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NEUROECONOMICS AND DECISION MAKING PROCESS

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Abstract

Neuroeconomics unified the once disparate fields of economics and psychology. The central thesis of the paper is that the development of behavioral economics in important respects parallels the development of cognitive science – Neuroeconomics has inspired more change within economics than within psychology because the most important findings in Neuroeconomics have posed more of a challenge to the standard economic perspective. The single most important source of inspiration for behavioral economists has been behavioral decision research, which can, in turn, be seen as an integration of ideas from cognitive science and economics. Neuroeconomics has primarily challenged the standard economic assumption that decision making is a unitary process – a simple matter of integrated and coherent utility maximization – suggesting instead that it is driven by the interaction between automatic and controlled processes. This paper reviews neuroeconomic research in areas of interest to both economists and psychologists: decision making under risk and uncertainty, intertemporal choice, and social decision making.

Keywords: neuroeconomics, behavioural economics, affect, behavioral welfare economics, decision making, caeteris paribus

JEL Classification: A12, D81

1. Introduction

In the last decades has been made Considerable progress, and increasingly, economists are taking up the challenge of attaching economic theory to psychological foundations. In the 1970s cognitive psychologists began studying judgment and economic decision making. They took maximization of utilities and logical rules of probability judgment as benchmarks and used conformity or deviation from these benchmarks as a way to theorize about cognitive mechanisms (much as optical illusions are used to understand perception). Important psychology of this sort was done Ward Edwards in the 1950s, and later by Amos Tversky, Daniel Kahneman, Baruch Fischhoff, Paul Slovic, and others. As more economists come to accept and incorporate findings from behavioral economics, the approach is likely to become such an integral part of the toolkit of economic analysis that we will no longer speak of a distinct 'behavioral economics.'

In its relatively short lifetime behavioral economists has influenced a wide range of subtopics of economics and allied fields, such as *behavioral law and economics* (Jolls, Sunstein, and Thaler 1998; Sunstein 2000) to *behavioral finance* (Shleifer, 2000; Bică and Constantinescu 2007), *behavioral development economics* (Mullainnathan, and Thaler 2000), *behavioral public finance* (McCaffery, and Slemrod 2006), *behavioral game theory* (Camerer (2003), and *behavioral macroeconomics* (Akerlof 2003). All of these are booming areas of research that not only extend the influence of the ideas coming out of behavioral economics, but also throw back insights and findings that enrich the foundation of the basic science core of the field.

Evaluating economic behavior without taking account of the findings of psychology is like dealing with quantitative relationships without using readily available techniques of mathematics. Nonetheless, since the beginning of the twentieth century, mainstream economics has done just that, limiting itself to the assumption of optimization or to others of an ad hoc basis that have struck individual economists as plausible for the time and circumstances. But investors often continue to hold onto stocks that have declined in value and have poorer prospects than before, compared to others.

In traditional economic thought, the analysis focuses on how to allocate resources efficiently. That is supposed to maximize welfare for consumers (or the potential of that), enabling consumers to do the best that is possible. Behavioral economics indicates that there are serious limits to that theory insofar as it describes how humans actually behave. Behavioral economics focuses more modestly on how to move economic behavior away from manifestly poor choices towards better ones – without venturing whether the result comes particularly close to any standard of optimization, which it contends, often is simply not ascertainable, in any event. It is concerned not only with what takes place when supply and demand are neatly in balance, but when, as is so often the case, market forces are in disequilibrium, as is common aftershocks to the system such as natural catastrophes, outbreaks of war, unanticipated bankruptcies and other market failures often due to a lack of information or to an incorrect perception of it, and, of increasing importance, because of breakthrough technological innovations. Behavioral economics considers whether there are *regularities* in what have been termed *anomalies* – the inconsistencies of what happens in actual life with mainstream economic theory – whether what that theory indicates should happen if we succeed in doing the best possible, fails to occur on a rather predictable basis.

Most behavioral economics has been micro in focus, but some also deals with macroeconomic analysis, most notably with the micro foundations of macro analysis. To the extent that the findings of behavioral economics are incorporated into economic theory, the latter shifts from a purely deductive theory, as has been the case to date, to an increasingly inductive one, relying on empirical findings, much as biology does. The principal standard by which behavioral economics should be judged is whether the more complex approach predicts sufficiently better to justify its additional cost, or, in those cases in which the approach of behavioral economics is less complex, in which the lesser cost is great enough to warrant sacrifice of the benefits forgone by feasible optimization. The findings of behavioral economics appear to offer hope for improving our ability to deal more effectively than heretofore with such complex interdisciplinary matters as health, environmental safety, organizational behavior and national development.

