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# Implications of Neuroscience Developments in Understanding Human Behavior for Teaching Agricultural Economics/Agribusiness

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# Implications of Neuroscience Developments in Understanding Human Behavior for Teaching Agricultural Economics/Agribusiness

# Introduction

Economists assume decision makers are rational and self-interested, and build models based on these assumptions. Results from these models are intended to provide insights into both consumer and producer behavior. In addition to their research, economists also generally teach as though students are consistently rational, logical, and analytical decision makers. However, decades of psychological research demonstrates that people frequently make decisions based on emotional reactions, interpersonal pressures, and cultural standards. Studies show that humans then apply ad hoc logic and analytical reasoning in an attempt to explain the decisions we have already made. Teaching agricultural economics at the undergraduate level is a challenging task. Some student difficulties in learning economics must certainly come from the fact that human beings are not always the rational, logical, analytical, self-interested beings that economists assume. Further, students may not recognize themselves when economists describe rational and self-interested behavior underlying our models.

Bridging the gap between economics and psychology, neuroeconomics may provide economics instructors with understanding and models of decision-making that aid in teaching economics. This growing field applies concepts and theories from psychology and experimental methods from neuroscience to better understand actual human economic behavior. Neuroeconomics, also referred to as "decision neuroscience" makes a crucial distinction between automatic ("hot") and controlled ("cold") decisionmaking processes. Automatic processes are quick, efficient, reactive, and can often be carried out in parallel. In addition, automatic processes frequently originate from emotions and are often based on instant reactions to stimuli. In direct contrast, controlled processes are deliberate, sequential, voluntary, and analytical. Economists base their theoretical models of human decision-making on controlled processes. Controlled processes represent the "rational" side of human decision-making. Economists assume that everyone uses controlled, rational modes of thinking during every decision-making process. Neuroscience research supports the distinction between automatic and controlled processing. In fact, research shows that automatic decisions occur in the emotional centers of the brain (limbic and paralimbic system) while controlled processes occur in the planning and organization centers of the brain (orbitofrontal cortex, anterior and dorsolateral regions of the prefrontal cortex).

Reconceptualizing human decision-making as a result of both automatic and controlled processing has many implications for agricultural economics and agribusiness teaching programs. If we teach students to recognize these different decision making processes, they can understand how they make their own decisions. In turn, this will help them to better learn economics, understanding that economic models are based on "rational," controlled processes of decision-making. It may also help them learn to be more effective decision makers, emphasizing the logical, analytical, planning functions that are so valuable to economic success, and recognizing the strengths and weaknesses of both processes used in decision making.

In this paper, we will first discuss the relationship between economics and applied economics, and how merging disciplines can cause challenges to the field of economics. We will then present the general principles of the dual-process theory of decision-making using recent neuroscience research to support it. We will then apply some of the principles of dual-process theory of decision-making to specific economic topic areas. We conclude with results of a survey conducted in a Risk Management course and include future directions for applying neuroeconomics to traditional agricultural economics teaching.

#### Economics, applied economics, and challenges to the profession

Traditionally, economists resist the recognition that individuals might be irrational or biased when making decisions. According to McFadden (1999), the rational consumer model is so deeply entwined in economic analysis that it is difficult for many economists to imagine that failures of rationality could infect major economic decisions or survive market forces. However, McFadden proceeds to say that there is accumulating behavioral evidence against the rational model. McFadden calls a consumer "Chicago man" if s/he conforms to the standard economic model of perception, preference, and process rationality. He makes four observations about the Chicago man model: it is convenient, successful, unnecessarily strong, and it is false. The Chicago man model is false because there is overwhelming behavioral evidence against literal interpretations of Chicago man as a universal model of choice behavior. McFadden goes on to list twentyfive major cognitive anomalies. In summarizing the evidence, he concludes that perception rationality fails, and process rationality fails, but he maintains some hope that preference rationality may hold given that evidence against it is primarily circumstantial. He states that confronted with the accumulated experimental evidence, economists must recognize that the Chicago-man model does not apply universally, or even regularly to choices made in non-market contexts.

The idea that Chicago-man type behavior cannot be assumed presents problems for the economics profession in general. McFadden suggests that economists should evolve Chicago man, correcting the most glaring deficiencies as a behavioral model and modifying economic analysis so that it applies to more realistic human behavior. This is a difficult task since one of the benefits of the rationality assumptions is the relative simplicity of the analysis that follows.

