Supplement to "The mean, the median and the St. Petersburg paradox": Survey

Survey recipients received a URL that linked to a webpage containing instructions for the survey. The webpage indicated that the survey was called the "Duke Center for Neuroeconomic Studies Gambling Survey." The first page contained the following instructions.

Welcome to the Duke Gambling Survey. Thank you for agreeing to participate.

The survey consists of 16 hypothetical questions. Nonetheless, we hope that you will answer as if your money were really at stake.

Please take your time and answer these questions carefully. Most people find that the entire survey takes about 10 or 15 minutes.

For each question, we ask you how much you would pay for a given gamble. You may give any answer, including fractional amounts and verbal descriptions.

If you wish to explain your reasoning, we are interested to hear about it. Below each answer there is a box to enter your comments. Note that this section is optional.

Click here to begin the survey.

After clicking the link, respondents were taken to an additional entry page. For the first survey, this page read as follows.

The first 11 gambles will have the following structure:

You continue to flip a coin until it comes up heads. As soon as it comes up heads, you get paid. They payment you get depends on the number of times it came up tails before heads appeared. The probability of heads on the first toss is 50%; the probability of heads on the second toss is 25%; the probability of heads on the third toss is 12.5%, and so on.

Click here to continue.

For the second survey, this page read as follows.

The first 5 gambles will have the following structure:

You continue to flip a coin until it comes up heads. As soon as it comes up heads, you get paid. They payment you get depends on the number of times it came up tails before heads appeared. The probability of heads on the first toss is 50%; the probability of heads on the second toss is 25%; the probability of heads on the third toss is 12.5%, and so on.

Click here to continue.

Each subsequent page contained a single question. The top of each page indicated the number of the question, out of 16 (for example, "Question 1/16"). Each question page contained a box for entering a bid value and a box for entering an explanation. Subjects could not skip questions.

Survey 1 consisted of the following questions.

1. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

2. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$16**. This process repeats until the coin comes up heads, with the payoff for heads **multiplying by 4** each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

3. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails. If the coin comes up tails **10 times in a row**, you will be paid **$1024** and the gamble will end.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

4. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails. If the coin

comes up tails **8 times in a row**, you will be paid **$256** and the gamble will end.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

5. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails. If the coin comes up tails **5 times in a row**, you will be paid **$32** and the gamble will end.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

6. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails. If the coin comes up tails **15 times in a row**, you will be paid **$32,768** and the gamble will end.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

7. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$4**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$8**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$16**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

8. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$0.99**. If it comes up tails, you will flip it again. If it comes up heads, you receive double this (**$1.98**). If it comes up tails, you will flip it again. If it comes up heads, you receive double this (**$3.96**). This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

9. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive an extra five dollars (**$6**). If it comes up tails, you will flip it again. If it comes up heads, you receive another extra five dollars (**$11**). This process repeats until the coin comes up heads, with the payoff for heads increasing by **$5** each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

10. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **1 cent (1¢)**. If it comes up tails, you will flip it again. If it comes up heads, you receive double this (**2¢**). If it comes up tails, you will flip it again. If it comes up heads, the payoff will double again (**4¢**). This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

11. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **50 cents (50¢)**. If it comes up tails, you will flip it again. If it comes up heads, you receive double this (**$1**). If it comes up tails, you will flip it again. If it comes up heads, the payoff will double again (**$2**). This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

12. Consider the following gamble:
There is a 20% chance you will receive $0
There is a 60% chance you will receive $10
There is a 20% chance you will receive $100

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

13. Consider the following gamble:
There is a 20% chance you will receive $0
There is a 60% chance you will receive $20

There is a 20% chance you will receive $70

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

14. Consider the following gamble:
There is a 20% chance you will receive $0
There is a 60% chance you will receive $26
There is a 20% chance you will receive $52

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

15. Consider the following gamble:
There is a 70% chance you will receive $5
There is a 20% chance you will receive $30
There is a 10% chance you will receive $50

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

16. Consider the following gamble:
There is a 70% chance you will receive $10
There is a 20% chance you will receive $15
There is a 10% chance you will receive $35

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

Survey 2 consisted of the following questions.

1. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails. This gamble will occur only once.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

2. Consider the following gamble:
This gamble is the same as the last one, except that the whole process is repeated **10** times. Each time, you may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

3. Consider the following gamble:
This gamble is the same as the last one, except that the whole process is repeated **100** times.

Each time, you may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

4. Consider the following gamble:
This gamble is the same as the last one, except that the whole process is repeated **1000** times.

Each time, you may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

5. Consider the following gamble:
This gamble is the similar to others, and is only repeated once.

Each time, you may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. If it comes up heads on the next flip, you receive **$8** and the gamble ends.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

6. Consider the following gamble:
There is a 40% chance of $10
There is a 20% chance of $20
There is a 20% chance of $50
There is a 10% chance of $100
This gamble will occur only once.

If the opportunity to play this gamble was on sale, what

is the maximum amount of money that you would pay for it?

7. Consider the following gamble:
There is a 20% chance of $10
There is a 40% chance of $20
There is a 20% chance of $40
There is a 10% chance of $100
This gamble will occur only once.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

8. Consider the following gamble:
There is a 0.1% chance of $10,000
There is a 99.9% chance of $0
This gamble will occur only once.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

9. Consider the following gamble:
There is a 1% chance of $1000
There is a 99% chance of $0
This gamble will occur only once.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

10. Consider the following gamble:
There is a 10% chance of $100
There is a 90% chance of $0
This gamble will occur only once.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

11. Consider the following gamble:
There is a 50% chance of $20
There is a 50% chance of $0
This gamble will occur only once.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

12. Consider the following gamble:
There is a 50% chance you will receive $200
There is a 50% chance you will lose $100
This gamble will occur only once.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

13. Consider the following gamble:
There is a 50% chance you will receive $200
There is a 50% chance you will lose $100
This gamble will be repeated 5 times, and you will receive the combined winnings.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

14. Consider the following gamble:
There is a 50% chance you will receive $200
There is a 50% chance you will lose $100
This gamble will be repeated 100 times, and you will receive the combined winnings.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

15. Consider the following gamble:
There is a 50% chance you will receive $2
There is a 50% chance you will lose $1
This gamble will occur only once.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

16. Consider the following gamble:
There is a 50% chance you will receive $2
There is a 50% chance you will lose $1
This gamble will be repeated 100 times, and you will receive the combined winnings.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

An additional 20 subjects were tested in a variant of the task using real stakes. Subjects were presented with either $5 or $10 (randomly chosen), and told the second portion of the survey would occur in a week.

Script for Petersburg Gamble:

Thank you for coming back to our study.

In the first part of this survey, I will ask you how much of your own money you wish to wager on a gamble. I will describe the gamble to you, and then I will ask you how much you feel the gamble is worth.

But instead of just asking you, we will perform a special kind of auction that is often used by economists to determine how much a gamble is worth to people. The way it

works is like this. I have written a randomly chosen number on this folded piece of paper. This number is chosen from the possible outcomes of the gamble. You can have as long as you like to pick an amount you feel the gamble is worth. Then, we will open the piece of paper. If your number is higher, you have to pay me the amount on the paper (that is, the lower amount) and if your number is lower, the gamble will not occur. This type of auction is structured so that your optimal strategy is to choose the dollar value that you feel the gamble is worth.

(Time for questions)

The gamble works like this, as described in Question 1 [point to Question 1]. You can flip a coin. If it comes up heads, you get a dollar. If it comes up tails, we will flip again. If it then comes up heads, you get two dollars, and if it comes up tails, we flip again. If it then comes up heads, you get four dollars, and if it comes up tails, we flip again. If it then comes up heads, you get eight dollars, and if it comes up tails, we flip again, and so on.

Before you make your decision, I want to make sure you understand the gamble and the various probabilities fully. There are no tricks, and you can ask anything you want.

(Time for questions)

Some people like to take a few minutes to do some calculations. This paper and pen are for you in case you want that. I will be working here. Just let me know when you are ready.