2. Actual directions in behavioral economics

Behavioral economics has seen a remarkable expansion since its emergence as an independent subdicipline, and in light of this fact, it would be impossible to accurately describe current research in but a few paragraphs. Nevertheless, some of the few developments can be tied to the loosening of ties between behavioral economics and behavioral decision research and the importation of insights from other subfields of psychology. In this article we discuss two of them: the emergence of neuroeconomics and the increased interest in the role of affect in economic behavior. The other major new development that we describe in this article is the emergence of behavioral welfare economics, which attempts to draw normative conclusions on the basis of the research. A core question addressed by *Kahneman's Nobel Lecture* (2002), where he distinguishes (see Figure 1) two modes of thinking and deciding: what he calls *intuition* and *reasoning*. Kahneman notes that there is considerable agreement among psychologists on the characteristics that distinguish these two cognitive processes. Following Stanovich and West (2000), he calls them respectively System 1 and System 2.

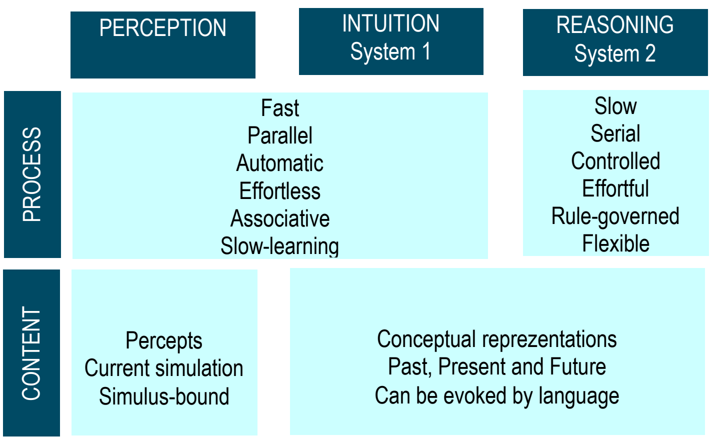

Figure 1. Kahneman's description of cognitive processes

Neuroeconomics involves using the emerging array of tools developed by neuroscientists to study the neural underpinnings of economic behavior. Neuroeconomics, a field initiated by the work of neurologists, explains the basis of at least some of the emotional and presumably all of the visceral factors in economic behavior. Eventually it may help explain all aspects of economic decision making, revealing how we are influenced by bio-regulatory signals to combine cognitive with affective and visceral processes.

Neuroeconomists have already conducted studies in which subjects' brains are scanned while they engage in mainstay behavioral economics tasks, such as the *ultimatum game* (Sanfey *et al.* 2003), *decision making under risk* (Tom *et al.* 2006) and *uncertainty* (Hsu *et al.* 2005) and *intertemporal choice* (McClure *et al.* 2004), as well as more traditional economic behaviors such as *deciding whether to purchase consumer goods*

(Knutson 2007). These studies have generally come to similar conclusions, namely that decision making can be understood, not as a matter of implementing existing preferences, but rather as the resolution of interaction, and often competition, between different specialized neural systems (Sanfey 2006). Neuroeconomics not only encompasses empirical work using neuroscience methods, but also involves importing insights from neuroscience to refine economic models of behavior. Again, perhaps the most important of these insights is that behavior, including economic behavior, results from the interaction of multiple interacting specialized neural systems. Thus, for example, Thaler and Shefrin (1981) proposed a multiple-self model in which a person's behavior is directly controlled by a series of myopic 'doers' who maximize short-run satisfaction, but the behavior of th doers is itself influenced by a farsighted 'planner' who maximizes the discounted sum of the doers' utilities (Fudenberg, and Levine 2004). Bernheim and Rangel (2004) built a dual-process model of addiction which assumes that the brain can operate in one of two modes, a 'cold mode' – the person makes sound, deliberative decisions with a broad, long-term perspective – or a 'hot mode' – the person's decision-making is influenced by emotions and motivational drives. Benhabib and Bisin (2002) assume that a person's behavior can be determined either by 'automatic processes' or by 'controlled processes'. They apply this framework to understanding saving behavior and describe how its predictions differ from those in saving-consumption models with hyperbolic discount.