Mittelhammer (2009) concurs with McFadden and states that there appears to be a steadily increasing call for both relevance and accountability in the work of economists. This spills over to agricultural economists who frequently view themselves as applied economists (even though Mittelhammer goes on to point out that there does not appear to be a universally accepted definition or even concept associated with the term, "applied economics"). Mittelhammer believes there has been an evolution in the profession that has arguably led to a narrowing in the scope of professionally acceptable frameworks for conducting applied economics analyses. He argues that this narrowing may be impeding rather than fostering advances in the field. The pendulum, it seems, may have swung far enough that a correction in the view of what constitutes acceptable applied economics may be beneficial, overdue, and perhaps even already underway. Further, the more varied and comprehensive the collection of approaches used to analyze the complex economic issues existent in the real world, the better. This complexity of ideas leaves the door open to recognition of new decision making paradigms that more accurately reflect how decision makers operate.

Undergraduate teachers do not face problems nearly as substantial as those that researchers face in introducing these new models of decision making. Students can

benefit greatly from lively, valuable discussions of how people really make decisions, and comparisons with the theoretical "Chicago man" decision-making model. McFadden (1999) believes that the discipline of economics needs to catch up to the field of marketing to understand the extent to which the mix and presentation of products reflects anomalies in consumer behavior. In a presentation entitled "Behavioral Economics into the Classroom" (2006), Alan B. Krueger, Ph.D. concluded that there are many reasons that we should bring behavioral economics into the classroom, including the following:

- It trains students to avoid making serious mistakes down the road
- It clarifies what is rational and irrational decision-making
- It leads to a better understanding of opportunity costs, time discounting, and other important economic concepts.
- It provides a leg up in the business world
- It provides a richer, more realistic understanding of decision-making in practice.
- It can lead to better policies
- It is easy to explain and demonstrate in class.

Students who are aware of their own departures from rationality will be able to prevent others from taking advantage of these tendencies. That is, they can improve their decision making by improving their self-awareness.

Ariely (2009) believes that recognizing where humans depart from the ideal rational being is an important part of the quest to truly understand ourselves, and one that promises many practical benefits. Understanding irrationality is important for our everyday decisions, and for understanding how we design our environment and the choices it presents to us. He believes that we are not only irrational, but *predictably* irrational—that our irrationality happens the same way, again and again. If this is the case, and experiments demonstrate this, then wouldn't it make sense to teach students about some of these irrational tendencies? Wouldn't students benefit from better understanding both their rational *and* irrational tendencies? The beauty of this approach is that it allows for changes in decision making. If we as economists just assume irrationality away, little room exists to recognize and improve upon how we decide. However, recognizing our irrational biases can lead to more effective decision-making that benefits both the individual and the greater economy.

#### Dual process models of decision making

As mentioned earlier, traditional economic theory ignores psychological theories of emotions, interpersonal influences, and cultural norms. About thirty years ago, Thaler and Shefrin (1981) modeled the individual as an organization. They believed that at any point in time, each individual is both a farsighted planner and a myopic doer. More recently, experts have expanded on this notion and have proposed a dual process framework of decision making. Fudenburg and Levine (2006) offer a simple "duel-self" model that provides a unified explanation for several empirical difficulties in explaining behavior. They assert that many types of decision problems should be viewed as a game between a sequence of short-run "impulsive selves" and a long-run "patient self." Ashraf and colleagues (2006) report that Adam Smith argued that behavior was determined by the struggle between what Smith termed the "passions" and the "impartial spectator". They say that Smith viewed behavior as under the direct control of the passions, but believed that people could override passion-driven behavior by viewing their own behavior from the perspective of an outsider—the impartial spectator. Loewenstein (2000) expands on this notion, asserting that a wide range of emotions, drive states, and feeling states grab people's attention and impact their behavior. He argues that people are powerfully influenced by their emotional states, and he discusses how to model individuals when they are in a hot state or in a cold state. Loewenstein and colleagues (2003) have also used state-dependent utility to model decision making—that is, the mental state of the individual influences the utility received from consumption. They work to explain projection bias in particular—a situation whereby people exaggerate the degree that their future tastes will resemble their current tastes. They review a variety of domains supporting the existence of poor decision making due to projection bias. Shiv and Fedorikhin (1999) examine how consumer decision making is influenced by automatic processes and more controlled processes. They believe that when our rational, analytical cognitive processes are available, they have an dominating impact on and influence over our behaviors. In contrast, when our analytical processes are in use or overloaded, our emotions have greater impact on our decisions. Benhabib and Bisin (2004) developed a model of consumption where individuals have the ability to invoke either automatic processes or alternative control processes. According to them, automatic processes are susceptible to temptation and control processes are immune to such temptations.

