote about gift giving equilibria and economic efficiency: this was published in the mainstream *Journal of Economic Theory*. Trout Rader's 1980 paper “The Second Theorem of Welfare economics when Utilities

are Interdependent” was also published in that journal, and made his reputation as an outstanding economist. In more recent years we have contributions such as Kranich's 1988 work in the *Journal of Public Economics*. Or even more recently in 2011 there is the work of Dufwenberg et al from which I stole this history.

While social preferences are interesting for a variety of reasons, few have suggested that they are terribly important to the things that concern economists: economic crises, for example. The exception is George Akerlof who in his Nobel lecture talks about a theory called efficiency wages as a source of economic fluctuations. Efficiency wages say that employers pay workers more than their “market wage” so that they will fear being fired. To make this work employers have to ration jobs – they must turn away some people who would work at this supra-market wage. These people are described as *involuntarily unemployed* – meaning they are willing and able to work at the prevailing wage. There are two explanations of why employers might do this. One, discussed by Shapiro and Stiglitz in 1984, is a perfectly standard economic explanation. Workers effort is unobserved, so to get them to work hard they have to be punished – that is fired – if they are caught shirking. But if workers are paid sufficiently little they won't care if they are fired, so they must be paid a premium for the threat to be effective. The other explanation is “behavioral.” Workers will have good feelings (social preferences) towards their employer if they are paid a bonus over the market and bad feelings if they are not.

I don't really want to get into a debate about this: no doubt both things are true – and likely not very quantitatively significant. But the key thing is: as far as economic research has been able to tell

– with many efforts and noble failures – unemployment is a symptom rather than a cause of business cycles. As best we can tell – and that is pretty well – it is fluctuations in productivity, in asset prices and in investment that drives the business cycle, not changes in the labor market.

### Incorrect Beliefs and Systematic Biases

In his survey DellaVigna lists several ways in which people systematically have incorrect beliefs. One is that people are systematically overconfident; that they tend to put too much reliance on small samples, and that they systematically underestimate their ability to adapt to future circumstances. To this we may add Akerlof's money illusion.

Money illusion basically means that if your salary goes up by 10% and prices go up by 10% you feel richer – despite the fact that you can't afford any more than you could originally. Of course we may be more aware of changes in our salaries than changes in other prices. Regardless, the main implication that Akerlof and others point to is what is called price stickiness: when demand falls there is a tendency not to lower prices. The evidence as to whether this is true is mixed, to say the least. But true or false, it can scarcely be said that economists have ignored the possibility – price stickiness is the foundation of what is called the New Keynesian macroeconomics. The idea is that prices are listed on menus and there is a (likely quite small) cost of printing a new menu. We find, for example, that Mankiw's 1985 paper on menu costs is cited by around 900 follow-on papers. It was published in the very mainstream *Quarterly Journal of Economics*, and Mankiw himself

was the Chairman of the Council of Economic Advisors – under President George W. Bush, no less!

Turning from money illusion to systematic overconfidence it is not that easy to tell if people are genuinely overconfident or if they merely want the world to believe they are confident. After all, there are many advantages in other people believing you are capable – and if you do not act confident, other people will lack confidence in you. Everybody knows that the captain of the sinking ship must act as if everything is under control. Moreover – we are all familiar with Lake Woebegone where all the children are above average – and we laugh because we understand that everyone cannot be above average. Except – they can be. Sobel and Santos-Pinto pointed this out in an article in the *American Economic Review* in 2005.

Ability and capability are measured on many dimensions. Take driving for example – How fast can you drive? How well do you avoid accidents? How well can you park? Can you corner? And so forth and so on. So any question about “How good a driver do you think you are” implies a value judgement about the relative importance of all these different dimensions of driving. Naturally I tend to excel at those elements of driving I think are important – I drive fast and corner well, but have a lot of accidents and I’m a lousy parker. So according to what I think is important I am above average driver. Of course you probably think that avoiding accidents and parking well are important, so naturally you are good at that. Of course according to your values you are also an above average driver. The point is of course – we can be – and are – all above average.

## 6. Behavioral Theories: Is Behavioral Economics Doomed?

Another systematic bias is that we do not understand properly the laws of probability applied to small numbers. That is, many people if a coin is flipped several times and comes up heads each time will say that the coin is now “due” to come up tails – although this is not true.

