

Supporting Information File 1 For:

Toplak & Stanovich (2024). Measuring Rational Thinking in Adolescents: The Assessment of Rational Thinking for Youth (ART-Y). *Journal of Behavioral Decision Making*.

Assessment of Rational Thinking for Youth (ART-Y) Battery

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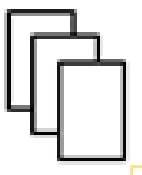
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Probabilistic and Statistical Reasoning Subtest

The items were intermixed with the Scientific Reasoning subtest items.

PROBABILITY MATCHING

1. Imagine a pile of 3 cards sitting in front of you on the table. Each of the cards has a letter on one side. The letter “A” is on 2 of the cards, and the letter “B” is on 1 card.



Randomly shuffle the cards and place them in a pile on the table with the letters facing down so that you can't see them. You will do this 6 times in total.

Each time the 3 cards are shuffled and placed on the table, your task is to guess the letter of the top card. **Is it the letter A or the letter B?**

Imagine that you will get \$100 each time you correctly guess which letter is on the top card. You want to make as much money as you can.

What are YOUR predictions for each of the 6 shuffles?

Indicate the letter A or B for each card in the boxes below.

I would predict letter _____ for Shuffle #1.

I would predict letter _____ for Shuffle #2.

I would predict letter _____ for Shuffle #3.

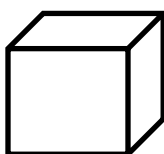
I would predict letter _____ for Shuffle #4.

I would predict letter _____ for Shuffle #5.

I would predict letter _____ for Shuffle #6.

Scoring: 1 point for 6 choices of A, 0 points other responses.
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2. Imagine a single die with 4 blue sides and 2 yellow sides.



This die will be rolled 30 times.

Each time before the die is rolled, you will be asked to predict which color will be on top. **Will it be blue or yellow?**

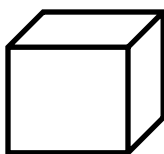
Imagine you will get \$1 for each correct guess. You want to make as much money as possible by making correct predictions on the 30 rolls.

If you were asked to guess after each roll, what strategy would you use in order to make as much money as possible? **Circle the strategy that is best.**

- Go back and forth between colors. For example, after predicting blue a bunch of times, then pick yellow. If you predict yellow a bunch of times, then pick blue.
- Because blue is more likely, pick blue on most of the rolls. Occasionally pick yellow.
- Wait to see what you get on each roll. For example, if the last one was blue, then guess yellow for the next one.
- Guess blue on all of the 30 rolls.

Scoring: Score 1 point for d; otherwise score 0.
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3. Imagine a single die with 4 green sides and 2 red sides.



This die will be rolled 6 times.

Each time before the die is rolled, you will be asked to predict which color will be rolled. **Will it be green or red?**

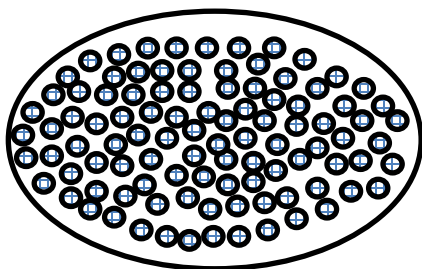
Imagine you will get \$5 for each correct guess. You want to make as much money as possible by making correct predictions on the 6 rolls.

If you were asked to guess after each roll, what strategy would you use in order to make as much money as possible? **Circle the strategy that is best.**

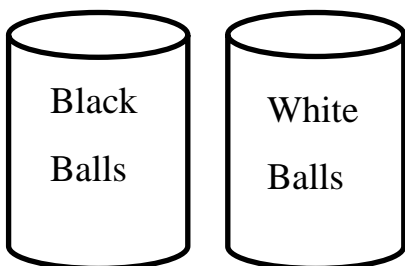
- a) I would predict green on each of the 6 rolls.
- b) I would predict green on 5 rolls and red on 1 of the rolls.
- c) I would predict green on 4 rolls and red on 2 of the rolls.
- d) I would predict green on 3 rolls and red on 3 of the rolls.
- e) I would predict green on 2 rolls and red on 4 of the rolls.
- f) I would predict green on 1 roll and red on 5 of the rolls.
- g) I would predict red on each of the 6 rolls.

Scoring: 1 point for a; 0 points for other responses.

4. Imagine a large bowl that has 100 balls that are each wrapped up in foil. You cannot see the color of each ball, but there are 80 black and 20 white balls.



You get to pick 10 of these wrapped balls, and guess if each one is black or white. You will put the ones you think are black in a cup marked “black balls” and the ones you think are white in a cup marked “white balls”.



After you pick these 10 balls, they will be unwrapped to see the color.

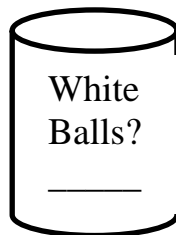
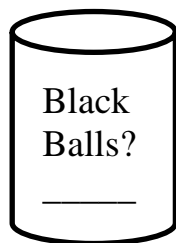
You will get \$5 for each ball if you correctly guessed the color by putting the balls in the correct cup.

How many balls would you put in the black cup?

Fill in the blank.

How many balls would you put in the white cup?

Fill in the blank.



Scoring: 1 point for 10 balls in black cup and 0 balls in white cup, otherwise score 0.

GAMBLER'S FALLACY

5. Imagine that you are tossing a **single fair** coin and it has just come up heads 5 times in a row. A coin is *fair* if it has a 50/50 chance of coming up heads or tails on each toss.

Which outcome is most likely on the 6th trial?

- It is more likely that tails will come up than heads on the 6th toss.
- It is more likely that heads will come up than tails on the 6th toss.
- Heads and tails are equally likely on the 6th toss.

Scoring: Score 1 for c and score 0 for a and b.

6. When playing slot machines, people win something about 1 in every 10 times. Nancy, however, has just won on her first 3 plays. What are her chances of winning the next time she plays?

- She has better than 1 chance in 10 of winning on her next play.
- She has less than 1 chance in 10 of winning on her next play.
- She has a 1 chance in 10 that she will win on her next play.

Scoring: Score 1 for c and score 0 for a and b.

7. Dice game: Even numbers win and odd numbers lose on a die throw. The *fair* die has six sides, with three even and three odd numbers. A die is *fair* if there is the same chance of throwing an even or an odd number on each throw.

Jan has thrown 7 odd numbers in a row. What are her chances of throwing an even number on her next throw?

- She has better than 3 chances in 6 of an even number on her next throw.
- She has less than 3 chances in 6 of an even number on her next throw.
- She has 3 chances in 6 of an even number on her next throw.

Scoring: Score 1 for c and score 0 for a and b.