Although neuroscience methods are ideas have up until now influenced economics in a fairly incremental fashion, it is possible that their influence will ultimately prove to be much more radical (Camerer, Lowenstein, and Prelec 2005). Incremental approaches take as their starting point orthodox decision theory and favour piece-meal, step-wise change (Camerer, and Lowenstein 2003). Many of the most important developments in behavioral economics – like prospect theory – were the results of an incremental approach. By contrast, radical approaches (Shafir, Simonson, and Tversky 1993) try to improve the predictive power and explanatory adequacy of current theory by starting from scratch. Though radical approaches have not yet scored any successes comparable to prospect theory, it is still too early to judge this research program. Neoclassical economics has dominated the economic scene for almost as long as classical economics dominated before it, so the time may be ripe for a new revolution. If so, behavioral economics, and perhaps its neuroeconomic variant, show promise of identifying the direction for such a transformation.

Affect**.** Like cognitive scientist, early behavioral economists tended to emphasize cognitive types of errors, such as judgmental biases, framing effects, hyperbolic time discounting and nonlinear probability weighting, as the main sources of suboptimaly in decision making. A number of new lines of research, however, have begun to draw attention to the important role of affect in judgement and choice (Loewenstein 1996; Loewenstein, and Lerner 2003; Loewenstein *et al.* 2001; Mellers, Schwartz, Ho, and Ritov 1997; Rick, and Loewenstein 2007). The new research is drawing new attention to, and providing new evidence for, the idea that affect can distort decision making – that people can behave self-destructively in the 'heat of the moment'. Indeed, the new research is also pointing to the conclusion that many biases that had earlier been viewed in cognitive terms, such as nonlinear probability weighting (Loewenstein *et al.* 2001; Rottenstreich, and Hsee 2001) or hyperbolic time discounting (Loewenstein 1996; McClure *et al.* 2004) may in fact reflect the influence of affective factors. Parallel developments have been occurring in psychology, with a large amount of work in the field of social psychology focusing on the role of emotion in behaviour (Wilson, Lindsey, and Schooler 2000). And similar developments are accruing in decision research and neuroscience, with the latter showing signs of splitting into two subfields, one focusing on 'cognitive neuroscience' and the other on 'affective neuroscience' (LeDoux 1996).

In an indication that behavioral economics is responsive to new developments in the fields it draws on, in both empirical work and in theory-development, a number of behavioral economists have been incorporating insights from the new research on affect into their work (Rick, and Loewenstein 2007). Whether it is for the purpose of understanding problems of self-control, destructive conflict, market gyrations or gambling behavior, there is a growing recognition among economists that large domains of economic behavior will remain outside of the range of economic models unless economists begin to get a grip on the role of emotions in behavior.

Behavioral welfare economics. Although behavioral economics began as a purely descriptive enterprise, its practitioners have always been interested in how people's decision making can improved (Fischhoff 1988). Thus, it should not be surprising that some behavioral economists have drawn normative conclusions and offered policy prescriptions. Many of the proposed interventions are motivate by the belief that people often fail to act rationally, and are intended to help people make better choices – that is, choices that better serve chooser's interests – than they would in the absence of the interventions. In the last few years, a whole program of what could be called 'light paternalism' has gained prominence. The hope underlying this program is that it may be possible to help people make better choice – choices that better serve to their own interests – without significantly restricting their autonomy or freedom of choice (Camerer *et al.* 2003). Sunstein and Thaler (2003) note that in many situations it is possible to help people make better decisions without restricting their autonomy. They illustrate the point with the hypothetical case of a company cafeteria manager who has the option of placing healthy items before unhealthy items in the food lie or doing the reverse, but does not have the option of doing neither. They argue that in such situations it make perfect sense for managers to adopt that they believe will help employees make better choices – namely placing the healthy food ahead of the unhealthy food. Similarly, Camerer *at al*., argue that it is often possible to craft policies that will benefit people if they do mistakes, but will not hurt people who are fully rational. Although the cognitive revolution, in effect, provided the impetus that sent behavioral economics 'into orbit', the field has maintained its vibrancy by drawing on other sources of inspiration, notably, input from research on neuroscience and affect. It has also increased its broader relevance by pioneering new approaches to public policy, most notably those based on different forms of light paternalism. Finally, in a pattern much like that of rational choice theory, but compressed into a much shorter period, behavioral economics has begun to export its insights to allied fields which have not only increased the range of applications but also thrown insights and research findings back to the core of the field.