A less clear-cut bias is that people appear not to use prior information effectively. For example, if we describe Steve as “shy and withdrawn, invariably helpful, but with little interest in people or the world of reality...” and so forth then ask people whether he is more likely to be a librarian than a salesman, many people will say salesman. Given the fact that there are vastly many more salesmen than librarians this is not in fact terribly likely. However, this finding is controversial, because in settings involving real decisions people seem to account for prior information more appropriately. For example, police investigating the homicide of a woman rarely dismiss the husband as a suspect merely because he is meek in manner.

Next, Della Vigna argues that we systematically underestimate our ability to adapt. For example, academics who do not get tenure find that it makes them much less unhappy than anticipated. This may well be true. If so it would mean, among other things, that people may over-react to economic crises that force them to change their way of life. What exactly we can do about this is unclear. Trumpeting from the rooftops “Life isn’t so bad – look for another line of work” probably isn’t going to win many political campaigns.

Della Vigna also points out that we have limited attention. We are surrounded by facts and can scarcely incorporate them all

into our beliefs in some magical and efficient way. For the most part this is innocuous – but work especially by Chris Sims on “rational inattention” points out that the impact of economic shocks may be muffled by our inability to immediately recognize what is happening.

Finally, DellaVigna points out that decisions depend on emotions. We are far more likely to buy that expensive car relaxing in a comfortable chair sipping coffee than if we are standing in the freezing rain – a fact that every car dealer knows. However, besides car dealers and other sales people – how this observation might enable us to build better economic institutions is uncertain.

### Identity

In his survey, DellaVigna suggests that the fact that we respond to social pressure is a systematic bias. That is, we are more likely to give the answer we think everyone else is likely to give. This is not so clearly behavioral – preferences for conformity have been part and parcel of economics at least since Duesenberry’s work on consumption in 1949. I suppose calling this “behavioral economics” gives a modern sheen to an oft-investigated topic. Certainly it forms the center-piece of Akerloff’s Nobel lecture discussion of the role of identity in reinforcing poverty.

*..behavioral economics also offers insight on the most enduring macroeconomic problem facing the United States: the disparity in income and social condition between the majority white population and the African American minority....The black poverty rate of 23.6% in 2000 was roughly triple the white rate of*

6. *Behavioral Theories: Is Behavioral Economics Doomed?*

7.7....*the problems of the poorest African-Americans go beyond mere poverty. They include extraordinarily high rates of crime, drug and alcohol addiction, out-of-wedlock births, female-headed households and welfare dependency...*

*Because standard economic theory, in our view, is incapable of explaining such self-destructive behavior, Rachel Kranton and I have developed models, based upon sociological and psychological observations to understand the persistence of African-American disadvantage. Our theory stresses the role of identity and the decisions that individual make about who they want to be. In our theory...dispossessed races...face a Hobbesian choice. One possibility is to choose an identity that adapts dominant culture. But such an identity is adopted with the knowledge that full acceptance by members of the dominant culture is unlikely. Such a choice is also likely to be psychologically costly to oneself since it involves being someone "different"; family and friends, who are also outside the dominant culture are likely also to have negative attitudes towards a maverick...*

Let us start by acknowledging that no social problem of this magnitude has an easy solution. Low education and ambition are undoubtedly passed from parent to child. While some succeed in

overcoming this handicap of early childhood, far more do not. I do not imagine that any economist, behavioral or otherwise would be likely to dispute this point.

The story Akerloff tells is a version of what is called the herding model – in the simplest version this just says that people follow the crowd. As far as I can tell there is nothing irrational about this. If we care about our social interaction with people – if we want to have friends, and I don't see anything particularly irrational in that – then the game theorist in me feels impelled to point out that we can have coordination equilibria in which everyone conforms, and anyone who does not conform is excluded, including those foolish enough not to exclude non-conformists.

However, before worrying about identity and crowd following, we might also want to start with more basic questions about poverty and rationality. For example: is drug use irrational when you are poor? If the alternatives are to live in miserable poverty or escape to drug-induced fantasy – well the fantasy doesn't sound so bad to me. Drug use is hardly particular to poor African Americans. Not surprisingly poor whites who live in rural areas of the southern United States are the center of the modern methamphetamine epidemic.

