"Risk/Reward" Decision Making Activity

Document Overview

"Risk/Reward" Decision Making Game Instructions
- First variation
- Second variation

Assessment Questions
Follow-up Readings and Questions

Minnesota State Science Standards:

9.1.1.1.2 Understand that scientists conduct investigations for a variety of reasons, including: to discover new aspects of the natural world, to explain observed phenomena, to test the conclusions of prior investigations, or to test the predictions of current theories.
9.1.1.1.7 Explain how scientific and technological innovations ─as well as new evidence─ can challenge portions of, or entire accepted theories and models including, but not limited to: cell theory, atomic theory, theory of evolution, plate tectonic theory, germ theory of disease, and the big bang theory.
9.1.1.2.1 Formulate a testable hypothesis, design and conduct an experiment to test the hypothesis, analyze data, consider alternative explanations and draw conclusions supported by evidence from the investigation.

Objective:

- Students will actively participate in an activity to demonstrate human decision making processes demonstrating risk and rewards choices.
- Students will determine what type of risk taker behavior they possess.
- Students will discuss the advantages and disadvantages of each type of thinking process.

Type of Activity: Lab/Whole Class Activity/Game

Duration: 50 – 55 minutes

Connection to Nobel speakers:

Paul W. Glimcher, Ph.D. Professor of Neural Science, Economics, and Psychology, Center for Neural Science, and Director, Center for Neuroeconomics, New York University.

Teacher Tips:

This activity is a chance for students to model risk/reward type decision making processes. The trick for the teacher is to find a valuable commodity that the students are willing to "gamble" with. That being said, several options exist for the students to hoard such as candy, hall passes, lunch privileges, extra credit points, daily grade points or even money. We believe the "commodity" should be able to be held in the students hand, something tangible so the students can be tied to it kinesthetically.

The game will have two variations: the first, should naturally lead students to choose safe, conservative choices and the second should allow kids to naturally choose a riskier set of decisions.

Additionally, this activity will include two biographies to introduce the students to Paul Glimcher, guest speaker at the 2011 Nobel Conference and Laurie Santos, Yale psychological researcher whose research with capuchin monkeys mimic human decision making processes that this activity replicates.

Lastly, it is suggested to then show the TED Talk video of Santos explaining her research and findings *after* the students have done the Risk/Reward Decision Making game. The video should stimulate discussion from the students in regards to the similarities of their decision making observations as compared to those of their "distantly related evolutionary cousins".

Concepts:

- Neuroeconomics
- Reward Pathways
- Decision Making
- Loss Aversion

Materials:

- A quantity of some valued "commodity" that the students will decide on gambling to keep or lose. This material can have a wide range of possibilities as described above in the *Teacher Tip* section of the lab.
- Coins for flipping with heads or tails options. Dice (optional)
- TED.com video: Laurie Santos: A monkey economy as irrational as ours, July 2010 *http://www.ted.com/talks/laurie_santos.html*

Description of Activity:

This activity will have students gambling to make decisions about a commodity to be valued for points, food, etc. The game will have two scenarios; one in which the commodity is gained and the other where a given quantity of commodity will be lost. In theory, the students should observe that their decision making processes will change with each scenario where in the end, a riskier set of decisions should be observed in one of the scenarios.

"Risk/Reward" Decision Making Game:

In the first variation, the students will be "gaining" their commodity from essentially a zero starting point. After a teacher determined set of time, the students will then take that accrued amount of commodity and use it as their start point in the second variation of the game.

First Variation: "Gained Value"

1. Explain to the students that they will be engaged in a game in which they will attempt to gain as much of their "commodity" (coins, candy, daily points, etc.) as possible. Everyone will be starting with the same amount of that "commodity" and it is in their best interest to gain as much as possible to be used as a start point for the second variation of the game.

2. Distribute to all students the same amount of the commodity. Make this amount enough to get them started, yet not enough for a kid to not want to play the game. It should be approximately 25 to 30% of the total maximum amount possible.