3. Neuroeconomics and Decision Making Process

3.1. Homo Neuroeconomicus and decision making process

Neuroeconomics explains decision-making as the product of brain processes involved in the representation, anticipation, valuation and selection of choice opportunities. It breaks down the whole process of decision into mechanistic components: certain brain areas may represent the value of the outcome of an action before decision, other ones may represent the value of the action *per se*, and yet other ones may represent these values at the time of the decision. Although such dispersion of data may appear confusing, economic psychology provides us with a useful framework for understanding the mechanics of rationality at the neural level in a coherent manner. Kahneman and his collaborators suggest that the concept of utility should be divided in subspecies. While *decision* utility is important (the expected gains and losses, or cost and benefits), decision-makers also value *experienced* utility (the hedonic, pleasant or unpleasant affect), *predicted* utility (the anticipation of experienced utility) and *remembered* utility (how experienced utility is remembered after the decision, e.g. as regretting or rejoicing). Neuroeconomics should identify neural structures and processes associated with these variables or, if necessary, suggest another typology.

The main contribution of neuroeconomics to decision theory so far is a new picture of decision-makers as adaptive and affective agents. *Homo Neuroeconomicus* is a fast decider that relies less on logic and more on a complex collection of flexible neural circuits associated with affective responses. Everyday utility maximization is more about feelings and less about the objective outcome of a decision: we use emotions to anticipate emotions in order to control our behavior toward a maximization of positive emotions and a minimization of negative ones. The neuroeconomic picture of individual rationality is thus affective through and through.

It is hard to accept that people make decisions in a laboratory setting similarly to how they would make those same decisions in the real world. Harrison points out that the representation of a task in an artificial lab environment is different from a real one. Yet research shows that the representation of something fake is very real in the mind of an individual.

3.2. Utility computation in decision making

Utility is a key concept in economics. Economists assume that people assign a utility for each option and then make choices by comparing these utilities. However, since these options might involve a wide range of rewarding stimuli, how our brain computes the utility for these diverse stimuli remains unknown. Recent *functional magnetic resonance imaging* (fMRI) studies suggest that different types of rewarding stimuli consistently increase activity in a common set of neural structures, including the *orbitofrontal cortex* (OFC), *amygdale*, and *nucleus accumben* (NAc). Studies have shown that rewards such as money activate the same coterie of neural structure (Elliott, Friston, and Dolan 2000) such as fruit juice and water, appetitive smells, and social rewards such as attractive faces, romantic love, aesthetic paintings, humor, music, cultural objects (sports cars). This pattern of activation, responding to these diverse stimuli, suggests that the brain may process rewards along a single common pathway. This network allows widely different rewards to be directly compared for the purpose of choosing between possible courses of action (Montague and Berns (2002).

One important area where neuroeconomics can contribute is in identifying neural substrates associated with economic concepts and in understanding their psychological functions. Kahneman *et al.* distinguish between 'decision utility,' which refers to the weight of an outcome in a decision, and 'experience utility,' which refers to its hedonic quality (Kahneman, and Tversky 1979). Although decision utility may be derived from predictions of the experience utility of different options, anticipated, experienced, and decision utilities often diverge in dramatic ways.

Neuroeconomic studies also support previously discovered economic rules concerning utility computation. The expected utility theory proposes that the expected utility of a choice is the sum of probability-weighted utilities for each possible outcome (von Neumann, and Morgenstern 1944). Neuroscience methods now offer researchers an opportunity to identify neural substrates that support the computation of these financial parameters and then to predict financial choices from brain activation. More importantly, Knutson *et al.* (2007) provided evidence that specific patterns of brain activation predict purchasing decisions. A core idea of prospect theory is that utility is computed by comparing the absolute value to some reference point (Tversky, and Kahneman 1981). Another important phenomenon concerning utility computation in economic decision is the *time discounting of utility*. Time discounting refers to the fact that people compute the utility at a future point according to a unified discount rate. Economic models assume that people discount future utility by a discount rate (Frederick, Loewenstein, and O'Donoghue 2002). McClure *et al.* (2004) used fMRI to examine the neural correlates of time discounting while subjects made a series of choices between monetary reward options that varied by delay to delivery. This study suggests that the brain houses at least two discounting mechanisms, one of which is sensitive to the value of immediate rewards and another is more sensitive to the value of future rewards.