Neuroscience research supports the distinction between automatic and controlled processing (Camerer, 2008; Sanfey, 2007). Early research resulted from disease models of individuals with neurological damage. These individuals showed predictable changes in decision-making. Bechara (2004) discusses several studies of decision-making in neurological patients who can no longer process emotional information normally. Damage to the ventromedial prefrontal cortex renders patients unable to make advantageous, rational decisions. These individuals have no regard for consequences and instead make judgments at a "gut" or emotional level.

Research has also gone beyond disease-models, and has examined "normal" decision-making as well. Results from decision-making studies in primates demonstrate that the economic value of items is represented in the orbitofrontal cortex (Padoa-Schioppa & Assad, 2006; Padoa-Schioppa, 2009). Functional neuroimaging in humans has provided another way to examine the neural basis of decision making in real time. Functional magnetic resonance imaging (fMRI) provides a safe, noninvasive method to study normal human decision-making. A recent study examined the relationship between self-control and decisions (Hare et al., 2009). Results showed that goal-directed decision-making produced increased neural activity in the ventromedial prefrontal cortex (the same brain area identified in the aforementioned neurological patients). Exercising self-control required inhibition of this goal-directed activity by increasing activation in the dorsolateral prefrontal cortex. Researchers interested in the influence of uncertainty on decision-making demonstrated that risk and ambiguity are represented in two separate regions of the brain (Hsu et al., 2005).

Cognitive neuroscientists have also examined brain regions involved when people must decide between immediate or delayed rewards. These delayed discounting, or intertemporal choice, paradigms are directly relevant to economic behavior and decision-making. McClure and colleagues (2004) proposed a model, the  $\beta$ - $\delta$  model, that

emphasizes the limbic system's (emotional center) role in immediate rewards while the prefrontal cortex (planning, organization) is involved in choosing larger, delayed rewards. Adolescents are notorious for making impulsive, irrational decisions. Neuroscience research again supports this notion as the reward centers of the teenage brain (emotional decisions) are particularly sensitive and the cognitive control regions (rational decisions) are underdeveloped (Leijenhorst et al., 2010). One recent study aimed to alter decision-making in adults so that the participants would more greatly value larger delayed rewards (Peters & Buchel, 2010). Researchers were successful in helping participants make more controlled, rational decisions.

Mukherjee (2010) unites neuroscience findings, psychological paradigms, and economic theory into a dual model for decision making that utilizes both automatic and controlled processes. He indicates that existing models in economics use only a single system, although he notes that economics is being increasingly influenced by a multiple systems approach to decision making. Mukherjee proposes that we generate values through the use of two psychological processes: valuation by calculation and valuation by feeling. He develops a parameter that represents the relative extent of emotional involvement. This provides insight into different decision making processes for oneself than for an organization. He feels that his model can be applied to a wide variety of empirical phenomena and can account for many anomalies in present representations of decision making processes.

Russell James, Ph.D., (Department of Housing and Consumer Economics, University of Georgia) has developed a set of PowerPoint slides that present the duel process model of decision making. They also discuss a large number of irrational tendencies and biases that humans have demonstrated. He has made these slides available for downloading through slide share. The slides are nicely illustrated, invite student interaction, and do an excellent job of keeping students' attention.

#### Areas of Application in Agribusiness and Agricultural Economics

Agricultural economics and agribusiness may greatly benefit from having a framework for decision making that includes both controlled and automatic processes. Agricultural economics and agribusiness programs should integrate the latest neuroeconomics research for effective, meaningful teaching. It is important that we provide students with a conceptual framework they can use to accurately comprehend human decision-making, consumer, and producer behavior. Conceptualizing decision-making as a dual-process theory will also help students understand their own behavior. Hopefully, this will help students better know themselves and the frameworks that we teach—realizing that economic theory relies on assumptions that often do not fit actual human behavior. Several examples of courses where this background might be helpful will now be discussed.

