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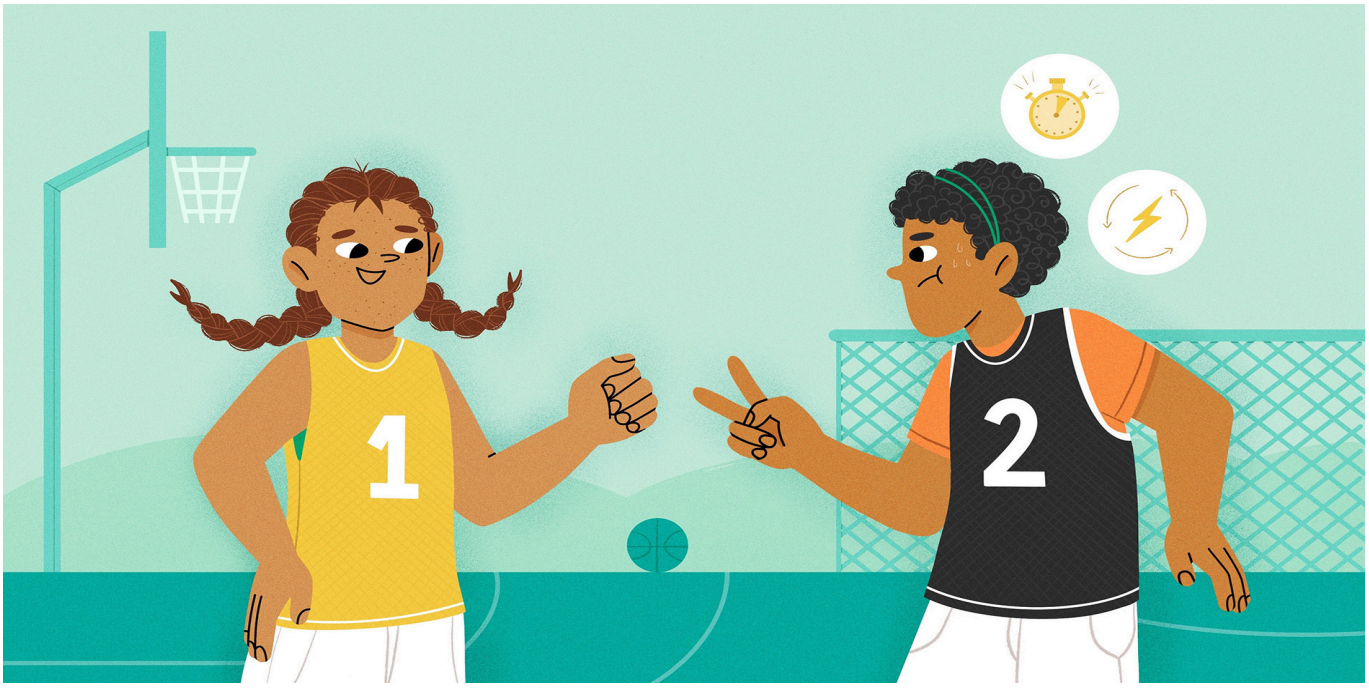

HOW DO SIMPLE GAMES HELP US TO UNDERSTAND DECISION-MAKING?

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YOUNG REVIEWERS:

ETTA
AGE: 10

JULIA
AGE: 8

LAS VEGAS KITTIE CATS
AGES: 9–13

We have to make lots of decisions every day, and sometimes we only have a short time or very little energy to put into making certain decisions. What determines whether we make good or bad decisions? Researchers have found there are different types of decision-makers, and they differ in how satisfied they are with their decisions. In our lab, we use simple games such as Rock, Paper, Scissors to study how good and bad decisions are made. We have found that people tend to make worse decisions after a negative outcome, such as losing the previous game. We have also found that people tend to spend less time thinking about their next decision after losing. Based on these results, we suggest taking your time when making a decision after a negative outcome in order to prevent making a hasty decision.

HOW DO YOU MAKE DECISIONS?

What kind of decisions do you make when you wake up in the morning? What are you going to wear? What are you going to have for breakfast? Should you look at your homework from the night

DESCRIPTIVE DECISION-MAKING

Changes from normative decision-making, representing the actual decisions that people tend to make in their everyday lives.

NORMATIVE DECISION-MAKING

The ideal decisions that people could make with unlimited time, information, and reasoning.

SATISFICER

A decision-making style that selects the first option that meets the minimum requirement(s).

