9. Conclusion: Psychology, Neuroscience and Economics

Economics is commonly condemned for favoring rigor and mathematics over relevance. Perhaps apocryphally the economist Kenneth Boulding is quoted as having said "Mathematics brought rigor to Economics. Unfortunately, it also brought mortis." In 1973 Wassily Leontief in his Nobel Prize lecture – apparently a popular forum for criticizing economics – said

> *Page after page of professional economic journals are filled with mathematical formulas leading the reader from sets of more or less plausible but entirely arbitrary assumptions to precisely stated but irrelevant theoretical conclusions.*

Much more recently the historian of economic thought, Mark Blaug, said

> *Economics was condemned a century ago as "the dismal science," but the dismal science of yesterday was a lot less dismal than the soporific scholasticism of today. To paraphrase the title of a popular British musical: "No Reality, Please. We're Economists."* at http://www.autisme-economie.org/article26.html

If all these distinguished economists agree, they must be right. And no doubt the solution is behavioral economics!

One version of the solution can be found in a quotation attributed to the dissident economist John Kenneth Galbraith: "In

economics it is a far, far wiser thing to be right than to be consistent." Unfortunately this makes little sense: it is hard to see how you can be right in a useful sense by being inconsistent. I can say "The stock market will go up tomorrow." An hour later I can say "The stock market will go down tomorrow." This is certainly inconsistent, and I am bound to be correct (as well as equally bound to be incorrect), but in what respect is it useful? Fortunately if you have read this book, you will have discovered that economics is concerned not with rigor over relevance, but with rigorous relevance, which is an altogether different matter. Economics does not need saving.

If economics does not need saving, it can certainly use improving. Unfortunately behavioral economics does not seem at all focused on the weaknesses of economics. It is true that people have an emotional irrational side that is not well captured by mainstream economic models. By way of contrast, psychologists have long been fascinated with this side of humankind, and have many models and ideas on the subject. In this sense it is perhaps not surprising that much of behavioral economics attempts to import the ideas and models developed by psychologists.

Unfortunately psychology is no more perfect than economics. There is evidence, for example, that pigeons are more intelligent than psychologists. In the 1950s psychologists conducted choice experiments with lights that could flash one of two colors. The goal of the subjects was to guess what light would flash next. If the colors are chosen independently the best thing to do is to guess the most likely color all of the time. Subjects did not do this: they tended to guess each color roughly in proportion to the frequency of

the color – for example if the light flashed green 2/3rds the time, they would guess green about 2/3rds of the time. This "failure to optimize" was called *probability matching*. It has been replicated with pigeons as well, for example by Graf, Bullock and Bitterman [1964]. Here is the thing. In 1971 Fiorini went back and examined the data. He found that the light flashes were not independent. If a light flashed green, then the next flash was more likely to be green than red. That means that the best thing to do is to guess whatever color you saw last – resulting in choices roughly proportional to the frequencies of the different color lights. In other words: the pigeons computed the optimum correctly – the psychologists who were studying them did not.

Interestingly these probability matching experiments are the basis of the psychological theory of learning called *reinforcement learning*. That reinforcement learning results in probability matching behavior was pointed out by two economists Borgers and Sarin [2000].

We can make endless jokes about who is smarter: economists, psychologists or pigeons. The point is that both economists and psychologists make mistakes – and both disciplines learn from their mistakes. Psychologists today no more subscribe to probability matching as a theory than economists subscribe to the idea that burying money in the ground is a cure for recessions.

More to the point – it is crucial to recognize that the goals of psychologists and economists are different, and that this has implications for importing ideas from psychology into economics.

The key difference between psychologists and economists is that psychologists are interested in individual behavior while

economists are interested in explaining the results of groups of people interacting. Psychologists also are focused on human dysfunction – much of the goal of psychology (the bulk of psychologists are in clinical practices) is to help people become more functional. In fact, most people are quite functional most of the time. Hence the focus of economists on people who are "rational." Certain kinds of events – panics, for example – that are of interest to economists no doubt can benefit from understanding human dysfunctionality. But the balancing of portfolios by mutual fund managers, for example, is not such an obvious candidate. Indeed one of the themes of this book is that in the experimental lab the simplest model of human behavior – selfish rationality with imperfect learning – does an outstanding job of explaining the bulk of the type of behavior that economists are interested in.

Another science that is changing the way we think about decision making is neuroscience. With modern technology such as the fMRI scanner it is now possible to study what happens physically in the brain while decisions are made. As Camerer, Lowenstein and Prelec said in the *Journal of Economic Literature* in 2005

> *This "rational choice" approach has been enormously successful. But now advance in genetics and brain imaging (and other techniques) have made it possible to observe detailed processes in the brain better than every before. Brain scanning (...) shows which parts of the brain are active when people make economic decision. This means that we will eventually*

> *be able to replace the simple mathematical ideas that have been used in economics with more neurally-detailed descriptions.*

Or as Aldo Rustichini said in 2003

> *This new approach, which I consider a revolution should provide a theory of how people decide in economic and strategic situations.*[1]

So will peering into the brain revolutionize economics? Almost certainly not. First, when we ask what the revolution is to be, we find from Camerer, Lowenstein and Prelec (for example) that

> *Much aversion to risks is driven by immediate fear responses, which are largely traceable to a small area of the brain called the amygdala. The amygdala is an "internal hypochondriac" which provides "quick and dirty" emotional signals in response to potential fears. But the amygdala also receives cortical inputs which can moderate or override its responses.*

Unfortunately, as Gul and Pesendorfer [2005] point out in some detail – economists have no interest in what happens in the amygdala. Worse: not only to we not care what happens in the amygdala, for the kind of decisions we are interested in much of the

[1] Quoted in Blakeslee [2003].

action does not take place in the brain, nor is it subject to memory and other limitations. Even before we all had personal computers, we had pieces of paper that could be used not only for keeping track of information – but for making calculations as well. For most decisions of interest to economists these external helpers play a critical role – and no doubt lead to a higher level of rationality in decision making than if we had to make all decisions on the fly in our heads.