#### Microeconomics

Discussions related to decision making models could be extremely beneficial in any microeconomics courses including principles of microeconomics or intermediate microeconomics. Students often have difficulty grasping the rational assumptions and their implications for behavior. Arguments for or against allowing markets to function may also be influenced by this new framework. If consumers make emotional and irrational decisions in their purchases (which they often do), how well can consumers truly run a market economy? Helping students be better consumers may be very important for a well functioning market. Students who understand hot and cold decision making processes may avoid making poor decisions that are detrimental to both themselves and the market.

Ariely (2006) states that we do not have an internal value meter that tells us how much things are worth. Rather, we focus on the relative advantage of one thing over another, and estimate value accordingly. Consequently, we often fail to think broadly about options. The result is that even the simple concept of "opportunity cost" is not easy for students to comprehend. As rational economists, we assume that students can easily understand the concept of opportunity cost. However, when people naturally think in terms of the relative advantage of one option over another, they may fail to see numerous radically different comparisons that hold substantial promise. In fact, teaching the concept of "opportunity cost" should be accompanied by the explanation that we need to consider wide ranging options when thinking about foregone opportunities, not just the very similar items that are comparable to what is chosen.

# Finance

Another area where a better understanding of human decision making processes might be particularly valuable is finance. Understanding finance principles requires use of rational, analytical thought processes. Applying these principles in decision making also requires the use of rational, controlled processes. If an individual uses automatic processes (emotions) for decision making in finance, this often leads to financial mistakes. Providing a framework for discussing financial decision making that includes both automatic and controlled processes may be extremely valuable for interpreting financial advice. In fact, personal finance advice often offers second best strategies simply because the recommenders of the strategy know that decision makers are not disciplined enough to use controlled processes. For example, the use of a credit card may be discouraged for people who make impulsive, unrestrained purchases. However, if one is disciplined and makes rational decisions, use of a credit card can be very efficient and even beneficial due to rebates based on purchase volume.

Understanding the concept of the time value of money and how it is calculated centers on the use of controlled processes. Automatic processes are heavily oriented to the present, and result in extremely high discount rates between now and the near future, and smaller discount rates between the near future and more distant future (hyperbolic discounting). People who use automatic decision-making processes would be likely to spend more money and save less than people who use controlled decision-making processes. There are many additional examples of strategies that are second best (yet better than no strategy) if one is using automatic rather than controlled processes for decision making.

#### **Risk Management**

Finally, having a framework for decision making that includes both controlled and automatic processes may be extremely valuable when applied to risk management. Risk management courses typically include analytical decision making techniques that use controlled processes. However, analytical techniques often depend on uncertain outcomes and estimation of probabilities. Numerous examples of consistently irrational and erratic tendencies in risk management decision making have been documented in behavioral economics and psychology. Understanding these tendencies and biases are crucial to making better decisions. Automatic, emotional decisions can potentially have large negative consequences in a number of situations related to risk management. When attempting to assess risk preferences, both psychological tests that determine risk tolerance and lottery-type questions that elicit certainty equivalents measure controlled decision making processes. Neither type of test recognizes or assesses the emotions that influence markets at different times. In addition, emotional decisions based on automatic processes are responsible for much behavior in markets. For example, buying stock after stocks have risen substantially is an emotional response to missing out on the gains, and selling stocks near the low stems from the emotional response of fear and panic. Emotions themselves can drive a feedback loop that makes values rise too high or fall too low. Loewenstein and colleagues (2001) have proposed a "risk-as-feelings" hypothesis that highlights the role of emotions experienced at the moment of decision making. They report that much research shows that emotional reactions to risky situations often diverge from controlled assessments of those risks. Further, when such divergence occurs, the emotional reactions often drive behavior. Finally, we should

recognize that many decisions will be made using automatic processes because individuals do not have the data necessary to use the analytical techniques we often teach. Thus students should be alerted to common decision-making biases associated with the automatic processes. The next section will go into more detail about the specific applications of dual-process theory of decision making to risk management.