3. Have each student visit the teacher a total of three times to play a game of chance that has these options:
    - Choose to flip the coin with positive or negative consequences **or**
    - Choose not to participate in the game of chance and receive a set amount of the commodity. This set amount of the commodity should be a bit conservative yet a safe and rewarding gain for those who choose not to gamble. We believe it should essentially be half of what a student would gain if they won on the gamble.
    - Here are the options:
        - Gamble:
            Heads will get you the same amount of what you have in your cache, thus doubling your total amount in the coffers.
            Tails will get you nothing for your coffers
        - Not Gamble:
            Receive a guaranteed payoff of half of your coffers
4. Have them play this game for a total of three times.

5. Have the students win as much of the commodity as possible to then be used in the second variation of the game. (Another option can exist where you stop the game at this point, count your students winnings and begin the second variation with everyone beginning with the same amount of the commodity.)

Second Variation: "Loss Aversion"

1. This is the variation that the students will play to gather points for the lesson. This variation is essentially the opposite of the first variation. Instead of gaining as much of the "commodity" as possible, every student will attempt to save as much of the "commodity" as possible at the end of this variation. The start point for this "loss aversion" could be the individual gain of each student from the first variation. (Again, should the teacher decide, you could instead have the students begin this variation with the same amount of the commodity. The following instruction in step #2 will do just that)

2. Distribute to all students the same amount of the commodity. Make this amount enough to get them started, yet not enough for a kid to not want to play the game. It should be approximately 25 to 30% of the total commodity possible.

3. Have each student visit the teacher a total of three times to play a game of chance that has these options:

- Choose to flip the coin with positive or negative consequences **or**
- Choose not to participate in the game of chance and lose a set amount of the commodity. This lost set amount of the commodity should be one third of what the student possesses in their cache. We want this loss to be a significant penalty for not gambling in the game, and force the kids to have to choose carefully on their options.
- Here are the options:
    - Gamble:

      Heads will get you a positive reward with the reward not necessarily known to the student. It could be a gain of zero **or** two times greater than what they have in their cache. The rewarded amount is dependent on the role of the die. Let evens and odds represent one of the positive reward options, zero or two times payoff amounts.
      Tails will get you nothing for your coffers.
    - Not Gamble:

      Receive a guaranteed loss of one third of your coffers.

4. Have them play this game for a total of three times.

Assessment Questions:

1. How did it feel to participate in the game where you gained the commodity? Can you explain your decision making process in this portion of the game?

2. Where your decision making processes similar or different when the rules of the game changed in the second variation? In other words, was there a differing amount of pressure when you could lose your commodity? Why or why not.

3. Do you believe there might be similarities or differences between you and your classmates in your decision making processes?

4. Do you believe there might differences between how males and females make these same decisions?

5. From a personal perspective, do you believe you might be predisposed to, or not to, gamble? Do you think this is genetically or environmentally determined? Explain your response.

Follow Up Readings:

Here are a couple of readings to further enhance our understanding of this concept of Neuroeconomics and the pathways of risky decision making.

Decision Making and the Brain

Neuroscientist Paul Glimcher of New York University and Rob DeSalle, curator of *Brain: The Inside Story*, will discuss the interdisciplinary field of neuroeconomics and how the brain enables humans to evaluate decisions, categorize risks and rewards, and interact with each other. Glimcher, whose books include *Neuroeconomics: Decision Making and the Brain* and *Foundations of Neuroeconomic Analysis*, recently answered a few questions about the discipline.

What is neuroeconomics?

Neuroeconomics is a highly synthetic and interdisciplinary effort to understand how both humans and animals make decisions.

What role does neuroeconomics play in our daily lives?