CONJUNCTION EFFECTS

8. A survey of a random sample of 1000 high school students was conducted. Please give your best estimate of the following values:

1. How many of the 1000 students had vandalized property?
_____ out of 1000 students
2. How many of the 1000 students have had school suspensions?
_____ out of 1000 students
3. How many of the 1000 students had smoked marijuana and vandalized property?
_____ out of 1000 students
4. How many of the 1000 students participated on high school sports teams?
_____ out of 1000 students
5. How many of the 1000 students had smoked marijuana?
_____ out of 1000 students

Scoring: Scoring two parts for 2 points on this question.

Part 1: 9. Vandalized minus marijuana and vandalized > 0 scored as 1.

Part 2: 10. Marijuana minus marijuana and vandalized > 0 scored as 1.

9. a. What is the probability that you will have root canal surgery on one tooth in the *next five years*? (enter a percentage between 0 to 100) _____ %
- b. What is the probability that you will have gum disease in the *next five years*? (enter a percentage between 0 to 100) _____ %
- c. What is the probability that you will have root canal surgery on one tooth and also have another tooth extracted in the *next five years*? (enter a percentage between 0 to 100) _____ %
- d. What is the probability that you will have too much plaque on your teeth in the *next five years*? (enter a percentage between 0 to 100) _____ %
- e. What is the probability that you will have a tooth extracted in the *next five years*? (enter a percentage between 0 to 100) _____ %

Scoring: Scoring two parts for 2 points on this question.

Part 1: 11. Root canal in five years (a) *minus* root canal surgery on one tooth and another tooth extracted in five years (c) > 0 scored as 1

Part 2: 12. Tooth extracted in five years (e) *minus* root canal surgery on one tooth and another tooth extracted in five years (c) > 0 scored as 1

10. A survey of a random sample of 500 male athletes at a high school was conducted. Please give your best estimate of the following values:

1. How many of the 500 male athletes play football?
_____ out of 500 male athletes

2. How many of the 500 male athletes have a part-time job?
 _____ out of 500 male athletes
3. How many of the 500 male athletes play both hockey and football?
 _____ out of 500 male athletes
4. How many of the 500 male athletes will go to summer school?
 _____ out of 500 male athletes
5. How many of the 500 male athletes play hockey?
 _____ out of 500 male athletes

Scoring: Scoring two parts for 2 points on this question.

Part 1: 13. Football (1) minus football and hockey (3) > 0 scored as 1

Part 2: 14. Hockey (5) minus football and hockey (3) >0 scored as 1

CAUSAL BASE RATES

11. Ms. Owen is going to take her class to a food court for lunch and they need to get served fast. The food court manager says the shortest lunch line-ups are almost always at *Hot Dog City*. Last time Ms. Owen went to the food court, the shortest lunch line-up was at *Fries R Us*.

Which food place is most likely to have the shortest lunch line-up for Ms. Owen's class?

- a) *Hot Dog City should definitely have the shortest line-up.*
- b) *Hot Dog City should probably have the shortest line-up.*
- c) *Fries R Us should probably have the shortest line-up.*
- d) *Fries R Us should definitely have the shortest line-up.*

Scoring: Correct Answer: a or b Score 1, otherwise Score 0.

12. The Garcias wanted a new car that would require as few mechanical repairs as possible. They decided to get either a *PathMaster* or a *RoadRider*. To help decide between these cars, they looked up each of these car's ratings in *Consumer Reports* magazine. *Consumer Reports* is a magazine that provides information from large surveys done with people who have used different products. The Garcias also talked with two neighbors who owned these cars.

Consumer Reports said that their national survey by car experts found that the *PathMaster* had a much lower number of and less expensive mechanical problems in the first three years than the *RoadRider*.

However, the neighbor who owned a *PathMaster* had the lots of mechanical problems and complained that his car had required many very expensive repairs in its first 3 years. **What do you think the Garcias should do?**

- a. They should definitely buy the *PathMaster*.
- b. They should probably buy the *PathMaster*.
- c. They should probably buy the *RoadRider*.
- d. They should definitely buy the *RoadRider*.

Scoring: Correct answer: a or b Score 1, otherwise Score 0.

13. Cora needed to buy a book over the web, and she needed to get it as quickly as possible. She decided to buy her book from either *E-Shop.com* or *OnlineShop.com*. To help decide which website was best, Cora looked at the hundreds of customer reviews for the two websites. She also talked with a friend who had recently purchased books online.

Almost all customers had found *E-Shop.com* to be the better of the two websites, because *E-Shop.com* had almost always shipped books more quickly.

When Cora asked her friend Lisa about her experiences with buying books online, Lisa said that she was very unhappy with the service she had received from *E-Shop.com*, because the book she ordered from them had taken over eight weeks to arrive. On the other hand, a book that she had ordered from *OnlineShop.com* arrived in only four days. **What do you think Cora should do?**

- a. She should definitely order from *E-Shop.com*
- b. She should probably order from *E-Shop.com*
- c. She should probably order from *OnlineShop.com*
- d. She should definitely order from *OnlineShop.com*

Scoring: a or b Score 1, otherwise Score 0.

14. Vincent wanted to develop his soccer skills and he had to choose between two instructional videos.

Masters of Soccer Inc. is a video series that was used last year by his best friend's team that won the championship last year. Vincent remembers his best friend talking about these videos all of the time last year, going on about how good they were.

Soccer Sensation Inc. is a video series that had been used by teams that won the most championships in the previous 10 years.

Which video series do you think that Vincent should choose?

- a. Vincent should definitely choose *Masters of Soccer Inc.*
- b. Vincent should probably choose *Masters of Soccer Inc.*
- c. Vincent should probably choose *Soccer Sensation Inc.*
- d. Vincent should definitely choose *Soccer Sensation Inc.*

Scoring: c or d Score 1.

SENSITIVITY TO SAMPLE SIZE/LAW OF LARGE NUMBERS

15. Thirteen year-old Nathan likes to play ping pong with his grandfather. Nathan's grandfather is much better at ping pong than Nathan, though Nathan sometimes wins. They usually play to 7, 9, 15 or 21 points a game. Which option gives Nathan the best chance of winning a game?

- a. Playing to 7 points.
- b. Playing to 9 points.
- c. Playing to 15 points.
- d. Playing to 21 points.
- e. It does not matter how many points they play to, because Nathan has the same chance of winning with each of the game options.

Scoring: Score 1 point for choice a, otherwise score 0.

16. A 16-year-old is better at playing a game of horseshoe toss and wins more games than his less skilled 12-year-old cousin. In this game, each horseshoe that lands on the spike wins one point. The game can be played to 5, 9, 15 or 21 points a game. Although the 16-year-old is the better player, which option gives the 12-year-old the best chance of winning a game?

- a. Playing to 5 points.
- b. Playing to 9 points.
- c. Playing to 15 points.
- d. Playing to 21 points.
- e. It does not matter how many points they play to, because the less skilled 12-year-old has the same chance of winning with each of the game options.