3.3. The role of emotions in decision making

Emotions influence our decisions. However, since it is not easy to measure emotions quantitatively, traditional economic studies usually ignore such influence and leave emotion outside the scope of decision making research. Behavioral economics begins to pay attention to the role that emotions play in decisions. The regret theory proposes that decision-makers can predict the regret they would experience when they realize that the chosen outcome is disadvantageous compared with alternative outcomes available if they choose alternative choices. The regret theory also states that people would choose options that would minimize future regret. Neuroeconomic studies on regret support these assumptions. Camille *et al.* (2004) tested the prediction that advantageous choice behavior depends on the ability to anticipate and hence minimize regret. Regret is mediated by a cognitive process known as counterfactual thinking. Counterfactually thinking is the mechanism by which we compare 'what is' with 'what might have been'. Ursu *et al.* (2005) showed that counterfactual effects are manifested in the human orbitofrontal cortex during expectation of outcomes. Taken together, these studies suggest that the orbitofrontal cortex has a fundamental role in mediating the experience of regret. They also confirm that the ability to experience and anticipate emotions is crucial to advantageous decision making (Bechara *et al.* 1997). Of course, emotions are not always beneficial to decisions. Extreme emotions can lead to irrational behaviors such as crime of passion. The influence of emotions on decision making can be both positive and negative, depending on the situation in which the decision is made. Shiv *et al.* (2005) found that dysfunction in neural systems subserving emotions lead to more advantageous decisions. Another study also showed that patients with sTable focal lesion in brain regions related to emotion also made more advantageous decisions and ultimately earned more money from their investments than normal participants and control patients (Shiv, Loewenstein, and Bechara 2005). These studies support the hypothesis that emotions play a central role in decision making under risk and demonstrate that the failure to process emotions can lead people to make more advantageous decisions when faced with the types of positive-expected-value gambles that most people routinely shun.

The role of emotions is also highlighted in the framing effect. The framing effect refers to the phenomenon that human choices are remarkably susceptible to the manner in which options are presented (Kahneman, and Tversky 1979; Tversky, and Kahneman 1981). This effect represents a striking violation of standard economic accounts of human rationality, although its psychological and neural mechanisms are not well understood. Martino *et al.* (2006) found that the framing effect was specifically associated with amygdale activity, suggesting a key role for the emotional system in mediating decision biases. Importantly, orbital and medial prefrontal cortex activity predicted a reduced susceptibility to the framing effect, reflecting the role of cognitive control in modulating the framing effect. Kahneman and Frederick (2007) interpreted these results with a dual system framework, in which different frames evoke distinct emotional responses that different individuals can suppress to various degrees. They emphasized that the ability to control emotions is important to make optimal decisions in some circumstances. Lo and Repin (2002) found that less experienced traders showed significant physiological reactions to about half of the market events (e.g. trend reversals). More experienced traders reacted much less to the same events, suggesting that years of experience enabled these traders to react less emotionally to dramatic events and thus to work efficiently. Moral decisions, the evaluation of actions of other people or of our own actions made with respect to social norms and values, are not the main topic in economics. However, moral does play an important role in our daily economic decisions. Psychological research on moral decision making has long been dominated by cognitive models that emphasize the role that reasoning and 'higher cognition' plays in the moral judgment (Kohlberg 1969).

However, neuroscience studies on moral decisions emphasize the role that emotions play in making moral judgment. Greene *et al.* (2001) found that brain areas associated with emotional processing were much more activated in moral-personal condition rather than moral-impersonal and non-moral conditions. These authors argued that moral dilemmas vary systematically in the extent to which they engage emotional processing and that these variations in emotional engagement influence moral judgment. Emotion might lead us to irrational decisions such as not to push a stranger onto the railway tracks to save five others. Further study has shown that brain regions associated with abstract reasoning and cognitive control are recruited to resolve difficult personal moral dilemmas in which utilitarian values require personal moral violations (Greene *et al.*(2004). It has been proposed that the controversy surrounding utilitarian moral philosophy reflects an underlying tension between competing subsystems in the brain: cognition and emotion (Montague, King-Casas, and Cohen 2006).