MAXIMIZER

A decision-making style that selects one of many options that meets the minimum requirement(s).

before? Hurry up, since the school bus is arriving! Because we have to make lots of decisions quickly, human decision-making is often described as "fast and frugal" [1]. Decisions are *fast* because they are made under time pressure. For example, you need to decide what to wear before catching the bus. Decisions are *frugal* because we only have a limited amount of resources for all the decisions we need to make. If you dedicate all of your mental resources to deciding what to wear, you may have no resources left to think about breakfast. The fast and frugal process of decision-making is called **descriptive decision-making**. On the other hand, if we had unlimited time and unlimited resources to make ideal decisions, this is called **normative decision-making** [1].

There are two main types of decision-makers: **satisficers** and **maximizers** [2]. Satisficers tend to use descriptive decision-making, and maximizers tend to use normative decision-making. For example, maybe this morning you had to decide which shirt and pants to wear. Did you look through your entire wardrobe and consider every combination of color and style from all the shirts and pants you own? This means you are a maximizer! Maximizers are more exhaustive when searching for options that fit all their requirements. Or maybe you just threw on the first shirt and pants you found? In that case, you are a satisficer! A satisficer is someone who selects the first option available as soon as that option satisfies all their requirements. Do you think you are a satisficer or a maximizer?

WHY ROCK, PAPER, SCISSORS?

In our lab, we use simple games like Rock, Paper, Scissors to understand how good humans really are at making decisions [3]. Why do we use games? First, games are useful because many people already know the rules of games like Rock, Paper, Scissors (Figure 1). Second, simple games can be played over and over again, which allows us to collect lots of data in a relatively short time. Third, we can control exactly how computerized opponents play during these games. For example, we can design a computer to play scissors more often. In this case, the human playing against the computer will want to play more rocks. Or we can design the computer to play more unpredictably. Changing how the computer plays makes the decisions that people must make easier or harder. Finally, we hope games are fun!

HOW DO PEOPLE RESPOND TO WINS AND LOSSES?

So how do we apply the idea of normative decision-making to Rock, Paper, Scissors? What is the very best way to play this game? Consider the things you need to do to make sure you do not lose against your opponent—this is called loss minimization, and it means trying to make

Figure 1

In the game Rock, Paper, Scissors, players make hand shapes to represent their choices: a fist for rock, an open hand for paper, and two fingers for scissors. Rock beats scissors, scissors beat paper, and paper beats rock. There is no one response better than another.

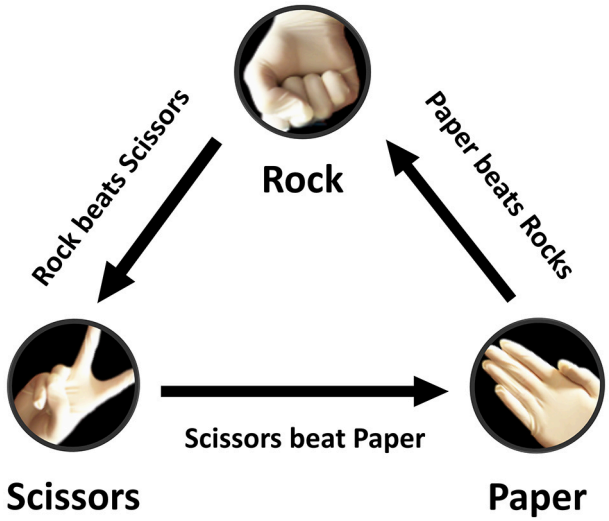

Figure 1

the number of losses you experience as small as possible. The key to loss minimization is to play as unpredictably as you can.

However, there is a form of learning that humans (and animals) use, called operant conditioning [4], in which our future actions are determined by previous outcomes. For example, if a dog raises its paw and you give it a treat, the dog will be more likely to raise its paw next time it sees you. Imagine you are writing two school assignments. You work on the first assignment every day for 2 weeks, do some extra research around the topic, and make sure that you read it through before submitting it. You forget about the second assignment until the due date and then quickly write something a few hours before the deadline. You get a great mark for the first assignment and a lousy mark for the second assignment. According to operant conditioning, you will be more likely to repeat your study behavior from the first assignment because you were "rewarded" for that behavior by getting a great mark. This is known as **win-stay**. In contrast, you will be more likely to change your study behavior related to the second assignment because you were "punished" for that behavior by getting a lousy mark. This is known as **lose-shift**.

WIN-STAY

Behavioral tendency to choose the same option (or "stay") after a win.

LOSE-SHIFT

Behavioral tendency to choose a different option (or "shift") after a loss.