Scoring: Score 1 point for choice a, Score 0 for other options

17. The basketball team at City University has 28 games each season. This year Sam is playing his 4th year on the team. Sam made an average of about 70% of his free throw shots at the end of each of those 3 seasons. After the first 5 games of the season this year, Sam's free throw average was 90%.

Question A. By the time he finishes this season, what do you think his free throw average is most likely to be this year?

- 1. Sam's free throw average for his 4th year will be about 95%
- 2. Sam's free throw average for his 4th year will be about 90%
- 3. Sam's free throw average for his 4th year will be about 70%
- 4. Sam's free throw average for his 4th year will be about 60%

Question B: Why did you answer Question A as you did above?

- a. When players are really good early in the season, opposing fans tend to heckle these players and distract them.
- b. It is too difficult to schedule extra practices later in the season, so every player's average goes down.
- c. Player's high average at the beginning of the season may be just luck. The longer season provides a more realistic test of the player's skills.

d. Players who do really well at the beginning of the season are under a lot of stress to keep it up. The stress makes their performance worse.

Scoring: Scoring two parts for 2 points on this question.
 Part 1: Question A score one for choosing 3.
 Part 2: Question B score for choosing c.

Scientific Reasoning Subtest

The items were intermixed with the Probabilistic and Statistical Reasoning subtest items.

FALSIFICATION TENDENCIES – SELECTION TASK

NOTE: These items were interspersed but presented in this order.

1. Imagine that you are a police officer on duty, walking through a local bar. It is your job to ensure that the drinking laws are in effect in this bar. When you see a person engaging in certain activities, the laws specify that certain conditions must first be met. **One such law is “If a person is drinking beer then the person must be over 21 years of age.”** Each of the boxes below represents a card lying on a table. There are two pieces of information about a person on each card. Whether or not the person is drinking beer is on one side of the card and the person’s age is on the other side. For two of the people, you can see their age, but you cannot see what they are drinking. For the other two people, you can see what they are drinking, but you cannot see their age. Your task is to decide whether or not this law is being broken in the bar.

Which of the cards below would you need to turn over in order to find out whether or not the law is being broken?

Age:
22

Turn Do not Turn

Age:
18

Turn Do not Turn

Drink
Beer

Turn Do not Turn

Drink:
Coke

Turn Do not Turn

Deontic Item

Scoring:

Calculate Pollard and Evans (1987) Logic Index.

Number of correct cards turned minus number of incorrect turns:

Correct = P and NQ

Incorrect = NP and Q

$P + NQ - NP - Q$

P (beer); NP (Coke); Q (22); NQ (18)

Logic index > 0 scored as 1

Logic index ≤ 0 scored as 0

2. Suppose that you are the assistant manager at Macy's, and it is your job to check sales receipts to make sure they are properly filled out according to a rule. The rule is: **Any sale over \$30 must be approved by the section manager, Mr. Jones.** Below are four sales receipts. The amount of the sale is on one side of each receipt, and the space for the approval signature is on the other side. **Which of the sales receipts shown below would you need to turn over in order to find out whether or not the rule is being violated?**

\$70	\$22	Approval: <u>Mr. Jones</u>	Approval: _____
Turn Do not Turn	Turn Do not Turn	Turn Do not Turn	Turn Do not Turn
O O	O O	O O	O O

Deontic Item

Scoring

Calculate Pollard and Evans (1987) Logic Index.

Number of correct cards turned minus number of incorrect turns:

$P + NQ - NP - Q$

P (\$70); NP (\$22); Q (Mr. Jones); NQ (___)

Logic index > 0 scored as 1

Logic index ≤ 0 scored as 0

3. Each of the boxes below represents a card lying on a table. Each one of the cards has a letter on one side and a number on the other side. **Here is a rule: If a card has a vowel on its letter side, then it has an even number on its number side.** As you can see, two of the cards are letter-side up, and two of the cards are number-side up.

Your task is to decide which card or cards must be turned over in order to find out whether the rule is true or false. Indicate which cards must be turned over.

K	A	8	5
Turn Do not Turn	Turn Do not Turn	Turn Do not Turn	Turn Do not Turn
O O	O O	O O	O O

Nondeontic/Abstract Item

Calculate Pollard and Evans (1987) Logic Index.

Number of correct cards turned minus number of incorrect turns:

$P + NQ - NP - Q$

P (A); NP (K); Q (8); NQ (5)

Logic index > 0 scored as 1

Logic index ≤ 0 scored as 0

4. Each of the tickets below has a destination on one side and a mode of travel on the other side. Here is a rule: “If ‘Baltimore’ is on one side of the ticket, then ‘plane’ is on the other side of the ticket.”

Your task is to decide which tickets you would need to turn over in order to find out whether the rule is being violated.

Destination: Baltimore	Destination: Washington, D.C.	Mode of Travel: Train	Mode of Travel: Plane
Turn Do not Turn	Turn Do not Turn	Turn Do not Turn	Turn Do not Turn
○ ○	○ ○	○ ○	○ ○

Nondeontic/Abstract Item
 Calculate Pollard and Evans (1987) Logic Index.
 Number of correct cards turned minus number of incorrect turns:
 $P + NQ - NP - Q$
 P (Baltimore); NP (Washington); NQ (train); Q (plane)
 Logic index > 0 scored as 1
 Logic index ≤ 0 scored as 0

CONVERGING EVIDENCE

5. Alice had been experiencing stomach problems. She suspected that she had developed an allergy to either milk, eggs, wheat or nuts because she never experienced any stomach problems on days when she did not eat any of these items.

To figure out which one of these foods was causing her stomach problems, Alice conducted two different tests on two different days.

For the first test, she had milk, eggs, and wheat but not nuts. She had stomach problems that day. For the second test, she had wheat and nuts but not milk and not eggs on that day. Alice had stomach problems on that day too.

	Consumed milk on test day?	Consumed eggs on test day?	Consumed wheat on test day?	Consumed nuts on test day?	Test Result
Test 1 day	Yes	Yes	Yes	No	Had Stomach Problems
Test 2 day	No	No	Yes	Yes	Had Stomach Problems

Which of the following is most likely causing Alice's stomach problems?

- a. Milk
- b. Eggs
- c. Wheat
- d. Nuts
- e. All are equally likely

Correct: Wheat, C

6. Arnold developed an allergic reaction while going on a hike in the country. He suspected that he had an allergy to dandelions, milkweeds, crabgrass, ragweed or tumbleweeds because he never experienced any allergy symptoms on days when he was not hiking in the country.

To figure out which one of these weeds may have given him an allergic reaction, Arnold conducted two different tests on two different days.

On day 1, he rubbed leaves from milkweed, crabgrass and tumbleweed on his arms, but not dandelion and not ragweed. He had no allergic reaction that day.

On day 2, he rubbed dandelion, milkweed and ragweed on his arms, but not crabgrass and not tumbleweed. He had an allergic reaction that day.