That is merely the tip of the iceberg. The human brain is a general purpose computing device – with external support it is what computer scientists call a Turing machine. And it is a theorem in computer science that all Turing machines are capable of exactly the same computations. That is – any decision algorithm that is possible we can carry out. We will have as much success understanding decision making by peering into the brain as we will in understanding how Microsoft Word works by peering into a computer chip.

This is not to say that neuroscience will add nothing to economics. If it is not going to replace existing theory or create a revolution, it may be potentially useful. While economic theories are not intended to predict what will happen in the amygdala they may never-the-less be successful at doing so. Insofar as they are, we have an additional way of measuring preferences. Much of "neuroeconomic" research focuses on decisions taken under uncertainty: for example, Glimcher [2002] or Dickhaut et al [2003]. While trying to understand the decision making process by peering into the brain is useless, our understanding of preferences may be enhanced through brain studies. This is true not only for risk

preferences – for example research such as that of Padoa-Schioppa and Assad [2006] show how neurons encode economic values. It must be, after all, that at some level our preferences are biologically determined – if neuroeconomics can help us better measure or understand those preferences it will have indeed helped to improve economics.

Both psychology and neuroscience are focused on individual behavior. Economics is focused on group behavior. This difference is crucial in many ways. There is a small segment of the psychology literature that effectively commits a fallacy of composition, reasoning that if we can explain individual behavior, this carries over immediately to the group. The most obvious example of this is the idea that if we could somehow make people better – more altruistic, say – then society at large would be better off. This is far from the case – as we discussed earlier, a nice example of an interactive setting where better people result in an inferior society can be found in Hwang and Bowles [2008].

There is a more intuitive way of making this point. From the perspective of his psychiatrist helping Tony Soprano become more functional is a good thing. From a social point of view if this enables him to be a more functional criminal it is a bad thing. Medical ethics are entirely focused on the patient, with no allowance for the role of the patient in society. The bottom line is that what is good for the individual is not always good for society, and we need to use game-theoretic and related models in order to understand the consequences of individual behavior for the entire group.

The need to study groups of potentially large numbers of people – as I write this we are approaching seven billion – imposes

constraints on economic models of individual decision making that are not present for psychologists. Economists need simple and broad models of behavior. Narrow complex models of behavior – neurally-detailed descriptions, for example – cannot easily be used to study the behavior of many people interacting. Hence the focus by economists on axiomatic models that provide a reasonable description of particular data while also giving decent results over a broad range of social settings. To take an example, research in psychology on hyperbolic discounting focuses on finding clever functional forms that will fit a broad range of data on human (and animal) behavior involving delayed rewards. From an economist's perspective, such models can be useful in testing and calibrating our own models – but they cannot be usefully embedded in complex social situations.

Another main theme of this book is that behavioral economics can contribute to strengthening existing economic theory, but, at least in its current incarnation, offers no realistic prospect of replacing it. Certain types of "behavioral" models are already important in mainstream economics: these include models of learning; of habit formation; and of the related phenomenon of consumer lock-in. Behavioral criticisms that ignore the great increase in the scope and accuracy of mainstream theory brought about by these innovations miss the mark entirely.

In the other direction are what I would describe as not part of mainstream economics, but rather works in progress that may one day become part of mainstream economics. The idea of level-*k* thinking is one such. Another that I did not discuss is the idea of ambiguity aversion. This captures the fascination economists have

had since Frank Knight's 1921 work with distinguishing mere risk from uncertainty. It is connected as well to the instrumental notion that some of the people we interact with may be dishonest.

Despite the joke about every four economists having five opinions, economists agree on many things. We agree that you are probably pretty good in your everyday economic decisions. We think you have little reason to invest a lot of time and effort in figuring out which economic policies will be the most favorable for you given that your vote counts for so little. For example: if you had to pay the 50% of the social security tax now paid by your employer, you'd probably correctly figure you'd lose some money. But economists figure your salary would adjust upwards (or less downwards) just enough that it wouldn't make much difference after a year or so. Are you going to spend a lot of time figuring out whether that is right or wrong?

By way of contrast behavioral economists seem to think that you are pretty bad at your job and at your day-to-day living. For some reason they also seem to think you are pretty good at evaluating the effect of different tax policies – and so will elect the politicians that will get it right. Well some behavioral economists anyway – a good place to conclude is with the writing of two behavioral economists George Loewenstein and Peter Ubel in 2010:

> *…[behavioral economics] has its limits. As policymakers use it to devise programs, it's becoming clear that behavioral economics is being asked to solve problems it wasn't meant to address. Indeed, it seems in some cases that behavioral economics is being used as a political expedient, allowing policymakers to avoid painful but more effective solutions rooted in traditional economics.*

Behavioral economics should complement, not substitute for, more substantive economic interventions. If traditional economics suggests that we should have a larger price difference between sugar-free and sugared drinks, behavioral economics could suggest whether consumers would respond better to a subsidy on unsweetened drinks or a tax on sugary drinks.

But that's the most it can do.