THE BEST WAY TO PLAY ROCK, PAPER, SCISSORS

Although win-stay and lose-shift are important for learning, can you see how these decisions might not be good in Rock, Paper, Scissors? Say you won with paper. You decide to *stay*, meaning you continue to play paper. Then, it becomes clear to your opponent that they should play scissors. Say you lost with rock, and you decide to *shift*. Now you have two options. Either you play paper (in which case, your opponent should play scissors), or you play scissors (in which case, your opponent should play rock).

Do you remember the difference between normative and descriptive decision-making? What kinds of decisions do we make when we play Rock, Paper, Scissors—normative or descriptive? First, let us look at what normative decision-making (the best possible decisions) should look like in the game. Remember that playing unpredictably is the key to minimizing losses. If you want to play unpredictably while playing Rock, Paper, Scissors 30 times, then you should stay with your previous response around 10 times (1/3) and change (shift) your response around 20 times (2/3). Also, you need to make sure that these fractions do not change depending on whether you win or lose.

Figure 2 shows that people sometimes play unpredictably, but this is determined by the outcome of the previous round. In terms of how much players stay after a win, the average frequency of win-stay is just about 10 times out of 30 (1/3 or 33.3%). However, in terms of how much players shift after a loss, the average frequency of lose-shift tends to be significantly larger than 20 times out of 30 (2/3 or 66.6%). This means that the quality of players' decision-making is impacted by what happened in the previous round of the game. If players win, then their decision-making is more likely to be normative (high quality) and they essentially become unpredictable. If they lose, then their decision-making is more likely to be descriptive (low quality): players increase the predictability of their behavior, which might then be exploited by their opponents.

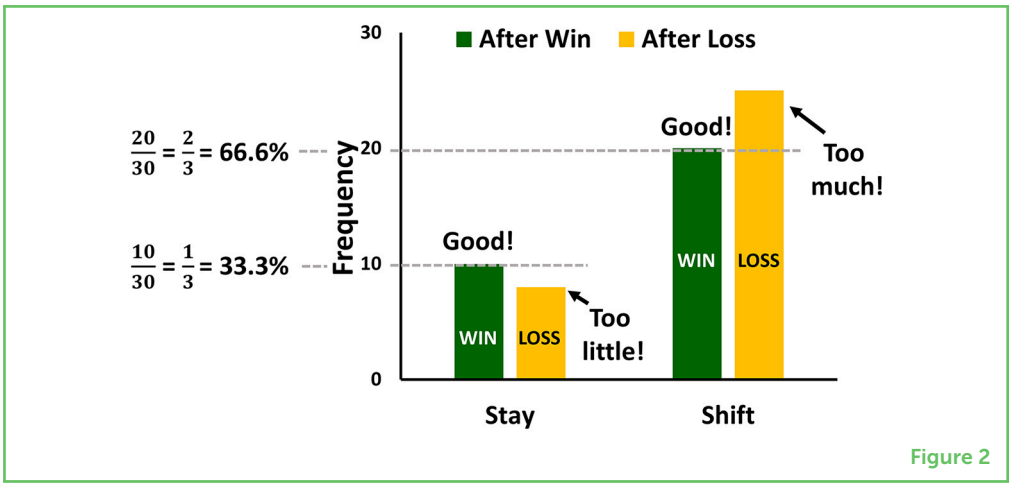

Figure 2

Figure 2

Want to be random when you play Rock, Paper, Scissors? Because there are three responses, you should stay with your last response about 10 times out of 30 and shift away from your last response about 20 times out of 30. Data show that players are good at using these fractions (1/3) after a win (normative decision-making) but are bad at using these fractions (2/3) after a loss (descriptive decision-making). After losses, people tend to shift more than they should.

WHAT CAUSES LOW-QUALITY DECISION-MAKING FOLLOWING LOSING?

Researchers have started to examine why decision-making might get worse following losing. One possibility is that people do not like being in a state of failure, and so they make the next decision faster. Figure 3 shows how quickly players respond on their next round of Rock, Paper, Scissors as a result of winning or losing. There is a clear difference between the speed of decision-making following wins and following

POST-LOSS SPEEDING

Behavioral tendency to make a decision faster after a loss.