	Rubbed dandelion on his arm?	Rubbed milkweed on his arm?	Rubbed crabgrass on his arm?	Rubbed ragweed on his arm?	Rubbed tumbleweed on his arm?	Test Result
Test 1 day	No	Yes	Yes	No	Yes	No Allergic Reaction
Test 2 day	Yes	Yes	No	Yes	No	Allergic Reaction

Which of the weeds are most likely causing Arnold's allergic reaction?

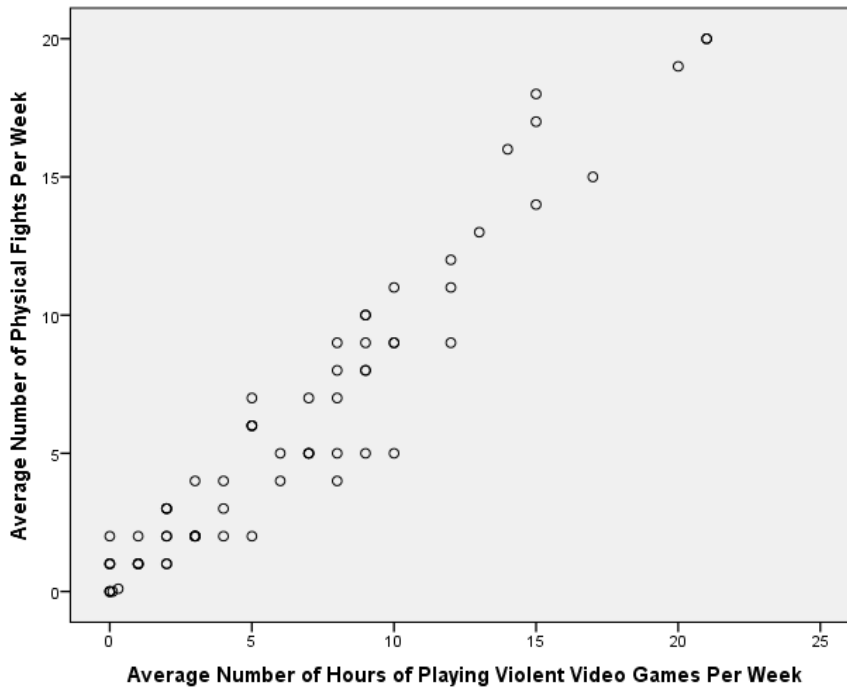
Please circle "Yes" or "No" beside each weed to indicate whether it may be causing Arnold's allergic reaction.

- Dandelion** causing allergic reaction? Yes or No
- Milkweed** causing allergic reaction? Yes or No
- Crabgrass** causing allergic reaction? Yes or No
- Ragweed** causing allergic reaction? Yes or No
- Tumbleweed** causing allergic reaction? Yes or No

Correct: Score 1 if circle "Yes" for dandelion AND ragweed; Score 0 otherwise.

LIMITS OF CORRELATIONAL RELATIONSHIPS

7. A recent study from a sample of school aged children showed the following graph on the relationship between the average number of physical fights each week and the average number of hours playing violent video games each week.

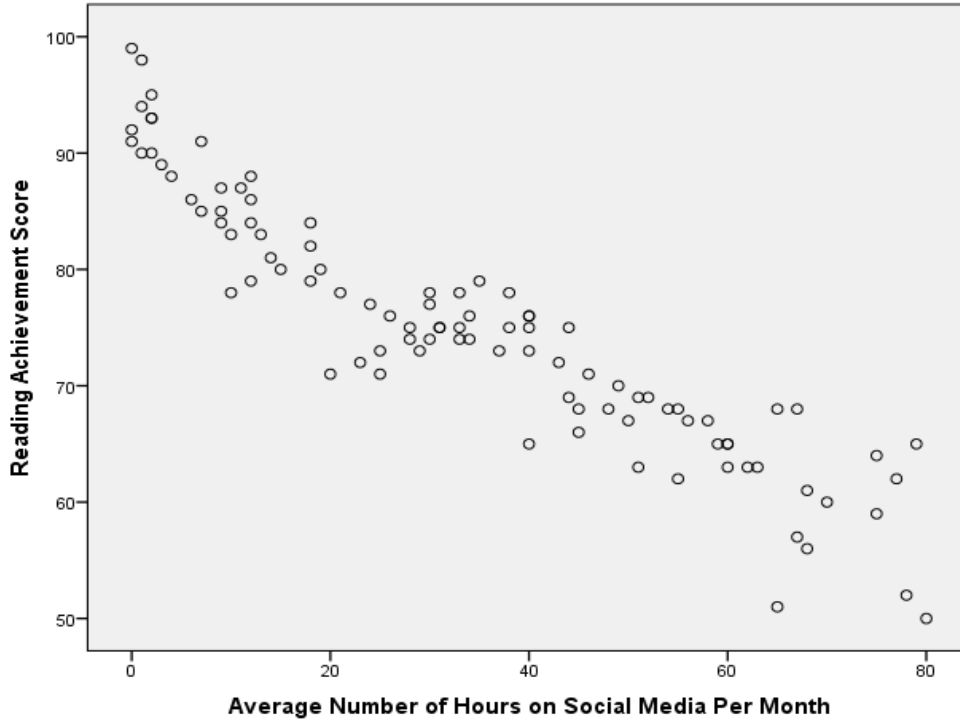


What can be concluded about the relationship between the average number of physical fights per week and the average number of hours of playing violent video games per week based on this graph?

- There is no relation between the number of physical fights per week and the number of hours of playing violent video games per week.
- More hours of playing violent video games per week is related to more physical fights per week.
- Fewer hours of playing violent video games per week is related to more physical fights per week.
- More hours of playing violent video games per week causes more physical fights per week.

Correct Answer: B

8. A recent study showed the following graph on the relationship between average number of hours spent on social media per month and average performance on a reading achievement test. The scores on the reading test ranged from 0 to 100, with 100 as a perfect score.



What can be concluded about the relationship between the average number of hours spent on social media per month and average performance on the reading achievement test?

- There does not appear to be any relationship between time on social media and average reading achievement.
- More hours on social media is related to higher reading achievement.
- More hours on social media is related to lower reading achievement.
- More hours on social media causes lower reading achievement.

Correct Answer: C

CONTROL GROUP REASONING

9. Last year, Principal Douglas introduced a new requirement that students must wear school uniforms at her high school, which was extremely expensive for parents. This year, Principal Douglas gave the students a survey asking them how happy they were at the beginning and end of the year. The survey indicated that students were much happier at the end of the school year than they were at the beginning. Principal Douglas then sent a letter to her students' parents informing them that the survey showed that the students were much happier at the end of the school year, and concluding that this was because of the new uniforms.

Is there a problem with Principal Douglas's conclusion?