#### A sample of irrational decision making and biases relevant to economics

There are many patterns of irrational decision-making and decision-making biases that have been identified. Below are some of the most common and most relevant to economics.

# Hyperbolic discounting

Sopher and Sheth (2005) report that the logical inconsistencies associated with non-constant discounting and the tendency of some people to discount in a non-constant manner have been documented in many experimental studies. These studies report that later consequences seem to be discounted at a lower rate than early consequences. This is the delayed discounting paradigm commonly used in behavioral neuroeconomics. They report that a hyperbolic discount function is an alternative to constant discounting that has been proposed to accommodate the types of violations of constant discounting commonly observed in experimental studies. In their study, their results show that the absolute magnitude of the evidence supporting the hyperbolic discounting hypothesis is rather small. They suggest trying to come up with a plausible statistical account of the observed behavior rather than to enshrine what may be, after all, just a collection of biases in human behavior.

The important point is that non-constant discounting has been well-documented in many experimental and neuroimaging studies. Students need to understand the consequences of the mismatch between the constant discounting methods and real-life variable discounting rates which likely better reflects their own preferences. Preliminary neuroimaging results suggest that these hyperbolic discounting curves could be altered (Peters & Buchel, 2010). One study summoned personally-relevant future episodic information (e.g. a family member's birthday, a planned vacation) for the participants to consider. This self-reflection strategy enabled participants to make more rational, controlled decisions about immediate versus delayed reinforcement. Helping students better understand discounting may ensure that they are less vulnerable to immediate gratification, in turn allowing them the opportunity to make more rational decisions saving for the future.

#### **Diversification Bias**

Kogler and Kuhberger (2007) describe diversification bias as the tendency to choose differently in identical choice situations. They use the dual process model and argue that the diversification bias is a consequence of the automatic system which fails to be corrected by the controlled system. This bias leads people to keep options open and select different strategies even when confronted with the same situation. This bias can have serious negative consequences when applied to marketing and other economic situations. One example of keeping options open is the tendency to delay marketingalways allowing one to keep the option of selling open. The result is waiting far too long thus accumulating storage costs and the opportunity costs and missing high prices that were good marketing opportunities.

#### Anchoring

Ariely, Lowenstein, and Prelec (2006) challenge the assumption that people know their tastes. They review research showing that valuation of ordinary products can be manipulated by non-normative cues (anchors). This makes the process of decisionmaking subject to anchors that can be easily manipulated by marketing strategies. Understanding this possibility, and attempting to control the anchors we use in evaluating decisions could potentially help make decision-making more effective.

### Paradox of Choice

Economists believe that the more choices people have, the better. They trust that because the choice set is expanded the selection from a rational standpoint cannot be made worse. Recent empirical studies, however, have provided clear evidence to the contrary. Iyengar and Lepper (2000) conducted three experiments that showed participants actually reported greater subsequent satisfaction with their selections when options were limited. The notion that people actually have too many choices has been termed, "the tyranny of freedom" (Schwartz 2000). This phenomena directly shows that people do not make rational decisions, and can be used to begin the discussion of how irrational individuals often are.

# Loss aversion and the endowment effect

Loss aversion and the endowment effect were studied by Kahneman, Knetsch and Thaler (1990). They found that randomly assigned owners of a mug required significantly more money to part with their possession (around \$7) than randomly assigned buyers were willing to pay to acquire it (around \$3). This can be attributed to loss aversion: owners' loss of the mug loomed larger than the buyers' gain of the mug. This effect causes a divergence between willingness to buy and willingness to sell. Sometimes this is called "the endowment effect."

# Status Quo Bias

The Status Quo Bias can be described as a tendency to make decisions by accepting the default option instead of comparing the marginal benefit to the marginal cost. Decision-makers have an overwhelming tendency to adopt defaults, to stick with the status quo even when the decision is important and the stakes are large and when the decision-maker is told that the default is suboptimal. Madrian and Shea (2001) found examples of this bias in participation in 401(k) plans, savings programs, and asset allocation. This illustrates the idea that people often stick to the automatic process and do not let the controlled process help them make better decisions. Better recognition of this tendency might help people overcome it, resulting in improved decision making.