POST-WIN SLOWING

Behavioral tendency to slow down when making a decision after a win.

losses. This has been described in two ways [5]. The first way is in terms of **post-loss speeding**, in which players intentionally speed up their decisions following a loss, to stop the experience of failure. The second way to describe this is in terms of a **post-win slowing**, in which players intentionally slow down their decisions following a win, to stay within the state of success for a little bit longer. After all, no one likes to experience losing and everyone likes winning! Whether players use post-loss speeding and/or post-win slowing when they are playing Rock, Paper, Scissors is a current area of study. Slowing down or speeding up mean that people might intentionally delay or hurry their next decisions. For example, if you like to bask in the glory of a win, the data would show you slowing down following wins, rather than speeding up following losses.

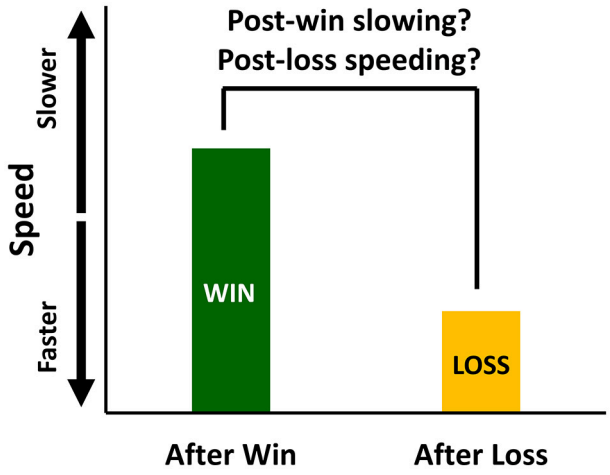

Figure 3

Figure 3

When players lost their last round of Rock, Paper, Scissors, they tend to make their next response faster than if they had just won. This difference could be interpreted as either speeding up responding after negative outcomes (post-loss speeding) or slowing down responding after positive outcomes (post-win slowing). The time players give themselves to think about their next response might impact how good that decision is.

WHAT HAVE YOU LEARNT?

Because we all must make lots of decisions against deadlines, human decision-making is often described as fast and frugal (*descriptive decision-making*). This is different from the higher-quality decisions we could make if we had unlimited time and unlimited resources (*normative decision-making*). Researchers like our group use simple games to study how the quality of decision-making changes as a result of winning and losing. Using Rock, Paper, Scissors, we found that the quality of decision-making following a win tends to be better than the quality of decision-making following a loss. This may be because of longer time spent on decisions following success.

How people make decisions when they have limited time and resources, and how that decision quality changes based on the outcome of earlier decisions, has important consequences for explaining how students might learn more effectively. For example, remember how we tend to make better decisions following wins? This suggests that teachers should give more positive feedback than

negative feedback, to encourage students to make better decisions. Students might also benefit from slowing down their decisions following negative outcomes, to avoid making mistakes in the future. So, the next time you play Rock, Paper, Scissors with your friends, think about what you learned in this article and remember to slow down and try to play randomly!

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YOUNG REVIEWERS

ETTA, AGE: 10

Etta is fascinated with all things scientific, with special interests in the brain and fungi. She also likes music, sports, and camping. Backcountry hiking trips every summer are a great source of inspiration for her curious questions about the brain and the natural world.

JULIA, AGE: 8

Julia loves to ask questions about anything and everything. In her spare time, she works on inventions in her lab (i.e., her bedroom) and follows a do-it-yourself gymnastics training plan. Along with her big sister, Etta, she has fun learning, challenging herself, and exploring the outdoors on family backcountry hiking trips.

LAS VEGAS KITTIE CATS, AGES: 9–13

We like reading science articles and seeing how many kids read the articles after us. They read the articles we read all over the world and that is cool. We all like cats and playing games. Some of us play soccer.

AUTHORS

BENJAMIN JAMES DYSON

I am the director of the Re:Cognition Lab at the University of Alberta in Canada. I have been interested in a number of topics throughout my career, including how we integrate sights and sounds, the mental processes associated with art appreciation, and decision-making. As well as being a keen record collector, I also design board games in my spare time. *bjdyson@ualberta.ca

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I am a Ph.D. student in the Re:Cognition Lab at the University of Alberta in Canada. I am broadly interested in how people make decisions under different goal structures, how they learn and use strategies, and what factors may be involved in the learning and using processes. I would like to observe brain activities *via* physiological methods. When not in the lab, I enjoy playing with cats, playing music, and watching videos.

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I am a Ph.D. student in the Re:Cognition Lab at the University of Alberta in Canada. I am interested in the inefficient decisions we often make (descriptive decision-making). I also have a great interest in what is happening in our brains during those decisions, using electrical brain signals. In my free time, I like to paint miniature models and play board games with my friends.