- There is no problem with Principal Douglas' conclusion.

- b. There could be other reasons (instead of the new uniforms) for the students' increased happiness at the end of the school year, so Principal Douglas could be wrong.
- c. The survey results would have been more accurate if the principal had asked the teachers whether the students were truly happier at the end of the school year, so Principal Douglas could be wrong.
- d. The problem with Principal Douglas's conclusion is that one year is not enough time to look at the effect of the new uniforms. She should do the survey again next year to see if students are still happier.
- e. The problem with Principal Douglas's conclusion is that it is just unbelievable that the new school uniforms could have made the students happier.

Scoring: B is Score 1, otherwise 0

10. All hockey players must wear headgear while playing hockey. The local youth hockey association is recommending that parents of its players purchase a new brand of headgear that a sports company claims provides better protection against concussions. Parents were told to go the company's website for more information about the new brand of headgear.

What would be the **most convincing evidence** that the new brand of headgear provides better protection against concussions?

- a. Parents who have tried and rated the new brand of headgear have posted positive reviews on the company's website saying that the new brand of headgear seems to work better than the old brand of headgear.
- b. The fact that hockey players are required to wear headgear when they play hockey.
- c. A famous hockey player says great things about this new brand of headgear in advertisements.
- d. Learning that the new brand of headgear is made with more expensive materials.
- e. Reports of an experiment showing that hockey players who use the new brand of headgear have fewer concussions than hockey players who use the old brand of headgear.

Scoring: E=Score 1, otherwise Score 0

11. A new program called "High Jump Math" claims to improve students' math skills over a period of six weeks. The program combines fun physical activities with math activities. A teacher is considering using this program with her students, but she wants to know if the program actually improves students' math skills.

What would be the **most convincing evidence** that the "High Jump Math" program improves students' math skills?

- a. The teacher could invite parent volunteers to observe and give their impressions of whether the program improved the students' math skills.
- b. The teacher could survey the students after the program and ask them if they thought the program helped with their math skills.

- c. The teacher could test the students' math skills right before and right after the program to see if their math skills improved, and compare these results to another classroom that did not use this program.
- d. The teacher could invite another teacher to observe the program and see whether it covers the curriculum.
- e. The teacher could ask another teacher who had tried the program whether she liked it.

Scoring: C=Score 1, otherwise Score 0.

COVARIATION DETECTION

12. Many teenagers' smartphones stop working when they accidentally drop them into water. The company Wireless Techie has created a new method that they think will save smartphones that have fallen into water.

The company gathered 130 phones that had fallen into water. They randomly selected 30 of these phones and tried the new method on them. They found that 18 of these phones began to work again and 12 did not.

The company did not try this new method on the 100 remaining phones. They simply plugged these phones into a charger to see if they would begin to work again. Of these 100 phones, 40 began to work again and 60 did not.

The table below shows the outcome:

	Phones Worked	Phones Did Not Work
Wireless Techie's new method	18	12
Plugging in the phone	40	60

Does the company's new method work?

Choose the statement that best summarizes the table results.

- a. The evidence shows that the company's new method is better than just plugging in the phone.
- b. The evidence shows that the company's new method is worse than just plugging in the phone.
- c. The evidence shows that the company's new method has the same outcome as just plugging in the phone.

Scoring: A Score 1, otherwise Score 0.

13. The residents of a local city secure their garbage can lids with bungee cords to keep raccoons out. A local company has developed a new latch made out of titanium that they claim is more

effective for keeping raccoons out of garbage cans than bungee cords. The company wanted to show that their new titanium latch was more effective by doing a study.

The company chose 375 homes in this city. They randomly selected 300 of them to try the new titanium latch for one year. Of these 300 homes with the new titanium latches, 200 found that their garbage cans stayed closed and 100 found that their garbage cans were opened by raccoons.

The remaining 75 homes used bungee cords for one year. Of these 75 homes using a bungee cord, 50 found that their garbage cans stayed closed and 25 found that their garbage cans were opened by raccoons.

The table below shows the outcome:

	Garbage Can Stayed Closed	Garbage Can Opened by Raccoons
New Titanium Latch	200	100
Bungee Cord	50	25

Do the new titanium latches work?

Choose the statement that best summarizes the table results.

- The evidence shows that the new titanium latches are better than bungee cords.
- The evidence shows that the new titanium latches are worse than bungee cords.
- The evidence shows that the new titanium latches were no different than bungee cords in keeping raccoons out of the garbage cans.

Scoring: C Score 1, otherwise Score 0.

Avoidance of Framing Subtest

Administration Notes: One item from each pair is presented in each of the two blocks. The blocks should be separated by several other subtests.

Block 1 order: 7a, 1b, 2a, 6b, 3a, 4b, 5a

Block 2 order: 7b, 1a, 2b, 6a, 3b, 4a, 5b

1a. [Attribute Framing – Positive] Your family asked you to do some grocery shopping this week. You are at the grocery store purchasing some ground beef, and the label indicates that a package of ground beef is 92% fat-free. How satisfied would you be with this product?

- 1. I would be very satisfied.
- 2. I would be satisfied.
- 3. I would be slightly satisfied.
- 4. I would be slightly dissatisfied.
- 5. I would be dissatisfied.
- 6. I would be very dissatisfied.

1b. [Attribute Framing – Negative] Your family asked you to do some grocery shopping this week. You are at the grocery store purchasing some ground beef, and the label indicates that a package of ground beef is 8% fat. How satisfied would you be with this product?

- 1. I would be very satisfied.
- 2. I would be satisfied.
- 3. I would be slightly satisfied.
- 4. I would be slightly dissatisfied.
- 5. I would be dissatisfied.
- 6. I would be very dissatisfied.

2a. [Attribute Framing – Positive] The company *Intermail.com* ships online orders in the mail, and 95% of their orders arrive on time. How would you rate this company's shipping speed?

- 1. Very good performance
- 2. Good performance
- 3. Somewhat good performance
- 4. Somewhat poor performance
- 5. Poor performance
- 6. Very poor performance

2b. [Attribute Framing – Negative] The company *Intermail.com* ships online orders in the mail, and 5% of their orders arrive late. How would you rate this company's shipping speed?

- 1. Very good performance
- 2. Good performance
- 3. Somewhat good performance
- 4. Somewhat poor performance
- 5. Poor performance
- 6. Very poor performance

3a. [Attribute Framing – Positive] A high school student received the following grades: 76% correct on the midterm exam and 94% correct on the final exam. How would you rate this high school student's overall performance in the course?

- 1. Very good performance
- 2. Good performance
- 3. Somewhat good performance
- 4. Somewhat poor performance

- 5. Poor performance
- 6. Very poor performance

3b. [Attribute Framing – Negative] A high school student received the following grades: 24% incorrect on the midterm exam and 6% incorrect on the final exam. How would you rate this high school student's overall performance in the course?

- 1. Very good performance
- 2. Good performance
- 3. Somewhat good performance
- 4. Somewhat poor performance
- 5. Poor performance
- 6. Very poor performance

4a. [Attribute Framing – Positive] A new cancer treatment has been developed for lung cancer and results have shown that the treatment has a five-year survival rate of 85%. How satisfied would you be with this new cancer treatment?

- 1. I would be very satisfied.
- 2. I would be satisfied.
- 3. I would be slightly satisfied.
- 4. I would be slightly dissatisfied.
- 5. I would be dissatisfied.
- 6. I would be very dissatisfied.

4b. [Attribute Framing – Negative] A new cancer treatment has been developed for lung cancer and results have shown that the treatment has a five-year death rate of 15%. How satisfied would you be with this new cancer treatment?

- 1. I would be very satisfied.
- 2. I would be satisfied.
- 3. I would be slightly satisfied.
- 4. I would be slightly dissatisfied.
- 5. I would be dissatisfied.
- 6. I would be very dissatisfied.

5a. [Attribute Framing – Positive] You are planning an upcoming trip that requires that you take a flight. You are evaluating possible airlines and a particular airline that you are evaluating reports that their flights are on-time 88% of the time.

How satisfied would you be with this airlines' performance?

- 1. I would be very satisfied.
- 2. I would be satisfied.
- 3. I would be slightly satisfied.
- 4. I would be slightly dissatisfied.
- 5. I would be dissatisfied.

___ 6. I would be very dissatisfied.

5b. [Attribute Framing – Negative] You are planning an upcoming trip that requires that you take a flight. You are evaluating possible airlines and a particular airline that you are evaluating reports that their flights are late 12% of the time.

How satisfied would you be with this airlines' performance?

- ___ 1. I would be very satisfied.
- ___ 2. I would be satisfied.
- ___ 3. I would be slightly satisfied.
- ___ 4. I would be slightly dissatisfied.
- ___ 5. I would be dissatisfied.
- ___ 6. I would be very dissatisfied.

6a. [Risky Choice - Positive Frame] Imagine that 1000 birds have been affected by an oil spill, and they will die if they are not moved to a different location. Scientists have two methods to transport birds that have been affected by an oil spill in their habitat:

Method A: 750 birds will be saved.

Method B: There is a 75% chance that 1000 birds will be saved and a 25% chance that no birds will be saved.

Which method would you pick?

- 1. I would definitely pick Method A
- 2. I would pick Method A
- 3. I think I would pick Method A
- 4. I think I would pick Method B
- 5. I would pick Method B
- 6. I would definitely pick Method B

6b. [Risky Choice - Negative Frame] Imagine that 1000 birds have been affected by an oil spill, and they will die if they are not moved to a different location. Scientists have two methods to transport birds that have been affected by an oil spill in their habitat:

Method A: 250 birds will die.

Method B: There is a 25% chance that 1000 birds will die and a 75% chance that no birds will die.

Which method would you pick?

- 1. I would definitely pick Method A
- 2. I would pick Method A
- 3. I think I would pick Method A
- 4. I think I would pick Method B
- 5. I would pick Method B

6. I would definitely pick Method B

7a. [Risky Choice - Positive Frame] The Trichotoledo virus affects dogs and this virus is expected to kill 200 dogs. There are two vaccines available to treat these dogs:

Vaccine A: 50 dogs will be saved.

Vaccine B: There is a 25% chance that 200 dogs will be saved and a 75% chance that no dogs will be saved.

Which vaccine would you pick?

1. I would definitely pick Vaccine A
2. I would pick Vaccine A
3. I think I would pick Vaccine A
4. I think I would pick Vaccine B
5. I would pick Vaccine B
6. I would definitely pick Vaccine B

7b. [Risky Choice - Negative Frame] The Trichotoledo virus affects dogs and this virus is expected to kill 200 dogs. There are two vaccines available to treat these dogs:

Vaccine A: 150 dogs will die.

Vaccine B: There is a 75% chance that 200 dogs will be lost and a 25% chance that no dogs will die.

Which vaccine would you pick?

1. I would definitely pick Vaccine A
2. I would pick Vaccine A
3. I think I would pick Vaccine A
4. I think I would pick Vaccine B
5. I would pick Vaccine B
6. I would definitely pick Vaccine B

Scoring: Each item pair is scored by subtracting the positive (gain) frame of the pair from the negative (loss). However, because the eventual score is an absolute value, the direction of the subtraction actually does not matter. This is because a framing effect in either direction represents a violation of the principle of descriptive invariance (Stanovich et al., 2016). The absolute value of the difference score represents the score for each item pair. The sum of the absolute difference scores was subtracted from 100 so that higher scores on the subtest indicates more avoidance of framing.

Knowledge Calibration Subtest

Instructions: In this task we would like you to answer some questions on many different topics. For each question, please choose which answer is correct AND choose how certain you are of your answer.

Here is an example:

What is the last name of the scientist who invented dynamite?

- A. Nobel
- B. Curie

How certain are you of your answer?

| | | | | |

50% chance that I answered correctly.	60% chance that I answered correctly.	70% chance that I answered correctly.	80% chance that I answered correctly.	90% chance that I answered correctly.	100% chance that I answered correctly.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

50% chance means that you are just guessing. 100% chance means that you are certain.

If you think the answer is Nobel, and you are 80% certain, you would answer like this:

- A. Nobel
- B. Curie

| | | | | |

50% chance that I answered correctly.	60% chance that I answered correctly.	70% chance that I answered correctly.	80% chance that I answered correctly.	90% chance that I answered correctly.	100% chance that I answered correctly.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please answer the following questions. Remember to choose the answer you think is correct and indicate how certain you are of your answer for each question. [Note: Each item below was followed by the confidence rating scale]

1. What is the longest river in South America?

- A. Amazon*
- B. Nile

2. For which country is the yen the monetary unit?

- A. China
- B. Japan*

3. What is the last name of the man who first studied genetic inheritance in plants?

- A. Darwin
- B. Mendel*

4. What is the proper name for a badminton bird?

- A. Birdie
- B. Shuttlecock*

5. What is the last name of the author who wrote “Oliver Twist”?

- A. Dickens*
- B. Twain

6. What is the last name of the man who invented the phonograph?

- A. Bell
- B. Edison*

7. What is the name of an inability to sleep?

- A. Sleepwalking
- B. Insomnia*

8. What is the name of the largest ocean on earth?

- A. Atlantic
- B. Pacific*

9. What is the capital of Denmark?

- A. Oslo
- B. Copenhagen*

10. What animal runs the fastest?

- A. Cheetah*
- B. Lion

11. What is the term for hitting a volleyball down hard into the opponents court?

- A. Spike*
- B. Hit

12. What is the name of the brightest star in the sky excluding the sun?

- A. Sirius*
- B. North Star

13. What is the name of the largest desert on earth?

- A. Antarctica*
- B. Great Sandy Desert

14. What is the name of the mountain range that separates Asia from Europe?

- A. Ural*
- B. Alps

15. What is the unit of sound intensity?

- A. Hertz
- B. Decibel*

16. What is the name of deer meat?

- A. Mutton
- B. Venison*

17. What is the name of the organ that produces insulin?

- A. Pancreas*
- B. Liver

18. What is the name of the automobile instrument that measures mileage (total distance travelled)?

- A. Odometer*
- B. Speedometer

19. What is the name of the bird that cannot fly and is the largest bird on earth?

- A. Ostrich*
- B. Penguin

20. What is the name for a cyclone that occurs over land?

- A. Hurricane
- B. Tornado*

21. What is the largest planet in the solar system?

- A. Saturn
- B. Jupiter*

22. What is the name of a dried plum?

- A. Prune*
- B. Raisin

23. In which sport is the Stanley Cup awarded?

- A. Soccer
- B. Hockey*

24. What is the name of the liquid portion of whole blood?

- A. Plasma*
- B. Platelets

25. What kind of metal is associated with a 50th wedding anniversary?

- A. Gold*
- B. Silver

26. What is the last name of the scientist who proposed the theory of relativity?

- A. Einstein*
- B. Newton

27. What is the name of the three-leaf clover that is the emblem of Ireland?

- A. Shamrock*
- B. Clover

28. In which country is Buenos Aires the capital?

- A. Argentina*
- B. Spain

29. What is the name of the mountain range in which Mount Everest is located?

- A. Himalayas*
- B. Appalachian

30. What is the name of an airplane without an engine?

- A. Jet
- B. Glider*

31. For which country is the rupee the monetary unit?

- A. France
- B. India*

32. What are people who make maps called?

- A. Geographer
- B. Cartographer*

33. What is the name of the spearlike object that is thrown during a track meet?

- A. Javelin*
- B. Pole Vault

34. What is the name of the ocean that is located between Africa and Australia?

- A. Pacific
- B. Indian*

35. Which breed of cat has blue eyes?

- A. Siamese*
- B. Calico

36. Which country was the first to use gunpowder?

- A. England
- B. China*

37. Which of the following ingredients is used for baking to make bread rise?

- A. Yeast*
- B. Baking soda

38. For which country is the rubel the monetary unit?

- A. Russia*
- B. India

39. Who was the first ruler of the Holy Roman Empire?

- A. Caesar
- B. Charlemagne*

40. Which of the following planets is closer to the sun?

- A. Earth
- B. Venus*

41. Which of the following instruments is used to measure body temperature?

- A. Thermometer*
- B. Barometer

42. Of which country is Budapest the capital?

- A. Slovakia
- B. Hungary*

Scoring:

Calculate the mean percentage confidence judgment minus the mean percentage correct. Take the absolute value of this difference score and subtract from 100 so that higher scores on the subtest indicate better knowledge calibration.

Rational Temporal Discounting Subtest

The items in this subtest are run consecutively.

Imagine that you are offered a choice between receiving a **specific amount of money now OR a different amount later**. Indicate your preference for each of the following:

1) \$1 now or \$10 in 2 days?

Strongly Prefer \$1 Now	Slightly Prefer \$1 Now	Slightly Prefer \$10 in 2 Days	Strongly Prefer \$10 in 2 Days
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2) \$2.50 now or \$10 in 2 days?

Strongly Prefer \$2.50 Now	Slightly Prefer \$2.50 Now	Slightly Prefer \$10 in 2 Days	Strongly Prefer \$10 in 2 Days
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3) \$5 now or \$10 in 2 days?

Strongly Prefer \$5 Now	Slightly Prefer \$5 Now	Slightly Prefer \$10 in 2 Days	Strongly Prefer \$10 in 2 Days
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4) \$7.50 now or \$10 in 2 days?

Strongly Prefer \$7.50 Now	Slightly Prefer \$7.50 Now	Slightly Prefer \$10 in 2 Days	Strongly Prefer \$10 in 2 Days
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5) \$9.99 now or \$10 in 2 days? (**FILLER ITEM**)

Strongly Prefer \$9.99 Now	Slightly Prefer \$9.99 Now	Slightly Prefer \$10 in 2 Days	Strongly Prefer \$10 in 2 Days
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6) \$24.99 now or \$25 in 1 month? (**FILLER ITEM**)

Strongly Prefer \$24.99 Now	Slightly Prefer \$24.99 Now	Slightly Prefer \$25 in 1 Month	Strongly Prefer \$25 in 1 Month
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7) \$24.50 now or \$25 in 1 month? (*FILLER ITEM*)

Strongly Prefer \$24.50 Now	Slightly Prefer \$24.50 Now	Slightly Prefer \$25 in 1 Month	Strongly Prefer \$25 in 1 Month
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8) \$15 now or \$25 in 1 month?

Strongly Prefer \$15 Now	Slightly Prefer \$15 Now	Slightly Prefer \$25 in 1 Month	Strongly Prefer \$25 in 1 Month
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9) \$12.50 now or \$25 in 1 month?

Strongly Prefer \$12.50 Now	Slightly Prefer \$12.50 Now	Slightly Prefer \$25 in 1 Month	Strongly Prefer \$25 in 1 Month
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10) \$10 now or \$25 in 1 month?

Strongly Prefer \$10 Now	Slightly Prefer \$10 Now	Slightly Prefer \$25 in 1 Month	Strongly Prefer \$25 in 1 Month
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11) \$7.50 now or \$25 in 1 month?

Strongly Prefer \$7.50 Now	Slightly Prefer \$7.50 Now	Slightly Prefer \$25 in 1 Month	Strongly Prefer \$25 in 1 Month
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12) \$5 now or \$25 in 1 month?

Strongly Prefer \$5 Now	Slightly Prefer \$5 Now	Slightly Prefer \$25 in 1 Month	Strongly Prefer \$25 in 1 Month
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13) \$2.50 now or \$25 in 1 month?

Strongly Prefer \$2.50 Now	Slightly Prefer \$2.50 Now	Slightly Prefer \$25 in 1 Month	Strongly Prefer \$25 in 1 Month
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14) \$1 now or \$25 in 1 month?

Strongly Prefer \$1 Now	Slightly Prefer \$1 Now	Slightly Prefer \$25 in 1 Month	Strongly Prefer \$25 in 1 Month
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15) \$1 now or \$100 in 3 months?

Strongly Prefer \$1 Now	Slightly Prefer \$1 Now	Slightly Prefer \$100 in 3 Months	Strongly Prefer \$100 in 3 Months
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16) \$2.50 now or \$100 in 3 months?

Strongly Prefer \$2.50 Now	Slightly Prefer \$2.50 Now	Slightly Prefer \$100 in 3 Months	Strongly Prefer \$100 in 3 Months
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17) \$5 now or \$100 in 3 months?

Strongly Prefer \$5 Now	Slightly Prefer \$5 Now	Slightly Prefer \$100 in 3 Months	Strongly Prefer \$100 in 3 Months
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18) \$10 now or \$100 in 3 months?

Strongly Prefer \$10 Now	Slightly Prefer \$10 Now	Slightly Prefer \$100 in 3 Months	Strongly Prefer \$100 in 3 Months
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19) \$25 now or \$100 in 3 months?

Strongly Prefer \$25 Now	Slightly Prefer \$25 Now	Slightly Prefer \$100 in 3 Months	Strongly Prefer \$100 in 3 Months
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20) \$50 now or \$100 in 3 months?

Strongly Prefer \$50 Now	Slightly Prefer \$50 Now	Slightly Prefer \$100 in 3 Months	Strongly Prefer \$100 in 3 Months
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21) \$75 now or \$100 in 3 months?

Strongly Prefer \$75 Now	Slightly Prefer \$75 Now	Slightly Prefer \$100 in 3 Months	Strongly Prefer \$100 in 3 Months
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22) \$97.50 now or \$100 in 3 months? (**FILLER ITEM**)

Strongly Prefer \$97.50 Now	Slightly Prefer \$97.50 Now	Slightly Prefer \$100 in 3 Months	Strongly Prefer \$100 in 3 Months
--------------------------------	--------------------------------	--------------------------------------	--------------------------------------

23) \$99 now or \$100 in 3 months? (**FILLER ITEM**)

Strongly Prefer \$99 Now	Slightly Prefer \$99 Now	Slightly Prefer \$100 in 3 Months	Strongly Prefer \$100 in 3 Months
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24) \$1980 now or \$2000 in 365 days? (**FILLER ITEM**)

Strongly Prefer \$1980 Now	Slightly Prefer \$1980 Now	Slightly Prefer \$2000 in 365 Days	Strongly Prefer \$2000 in 365 Days
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25) \$1950 now or \$2000 in 365 days? (**FILLER ITEM**)

Strongly Prefer \$1950 Now	Slightly Prefer \$1950 Now	Slightly Prefer \$2000 in 365 Days	Strongly Prefer \$2000 in 365 Days
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26) \$1900 now or \$2000 in 365 days? (**FILLER ITEM**)

Strongly Prefer \$1900 Now	Slightly Prefer \$1900 Now	Slightly Prefer \$2000 in 365 Days	Strongly Prefer \$2000 in 365 Days
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27) \$1500 now or \$2000 in 365 days?

Strongly Prefer \$1500 Now	Slightly Prefer \$1500 Now	Slightly Prefer \$2000 in 365 Days	Strongly Prefer \$2000 in 365 Days
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28) \$1250 now or \$2000 in 365 days?

Strongly Prefer \$1250 Now	Slightly Prefer \$1250 Now	Slightly Prefer \$2000 in 365 Days	Strongly Prefer \$2000 in 365 Days
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29) \$1000 now or \$2000 in 365 days?

Strongly Prefer \$1000 Now	Slightly Prefer \$1000 Now	Slightly Prefer \$2000 in 365 Days	Strongly Prefer \$2000 in 365 Days
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30) \$750 now or \$2000 in 365 days?

Strongly Prefer \$750 Now	Slightly Prefer \$750 Now	Slightly Prefer \$2000 in 365 Days	Strongly Prefer \$2000 in 365 Days
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31) \$500 now or \$2000 in 365 days?

Strongly Prefer \$500 Now	Slightly Prefer \$500 Now	Slightly Prefer \$2000 in 365 Days	Strongly Prefer \$2000 in 365 Days
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32) \$250 now or \$2000 in 365 days?

Strongly Prefer \$250 Now	Slightly Prefer \$250 Now	Slightly Prefer \$2000 in 365 Days	Strongly Prefer \$2000 in 365 Days
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33) \$100 now or \$2000 in 365 days?

Strongly Prefer \$100 Now	Slightly Prefer \$100 Now	Slightly Prefer \$2000 in 365 Days	Strongly Prefer \$2000 in 365 Days
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34) \$50 now or \$2000 in 365 days?

Strongly Prefer \$50 Now	Slightly Prefer \$50 Now	Slightly Prefer \$2000 in 365 Days	Strongly Prefer \$2000 in 365 Days
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35) \$20 now or \$2000 in 365 days?

Strongly Prefer \$20 Now	Slightly Prefer \$20 Now	Slightly Prefer \$2000 in 365 Days	Strongly Prefer \$2000 in 365 Days
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Scoring:

27 of the items are scored and 8 filler items are not scored. For the scored items, score 1 for “slightly prefer” and score 2 for “strongly prefer” for all delayed choices, and score 0 for immediate/now choices. The 8 filler items are not scored.

Rational Thinking Dispositions

Instructions for thinking disposition scales:

This questionnaire lists a series of statements about various topics. Read each statement and decide whether you agree or disagree with each statement. Choose the response that best describes your opinion. There are no right or wrong answers, so do not spend too much time deciding on an answer. The first thing that comes to mind is probably the best response.

Each item was followed by the following rating scale:

Disagree Strongly	Disagree Moderately	Disagree Slightly	Agree Slightly	Agree Moderately	Agree Strongly
1	2	3	4	5	6

The items from the two thinking disposition scales were intermixed. R refers to reverse-scored items.

Actively Open-Minded Thinking Scale

1. Changing your mind is a sign of weakness. (R)
2. A person should always consider new possibilities.
3. If I think longer about a problem I will be more likely to solve it.
4. Basically, I know everything I need to know about the important things in life. (R)
5. Considering too many different opinions often leads to bad decisions. (R)
6. Solutions to problems usually happen by thinking about them, rather than by waiting for good luck.
7. It's OK to be undecided about some things.
8. It's bad to change how you think about something. (R)
9. Coming to decisions quickly is a sign of wisdom. (R)
10. It doesn't really matter if I get some facts wrong because the facts are always changing anyway. (R)
11. I like to gather many different types of information or evidence before I decide what to do.
12. I don't feel I have to have reasons for what I do. (R)

Deliberative Thinking Scale

1. I enjoy mentally challenging tasks.
2. I find complicated mental tasks boring. (R)
3. I enjoy thinking about why things work the way they do.
4. I pride myself on thinking only as hard as I have to. (R)
5. I avoid tasks that require a lot of hard thinking. (R)
6. I enjoy working on problems that don't have clear-cut solutions.
7. It is satisfying to work on difficult problems.
8. I enjoy spending time on complex problems.
9. Once I've come up with a solution to a problem, it's a waste of time to think further. (R)
10. I don't like trying to solve problems that require a lot of concentration. (R)
11. I enjoy trying to figure out new solutions to problems.
12. If I have to think hard about a problem, I will give up. (R)