Decisions — the events that neuroeconomists seek to understand and predict — are embedded every aspect of our lives: what to have for breakfast, who to marry, or where to invest our retirement accounts. We make these choices effortlessly, but how? Over the last decade the basic outlines of the answer to that question have begun to become clear and the answers are surprising, exciting, and at times even troubling. It now seems clear that every day, at every action, our brains unconsciously compute and store the values of every event that befalls us. So I would have to say: neuroeconomics *is* our daily lives.

In your book Neuroeconomics: Decision Making and the Brain*, you write about decision-making in nonhuman primates. What are the differences between how humans and other primates make decisions? Are there any similarities?*

I think in general that the mechanisms of decision-making in humans and in other mammals are much more similar than we had expected. Let me give one example. My old student Michael Platt recently showed that male monkeys will give up fruit juice treats in order to look at pictures of other monkeys. But even more interesting is that they will give up more, they'll pay more, to look at high-ranking monkeys than to look at low ranking monkeys. I can't help but notice that humans are much the same. Have you seen how much a copy of *People* magazine costs these days?

What role does money play in decision-making, and why?

Money is one of the great puzzles in decision-making. Money is a recent invention that has swept before it almost all of human society. Even some species of monkeys can be taught to use money. Why is money so easy for us to use? A couple of theories have been proposed. One is that money taps into pre-existing neural circuits that play a role in social valuation.

Another is that money activates dedicated brain circuits that evolved to trade off different kinds of rewards like food and water. In essence that theory proposes that the mammalian brain evolved a common currency of its own, and that money arose in human society precisely because our brains incorporate that feature.

What are the long-term goals of your research?

The single long-term goal of my work is to develop what we call "The Standard Model" of human decision-making. What we are trying to do is to combine economics, psychology, and neuroscience into a single descriptive model that explains how we make choices. Of course such a model would also have strong predictive power and significant policy implications. Perhaps surprisingly, I would argue that we are already making good headway towards this end. Under some conditions, to take one example, we can use brain scanner data to predict the individual choices of consumers with an accuracy approaching 90 percent.

From the American Museum of Natural History:

http://www.amnh.org/news/2011/01/decision-making-and-the-brain/#more-2760

Laurie Santos: Cognitive psychologist

Laurie Santos studies primate psychology and monkeynomics -- testing problems in human psychology on primates, who (not so surprisingly) have many of the same predictable irrationalities we do.

Laurie Santos runs the Comparative Cognition Laboratory (CapLab) at Yale, where she and collaborators across departments (from psychology to primatology to neurobiology) explore the evolutionary origins of the human mind by studying lemurs, capuchin monkeys and other primates. The twist: Santos looks not only for positive humanlike traits, like tool-using and altruism, but irrational ones, like biased decisionmaking.

In elegant, carefully constructed experiments, Santos and CapLab have studied how primates understand and categorize objects in the physical world -- for instance, that monkeys understand an object is still whole even when part of it is obscured. Going deeper, their experiments also search for clues that primates possess a theory of mind -- an ability to think about what other people think.

Most recently, the lab has been looking at behaviors that were once the province mainly of novelists: jealousy, frustration, judgment of others' intentions, poor economic choices. In one experiment, Santos and her team taught monkeys to use a form of money, tradeable for food. When certain foods became cheaper, monkeys would, like humans, overbuy.

As we humans search for clues to our own irrational behaviors, Santos' research suggests that the source of our genius for bad decisions might be our monkey brains.

"Through a series of groundbreaking experiments, Santos has seen in her primates a humanlike propensity for hoarding, larceny, and competitiveness. By exploring the inner lives of primates, she has offered persuasive evidence that monkeys are capable of sophisticated insight, complex reasoning, and calculated action." Linda Marsa, *Discover*

From TED.com:

http://www.ted.com/speakers/laurie_santos.html

Watch the video on Monkey Economics:

Laurie Santos: A monkey economy as irrational as ours

http://blog.ted.com/2010/07/29/a-monkey-economy-as-irrational-as-ours-laurie-santos-on-ted-com/