3.4. Economic decisions in social context

Human always make decisions in social situations. We care about others' decisions and outcomes and learn from others' behaviors. The game theory proposes that people make decisions based on the prediction of others' possible actions and the associated outcomes. Neuroeconomic studies have found evidence to support this view. Recently, a number of studies showed that decisions in social context are closely related to theory of mind, which is the ability to attribute various mental states to self and others in order to explain and predict behavior. Rilling *et al.* (2004) examined whether playing interactive economic games with social partners similarly engaged the putative theory of mind neural network. They observed stronger activations in these regions for human-human interaction than for human-computer interaction. Fukui *et al.* (2006) also found that the counterpart effect (human minus computer) exclusively activated mentalizing related areas (medial frontal area and superior temporal sulcus). Other studies also showed that it is not easy to resist the influence of the other's behavior and the outcome. Asch *et al.* (1951, 1952) showed that people tend to conform to others.

Cooperation behaviors, especially those that happen among strangers are common but still not well-understood by economists. The neuroeconomics studies of cooperation are now helping to shed light on these interesting controversies in behavioral and game theory. Rilling *et al.* (2002) used fMRI to scan women as they played the iterated *Prisoner's Dilemma Game*, a famous game used by economists to model cooperation. Mutual cooperation was found to be associated with consistent activation in brain areas that have been linked with reward processing. Overall, these studies consistently suggest that prosocial behaviors such as cooperation, trust, and donation are rewarding in themselves.

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5. Conclusions

In conclusion, we should stress that behavioral economics is not meant to be a separate approach in the long run. Nevertheless, behavioral economics is more like a school of thought or a style of modelling, which should lose special semantic status when it is widely taught and used. Our hope is that behavioral models will gradually replace simplified models based on stricter rationality, as the behavioral models prove to be tracTable and useful in explaining anomalies and making surprising predictions.

Economics stands only to gain from the tools of neuroeconomics. Of course, similarly to the standard supply and demand model taught in every introductory economics class, the benefits accrue to the average and not to each individual. It is possible that some economic theories will be proven wrong and those who coined them will feel hurt and bruised. On the flip side, there will be many whose theories will be proven to stand taller than ever.

This article reviews three research fields in which the neuroeconomic endeavor can make important contributions to economic theories. Neuroscientific methods offer the promise of identifying neural substrates that support the emotional and high level cognitive process. Thereby neuroeconomics has the advantage of providing direct tests of existing as well as new economic theories. To facilitate the build up of more revealing models of decision making, it should be taken into account the underlying neural mechanisms that drive economic behaviors.

Neuroeconomic studies can deepen our understating of various decision making phenomena and the clinic symptoms such as addictive gambling, compulsive shopping, and so on. It also has great applicable implications in areas such as making more effective advertising, building cooperative relationship in economics trade, and designing more reasonable payment protocol to enhance the work efficacy and happiness of workers. But there are several challenges ahead for neuroeconomic research. First of all, each of cognitive neuroscience methods has it own inherent disadvantages (Shiv, Bechara, and Levin 2005). More importantly, cognitive neuroscience studies usually cannot establish the causal relationship between a pattern of brain activity and a particular psychological function. Cognitive neuroscience methods, such as fMRI, reveal only a correlation between brain activity and a task manipulation or behavioral response. Such correlations should be taken with caution and must not be misunderstood as a proof of causality. Furthermore, high level cognitive processes such as cooperation are challenging to emulate and control in the psychology or neuroscience laboratories. Researchers have to be cautious when they extend conclusions from neuroeconomic studies in the laboratory to the real social life. Nevertheless, it is clear that although neuroeconomics is still far from opening the 'black box' of the brain completely, it offers tremendous potentials to shed new and important insights on the mental and neural processes underlying economic behaviors.

References:

[1] Akerlof, George A. 2003. Behavioral macroeconomics and macroeconomic behaviour. *American Economist*, 47: 25 – 47.

[2] Asch, S.E. 1951. *Effects of group pressure upon the modification and distortion of judgments*, in: Guetzkow H.S., ed. *Group, Leadership and Men Research in Human Relations*. Pittsburgh: Carnegie Press, 177—190;

[3] Asch, S.E. 1952. *Social Psychology*, New York: Prentice-Hall.

[4] Bechara, A. *et al.* 1007. Deciding advantageously before knowing the advantageous strategy. *Science*, 275: 1293—1295.

[5] Benhabib, J., Bisin, A. 2002. *Self-control and consumption-savings decisions: Cognitive perspectives*, Working Paper, New York University.

[6] Bernheim, B.D., Rangel, A. 2004. Addiction and cue-triggered decision processes. *American Economic Review*, 94(5), 1558 – 1590.

[7] Bică, Gheorghe, Constantinescu, Madalina, 2007. Behavioral Finances and Their Influences on Financial Markets. *Arhivele Olteniei*, no. 21: 341 – 348.

[8] Camerer, C., Lowenstein, G. 2003. *Behavioral economics: Past, present, future*, In Colin Camerer, George Loewenstein and Matthew Rabin (eds.) *Advances in Behavioral Economics*, New York and Princeton: Russell Sage Foundation Press and Princeton University Press.

[9] Camerer, C., Lowenstein, G., Prelec, D. 2005. Neuroeconomics: How neuroscience can inform economics. *Journal of Economic Literature*, 43, 9 – 64.

[10] Camerer, Colin F. 2003. *Behavioral game theory: Experiments on strategic interaction*, Princeton; Princeton University Press.

[11] Camille, N. *et al.* 2004. *The involvement of the orbitofrontal cortex in the experienced of regret*, in: *Science*, 304: 1167—1170.

[12] de Martino, B. *et al.* 2006. Frames, biases, and rational decision-making in the human brain. *Science*, 313: 684—687.

[13] Fischhoff, B. 1988. *Judgment and decision making*, in: Robert J, Sternberg, and Edward E. Smith (eds.), *The psychology of human thought*, New York: Cambridge University Press, pp. 153 – 187.

[14] Frederick, S., Loewenstein, G., O'Donoghue, T. 2002. Time discounting and time preference: A critical review. *Journal of Economic Literature*, 40: 351—401.

[15] Fudenberg, D., Levine D.K. 2004. *A dual self model of impulse control*, Working Paper, Harverd University, Department of Economics.

[16] Fukui, H., Murai T., Shinozaki J., *et al.* 2006. The neural basis of social tactics: An fMRI study, *Neuroimage*, 32: 913—920.

[17] Greene, J.D., Nystrom, L.E., Engell, A.D. *et al.* 2004. The neural bases of cognitive conflict and control in moral judgment. *Neuron*, 44: 389—400.

[18] Greene, J.D., Sommerville, R.B., Nystrom, L.E. *et al.* 2001. An fMRI investigation of emotional engagement in moral judgment. *Science*, 293: 2105—2108.

[19] Henrich, J., Boyd, R., Bowles, S. *et al.* 2001. In search of homo economicus: Behavioral experiments in 15 small scale societies. *American Economic Review*, 91(2): 73—78.

[20] Hsu M. *et al.* 2005. Neural systems responding to degrees of uncertainty in human decision making. *Science*, 310(5754): 1680 – 1683.

[21] Jolls, C., Sunstein, C., Thaler R. 1998. A behavioral Approach to law and economics. *Stanford Law Review*, 50(5): 1471 – 1550.

[22] Kahneman, D., Frederick, S. 2007. Frames and brains: Elicitation and control of response tendencies. *Trends in Cognition Science*, 11: 45—46.

[23] Kahneman, D., Tversky, A. 1979. Prospect theory: An analysis of decision under risk. *Econometrica*, 47: 263—291;

[24] Kahneman, D. 2002. *Maps of Bounded Rationality: a perspective on intuitive judgment and choice*, Nobel Prize Lecture, December 8, also in: *The American Economic Review*, (2003), vol. 93, no. 5: 1449 – 1475(27).

[25] Knutson, B. *et al.* 2007. Neural predictions of purchases. *Neuron*, 53(1): 147 – 156.

[26] Kohlberg, L. 1969. *Stage and sequence: The cognitive-developmental approach to socialization*, in: Goslin D.A., ed. *Handbook of Socialization Theory and Research*, Chicago: Rand McNally, 347—480.

[27] LeDoux, J.E. 1996. *The emotional brain: The mysterious underpinnings of emotional life*, New York, NY: Simon and Schuster.

[28] Lo, A.W., Repin, D.V. 2002. The psychophysiology of real-time financial risk processing. *Journal of Cognition Neuroscience*, 14(3): 323—339.

[29] Loewenstein, G. *et al.* 2001. Risk as Feelings. *Psychological Bulletin*, 127(2): 267 – 286.

[30] Loewenstein, G., Lerner, J. 2003. *The role of affect in decision making*, in Richard J. Dawson, Klaus R. Scherer and H. Hill Goldsmith (eds.), *Handbook of affective science*, 691 – 642, Oxford, Oxford University Press.

[30] Loewenstein, G. 1996. Out of control: Visceral influences on behaviour. *Organizational Behavior and Human Decision Process*, 65(3): 272 – 292.

[31] McCaffery, E., Slemrod, J. 2006. *Behavioral public finance: toward a new agenda*, New York, Russell Sage Foundation Press.

[32] McClure, Sam M. *et al.* 2004. Separate neural systems value immediate and delayed monetary rewards. *Science*, 304: 503 – 507.

[33] Mellers, B.A., Schwartz, A., Ho, K., Ritov, I. 1997. Decision affect theory: Emotional reactions to the outcomes of risky options. *Psychological Science*, 8(6), 423 – 429.

[34] Menon, V., Levitin, D.J. 2005. The rewards of music listening: Response and physiological connectivity of the mesolimbic system. *Neuroimage*, 28: 175—184.

[35] Montague, P.R., Berns, G.S. 2002. Neural economics and the biological substrates of valuation. *Neuron*, 36: 265—84.

[36] Montague, P.R., King-Casas, B., Cohen, J.D. 2006. Imaging valuation models in human choice. *Annual Review of Neuroscience*, 29: 417—448.

[37] Mullainnathan, S., Thaler, R. 2000. *Behavioral Economics*, MIT, working papers.

[38] O'Doherty, J.P., Kringelbach, M.L., Rolls, E.T. *et al.* 2001. Abstract reward and punishment representations in the human orbitofrontal cortex. *Natural Neuroscience*, 4: 95—102.

[39] Rick, S., Loewenstein, G. 2007. *The Role of Emotion in Economic Behavior*, in; Lewis, M., Haviland, J.M., and Barrett, L.F., (eds.), *The handbook of emotion*, 3rd edition, New York: Guilford.

[40] Rilling, J.K., Sanfey, A.G., Aronson, J.A. *et al.* 2004. The neural correlates of theory of mind within interpersonal interactions. *Neuroimage*, 22: 1694—1703.

[41] Rilling, J.K., Gutman, D., Zeh, T. *et al.* 2002. A neural basis for social cooperation. *Neuron*, 35(2): 395—405.

[42] Rottenstreich, Y., Hsee, C.K. 2001. Money, kisses, and electric shocks: On the affective psychology of risk. *Psychological Science*, 12(3): 185 – 190.

[43] Sanfey, A.G. *et al.* 2006. Neuroeconomics: Integrating the disparate approaches of neuroscience and economics. *Trends in Cognitive Science*, 10(3): 108 – 116.

[44] Shiv, B., Loewenstein, G., Bechara, A. *et al.* 2005. Investment behavior and the negative side of emotion. *Psychological Sciences*, 16: 435—439.

[45] Shleifer, A. 2000. *Inefficient markets: An Introduction to behavioral finance*, Oxford University Press;

[46] Simonson, I., Tversky, A. 1993. Reason-based choice. *Cognition*, 49: 11 – 36.

[47] Sunstein, C. 2000. *Behavioral law and economics*, Cambridge, UK, Cambridge University Press.

[48] Thaler, R.H., Shefrin, H.M. 1981. An economic theory of self-control. *Journal of Political Economy*, 89(2): 392 – 406.

[49] Thaler, R.H., Sunstein, C.R. 2003. Libertarian paternalism. *American Economic Review*, 93: 175 – 179.

[50] Tom S. *et al.* 2006. *Losses loom larger than gains in the brain: Neural loss aversion predicts behavioral loss aversion*, Working Paper. Uncertainty laboratory research group, University of California, Los Angeles.

[51] Tversky, A., Kahneman, D. 1981. The framing of decisions and the psychology of choice. *Science*, 211: 453—458.

[52] Ursu, S., Carter, C.S. 2005. Outcome representations, counterfactual comparisons and the human orbitofrontal cortex: Implications for neuroimaging studies of decision-making. *Cognition and Brain Resources*, 23: 51—60.

[53] von Neumann, J., Morgenstern, O. 1944. *Theory of Games and Economic Behavior*, Princeton: Princeton University Press.

[54] Wilson, T.D., Lindsey, S., and Schooler, T.Y. 2000. A model of dual attitudes. *Psychological Review*, 107: 101 – 126.

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