# **Survey Results**

A questionnaire was developed specifically for the purpose of assessing student response to the dual-process theory of decision-making and the many relevant applications of the dual-process model of decision-making. The questionnaire is included in the Appendix. Students were introduced to the dual-process theory in an upper level undergraduate course titled Risk Management in the Agricultural Economics Department at Kansas State University. Based on survey results, none of the 24 students who filled out the survey had previous exposure to this material, or the illustrations of irrational decision making and biases that often exist for decision-makers.

Students were asked four questions regarding the benefit of understanding dual process to decision making for learning economics and in understanding their own decision making. The students were asked if having the dual-process framework is useful now for learning "rational decision making processes". On a scale of 1 (no, not at all) to 3 (somewhat) to 5 (yes, definitely), the average response was 3.96. One student noted on his first exam that he had spent \$37,000 in tuition for classes teaching that we are all rational. In this course, he finds out that we aren't rational! The second question asked if understanding the dual-self framework earlier in college would have made it easier to learn the economic thought process. Their response was 3.38 on the same scale. Another question asked if they thought other economics students would benefit from learning the dual-self framework early in their program, and the response was higher than the first two questions at 4.17. Finally, we asked if thinking about decision-making as a dual-self process aids in better understanding their *own* decision making process, and the average

response was 4.46, the highest ranking of all the questions. The above quantitative responses converged with the instructor's qualitative impressions of the students' response to the course. The instructor felt that the student response to this material was overwhelmingly positive. Students recognize, particularly in a risk management course, that rational processes are difficult to utilize due to the lack of numbers to use rationally.

The survey also asked students if learning about the dual self process would make them think more carefully about how they will make decisions in the future. The response was 4.21 on a scale of 1 (no, not at all) to 5 (yes, definitely) indicating that they believe this material will help them think more carefully about decision making in the future. The survey also asked if they would like to change the way they make decisions, (that is be more rational, or me more emotional). Their response was a 3.08 on a scale of 1 (no, not at all) to 5 (yes, definitely).

Included in the questionnaire were questions asking students to evaluate their own current decision-making on a scale of 1 (rational/controlled) to 5 (emotional/automatic) in 11 of areas of their lives. The average rankings are shown in Table 1.

It is interesting to note that their rankings were lowest (meaning that they were the most rational/controlled) when making decisions about credit cards and loans/debt, and they were the most emotional/automatic when making decisions about hobbies/leisure time and health/diet/exercise. Given the obesity epidemic in the country, it may be valuable for all students to recognize decision making processes in order to make better health choices related to food consumption and exercise.

# Table 1. Current Decision-making

Domain	Mean score
School/Career	2.04
Health/Diet/Exercise	3.13
Personal spending	2.46
Saving/Investing	2.33
Loans/Debt	1.79
Credit cards	1.71
Romantic relationships	2.78
Friendships	2.71
Alcohol/Tobacco Use	2.67
Hobbies/Leisure time	3.46
Religion/Spirituality	2.46

Finally, they were asked how they would like to change their decision making process on a scale of 1 (be more rational/controlled) to 3 (stay the same) to 5 (be more emotional/automatic). The responses are given in Table 2. The lowest numbers representing the strongest desire to be more rational/controlled were the categories of health/diet/exercise and personal spending. It is also interesting to note that all the rankings were less than three, indicating that on average, students desire to be more rational/controlled in every single domain.

# Table 2. Desire to Change Decision-making

Domain	Mean score
School/Career	2.13
Health/Diet/Exercise	1.77
Personal spending	1.91
Saving/Investing	2.04
Loans/Debt	2.26
Credit cards	2.30
Romantic relationships	2.64
Friendships	2.87
Alcohol/Tobacco Use	2.48
Hobbies/Leisure time	2.74
Religion/Spirituality	2.45

Several students included qualitative comments as well, which we felt were worth including:

"I believe knowing about the dual-self framework makes you stop and think before making decisions. It forces you to decide which dual-self, either the elephant (automatic system) or rider (controlled system), should be involved in making the decision."

"This class has showed a different side of learning and decision making that most will not tell you. I have found it interesting and helpful."

"I think that this class is greatly beneficial to the way a person should look at decisions when using the dual-self framework for behavior."