Is criminal activity irrational? From an economic point of view it is – criminals don't do that well financially. But when we factor in the excitement of being a criminal the choice is less obvious. Certainly if I grew up in a poor neighborhood, being part of a criminal gang would have a lot of appeal. With respect to out-of-wedlock births, female-headed households and welfare dependency: it would be useful to keep in mind that the government will give you

money if you are poor and have dependent children – unless of course you are married.

Lack of education is certainly an important source of poverty. This in turn depends on the effort put into education. Does student give up social activity to study hard? Does the parent give up luxuries to pay for the child's education? Standard economics suggests that whether this is so depends on incentives. In the African American community especially, do not forget that until the mid-1960s African Americans were excluded from many educational opportunities by force of law. The story of the great American mathematician – and hero to all economists – David Blackwell is a striking case in point. After finishing his Ph.D. Blackwell was turned down for an assistant professor job at Berkeley for one reason and one reason only: he is African American. If I were a young African American I would certainly be inclined to think: if one of the greatest mathematicians of the century with all of his education can't get a job – what hope is there for me?

The negative discrimination of the 1960s eventually turned into positive discrimination called affirmative action. If negative discrimination made it rational for African Americans not to invest in education, why did not reverse discrimination result in a flowering of education? Perhaps as Akerloff suggests the problem lies in some sort of social identity.

I am not unsympathetic to that idea, but I think it is useful to look also at other stories of discrimination. Does reverse discrimination result in the flowering of education? The reputation in educational institutions of the English upper class and rich Saudis speaks for itself. Does negative discrimination necessarily

discourage education? When my father attended Harvard University shortly after World War II, he was quite lucky to do so – he is Jewish, and at that time Harvard had explicit Jewish quotas. The affirmative action in favor of African Americans generally discriminated against other races and social groups – not so much whites as Asians. Yet these other groups who were discriminated against put enormous effort into education.

Let's step back for a moment, and try to view all this through the lens of common sense. African Americans were very heavily discriminated against and provided low effort. They were discriminated in favor of, and like other groups that were discriminated in favor of, they provided low effort. By way of contrast Jews and Asians who were mildly discriminated against provided high effort. Could it be that both heavy discrimination against and favorable discrimination both provide incentives for low effort, while middle levels of discrimination against provide incentives for high effort? That would reconcile all these facts without recourse to identity or social pressure, or indeed anything "behavioral."

To show how an economist would approach this, I will build a simple mathematical model of discrimination and effort in education. Suppose a student makes an effort  $f$  and draws a test score  $s$ . If the score exceeds a threshold  $t$  the student is admitted to college. A very simple model hypothesizes that the test score is drawn from what is called an exponential distribution with mean equal to the level of effort – so that higher effort results, on average, in higher test scores. Under this assumption we can compute that the probability of admission is  $p = \exp(-t/f)$ .

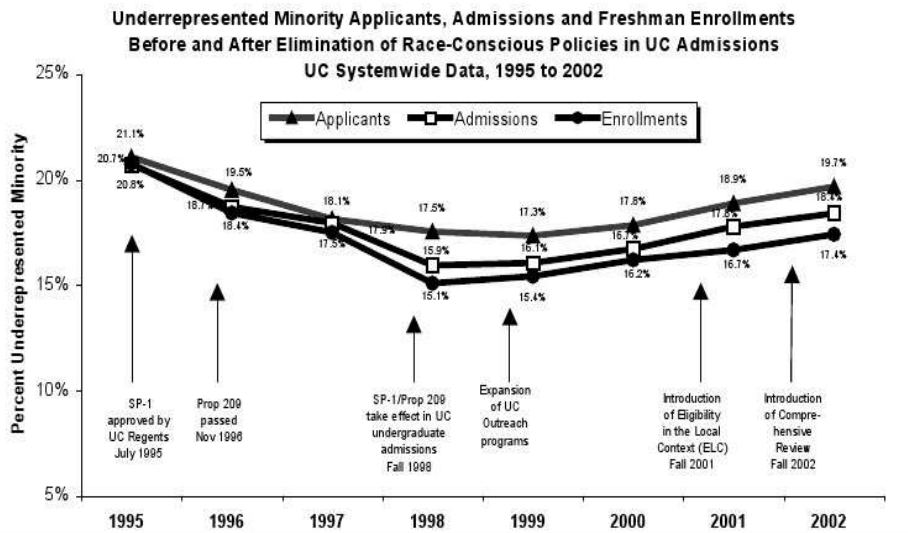
To model incentives, suppose that 0 is the reward for not being admitted to college, that  $w$  is the reward for success and that the cost of providing a unit of effort is 1. Then the objective function or “utility” of a student is given by reward times the probability of reward, minus the expense of effort:  $u = w \exp(-t/f) - f$ .

I’m afraid the next bit is kind of technical. The bottom line is that if students choose the “optimal” or “rational” level of effort then the probability of admission is  $f = -wp \log p$ , the so-called “entropy” function much beloved of physicists. If that is okay with you skip to the next paragraph. Otherwise, observe that the first derivative of the objective function is  $u' = w \exp(-t/f)(t/f^2) - 1$ . As effort  $f \rightarrow 0$  we can use l’Hospital’s rule to show that  $u' \rightarrow 0$ , and as  $f \rightarrow \infty$  we have  $u' \rightarrow -1$ . The second derivative is  $w \exp(-t/f)(t/f^3)(t/f - 2)$  which is initially positive for  $f < t/2$ , then changes sign once and becomes negative. The objective function, in other words, is single-peaked. What this means is that the optimum is the unique solution of the first order condition  $u' = w \exp(-t/f)(t/f^2) - 1 = 0$  which may be rewritten as  $f = w \exp(-t/f)(t/f)$ . We can rewrite this in terms of the probability of admission as  $f = -wp \log p$ .

What does the entropy function  $f = -wp \log p$  look like? It is non-negative, when  $p = 0$  it is zero, and when  $p = 1$  it is also zero, and in between it has a single peak. What this means is that if the probability of admission is either very high or very low, you should provide little effort (heavy discrimination against, or discrimination in favor) and for intermediate chances of admission – you should provide a lot of effort.

6. Behavioral Theories: Is Behavioral Economics Doomed?

We can pit this theory against reality. Prior to 1995 the University of California discriminated in favor of African Americans. In that year it abolished discrimination based on racial considerations. Bearing in mind when you actually apply to college, it is a bit late to change your effort level, we would expect that the immediate effect of ending affirmative action would be to lower



acceptance rates for African American students. However, over a longer period of time, we expect the effort level of younger students to adjust upwards, so that after an initial drop, over time, admissions rates would start go up. A report of the Office of the President of the University of California in 2003 provides the relevant data. And indeed we see that after an initial four-year decline in admission rates, they begin to go back up again.

Summing Up

As the introduction to this section says and the previous chapters document – economic theory has its weaknesses.

Unfortunately as this chapter and the next document behavioral economics is driven by the concerns of psychologists not economists, so does little to remedy the weaknesses of economic theory.

It is easy to be dismissive of standard theory on the grounds that clever theorists can explain anything. It is equally fashionable to complain that economic theories have too many explanatory variables – which for behavioral economists is a case of the pot calling the kettle black. These critiques miss a deeper point: are people functional in the decisions they make or not? In fact people (and for that matter, as we will see, pigeons) are quite clever. Seemingly dysfunctional behavior is often quite sensible when the circumstances and incentives are understood properly – but circumstances and incentive can be subtle. The evolutionary biology literature is a case in point – a lot of very strange seeming behavior by animals – changing sexes over the lifecycle, for example – makes quite a lot of sense when properly understood.

There is a line between understanding something that is truly functional and rationalizing everything we see. In the end, though, the test isn't that hard. A good definition of a behavioral mistake is – when we explain to people why they are doing the problem wrong they agree and change their behavior. If their behavior was functional in the first place they aren't terribly likely to do this. My complaint against a lot of “behavioral economics” is that there is such an obsession with people being dysfunctional that not only are the subtle reasons why behavior may be functional overlooked – but often the extremely obvious reasons are overlooked as well. The

example of procrastination in the next chapter is one example of many.

Let me conclude with a suggestion for behavioral economists. If there is something glaringly missing from economics it is a theory of imagination. Imagination plays a key role in our preferences: besides the obvious things such as novels and movies, our imagination contributes to our enjoyment of goods and services in many dimensions. At the same time imagination is crucial to innovation – it is the driving force behind our ever increasing production and the material benefits that brings. Yet there is a trade-off in imagining things. Living a life entirely of fantasy – pretending we are Nobel prize winning scientists and Olympic athletes – is not terribly satisfying. Useful imagination must be grounded in reality. The serious research of understanding the trade-off between fantasy and reality may not be as much fun as fantasizing that people are irrational – but in the long run it provides greater benefits.