Following this gamble, subjects were asked to answer a series of hypothetical questions by writing their answers on a piece of paper. This survey was printed, and not read aloud to the subjects. These questions were used to directly compare the behavior of the subjects with those in the earlier internet survey. In addition, the final question (Question 16) was used to test that they understood the probabilities associated with the gamble.

Welcome to the Duke Gambling Survey. Thank you for agreeing to participate.

The survey consists of 16 hypothetical questions. Nonetheless, we hope that you will answer as if your money were really at stake.

Please take your time and answer these questions carefully.

For each question, we ask you how much you would pay for a given gamble. You may give any answer, including fractional amounts and verbal descriptions.

In general:

You continue to flip a coin until it comes up heads. As soon as it comes up heads, you get paid. They payment you get depends on the number of times it came up tails before heads appeared. The probability of heads on the first toss is 50%; the probability of heads on the second toss is 25%; the probability of heads on the third toss is 12.5%, and so on.

1. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

2. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$16**. This process repeats until the coin comes up heads, with the payoff for heads **multiplying by 4** each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

3. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails. If the coin comes up tails **10 times in a row**, you will be paid **$1024** and the gamble will end.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

4. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails. If the coin comes up tails **8 times in a row**, you will be paid **$256** and the gamble will end.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

5. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails. If the coin comes up tails **5 times in a row**, you will be paid **$32** and the gamble will end.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

6. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails. If the coin comes up tails **15 times in a row**, you will be paid **$32,768** and the gamble will end.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

7. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$4**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$8**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$16**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

8. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$0.99**. If it comes up tails, you will flip it again. If it comes up heads, you receive double this **($1.98)**. If it comes up tails, you will flip it again. If it comes up heads, you receive double this **($3.96)**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

9. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive an extra five dollars **($6)**. If it comes up tails, you will flip it again. If it comes up heads, you receive another extra five dollars **($11)**. This process repeats until the coin comes up heads, with the payoff for heads increasing by **$5** each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

10. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **1 cent (1¢)**. If it comes up tails, you will flip it again. If it comes up heads, you receive double this **(2¢)**. If it comes up tails, you will flip it again. If it comes up heads, the payoff will double again **(4¢)**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

11. Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **50 cents (50¢)**. If it comes up tails, you will flip it again. If it comes up heads, you receive double this **($1)**. If it comes up tails, you will flip it again. If it comes up heads, the payoff will double again **($2)**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

12. Consider the following gamble:
This gamble is the same as the last one, except that the whole process is repeated **10** times. Each time, you may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

13. Consider the following gamble:
This gamble is the same as the last one, except that the whole process is repeated **100** times.

Each time, you may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

14. Consider the following gamble:
This gamble is the same as the last one, except that the whole process is repeated **1000** times.

Each time, you may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. This process repeats until the coin comes up heads, with the payoff for heads doubling each time it comes up tails.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

15. Consider the following gamble:
This gamble is the similar to others, and is only repeated once.

Each time, you may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. If it comes up heads on the next flip, you receive **$8** and the gamble ends.

If the opportunity to play this gamble was on sale, what is the maximum amount of money that you would pay for it?

16. The following question repeats question 1:

You continue to flip a coin until it comes up heads. As soon as it comes up heads, you get paid. They payment you get depends on the number of times it came up tails before heads appeared. The probability of heads on the first toss is 50%; the probability of heads on the second toss is 25%; the probability of heads on the third toss is 12.5%, and so on.

Consider the following gamble:
You may flip a coin. If it comes up heads, you receive **$1**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$2**. If it comes up tails, you will flip it again. If it comes up heads, you receive **$4**. This process repeats until the coin comes up heads, with the payoff for

heads doubling each time it comes up tails.

What is the probability that this gamble will provide $0?
What is the probability that this gamble will provide $1?
What is the probability that this gamble will provide $2?
What is the probability that this gamble will provide $4?
What is the probability that this gamble will provide $8?
What is the probability that this gamble will provide $16?
What is the probability that this gamble will provide $32?
What is the probability that this gamble will provide $64?