# Summary

Economics characterizes humans as perfectly rational cognitive machines, operating in a logical, predictable fashion. We know that humans are not always rational, however. Using the strengths of different disciplines, we can begin to better understand human decisions and behavior. Psychology's strengths lie in theories and empirical behavioral tasks. Neuroscience uses very precise methodology to gain a better understanding of the neural, biological, and physiological basis of behavior. Economics uses mathematically-sound formal modeling. Merging these three disciplines, the field of neuroeconomics, will help provide a more comprehensive understanding of human decision-making. This paper has provided an overview of an emerging dual-process model of human decision-making. We discussed a number of examples from behavioral economics that illustrate the fact that people often make irrational decisions and have biased tendencies in decision-making.

Recognition of the two types of decision-making: controlled/rational and automatic/emotional may explain why it is so difficult for students to relate to rational economic decision making. It also helps explain why instructors become so frustrated in teaching basic economics concepts. From our Risk Management survey results, it was clear that students felt that learning the dual-process model of decision-making was both enjoyable and helpful. Teachers crave successful students and it seems that using the dual-process theory of decision making can be invaluable in student comprehension and satisfaction. Recognition of the different decision making processes should result in more effective teaching and should benefit students as they strive to learn both basic and applied economic principles.

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# Decisions, Decisions

1. Did this class provid	le your first e	kposure to th	ne dual-self f	ramework	of decision-	making?
	Yes		No			
2. If not, when/where	did you first	earn about t	he dual-self	framework	of decision	-making?
When			(e	x. High scho	ool, college)	)
Where			(e	x. a class, le	eisure readi	ng, a friend)
If another clas	s, which one?					
3. Is having a dual-self generally taught in ecc	f framework u pnomics?	iseful now fo	r learning "r	ational dec	ision makin	g processes"
No, not at all		Some	ewhat		Yes, defir	nitely
1	2		3	4	5	
4. Would understandir "the economic though	ng the dual-se t process" wh	If frameworl ich is empha	< earlier in co isized throuยู	ollege have ghout the e	made it eas conomics p	sier to learn rogram?
No, not at all		Some	ewhat		Yes, defir	nitely
1	2		3	4	5	
5. Do you think that o framework of decision	ther economi -making early	cs students v in their pro	vould benefi gram of stud	it from lear y?	ning about t	the dual-self
No, not at all		Some	ewhat		Yes, defi	nitely
1	2		3	4	5	
6. Does thinking about decision-making as a dual-self process aid you in better understanding your own decision making process?						
No, not at all		Some	ewhat		Yes, defi	nitely
1	2		3	4	5	
7. How you do view your own current decision-making in regards to the following areas: Rational/Controlled Emotional/Automatic						
	1	2	3		4	5
School/Career	1	2	3		4	5
Health/Diet/Exercise	1	2	3		4	5
Personal spending	1	2	3		4	5
Saving/Investing	1	2	3		4	5
Loans/Debt	1	2	3		4	5
Credit cards	1	2	3		4	5

Romantic Relationship	s 1	2	3	4	5
Friendships	1	2	3	4	5
Alcohol & Tobacco use	1	2	3	4	5
Hobbies/Leisure time	1	2	3	4	5
Religion/Spirituality	1	2	3	4	5

8. After learning about theories of how people make decisions, do you think that you will think more carefully about how you make decisions in the future?

No, not at all		Somewhat		Yes, definitely	
1	2	3	4	5	

9. Would you like to change the way you make decisions? (ex. Be more rational? or Be more emotional?)

No, not at all		Somewhat	Yes, definitely	
1	2	3	4	5

10. In the following areas, how would you like to change your decision-making process?

Be more Rational/Contr	rolled	Stay the same		More Emotion/automatic	
	1	2	3	4	5
School/Career	1	2	3	4	5
Health/Diet/Exercise	1	2	3	4	5
Personal spending	1	2	3	4	5
Saving/Investing	1	2	3	4	5
Loans/Debt	1	2	3	4	5
Credit cards	1	2	3	4	5
<b>Romantic Relationships</b>	1	2	3	4	5
Friendships	1	2	3	4	5
Alcohol & Tobacco use	1	2	3	4	5
Hobbies/Leisure time	1	2	3	4	5
Religion/Spirituality	1	2	3	4	5

11. Other comments: