# Do women give up competing more easily? Evidence from the lab and the Dutch Math Olympiad<sup>\*</sup>

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#### Abstract

We use lab experiments and field data from the Dutch Math Olympiad to show that women are more likely than men to stop competing if they lose. In a math competition in the lab, women are much less likely than men to choose competition again after losing in the first round. In the Math Olympiad, girls, but not boys, who fail to make the second round are less likely to compete again one year later. This gender difference in the reaction to competition outcomes may help to explain why fewer women make it to the top in business and academia.

**JEL:** C91, D03, J01, J16

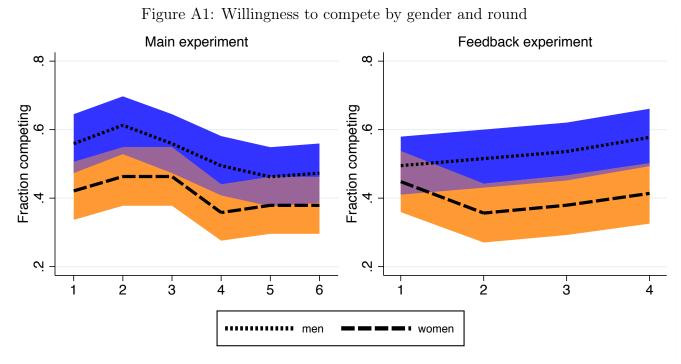
**Keywords**: willingness to compete, gender, career decisions, lab experiment, regression discontinuity

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### Online appendix

### Raw gender gap in willingness to compete over the rounds



Note: Shaded areas represent 90-percent confidence intervals. The main experiment consisted of 6 rounds of 3 minutes each and the feedback experiment consisted of 4 rounds of 4 minutes each.

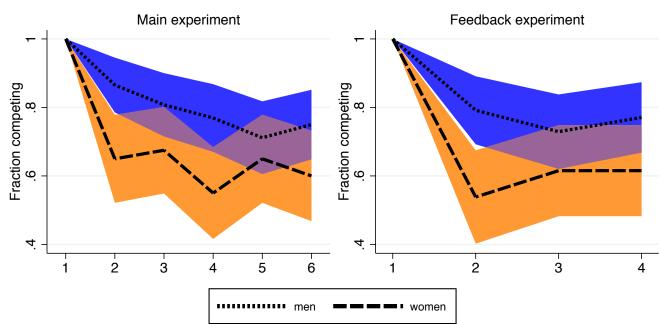


Figure A2: Willingness to compete by gender and round (participants who choose competition in round 1)

Note: Shaded areas represent 90-percent confidence intervals. The sample consists of those participants who choose competition in round 1. Main experiment: N=92 (40 women and 52 men). Feedback experiment: N=87 (39 women and 48 men). The main experiment consisted of 6 rounds of 3 minutes each and the feedback experiment consisted of 4 rounds of 4 minutes each.

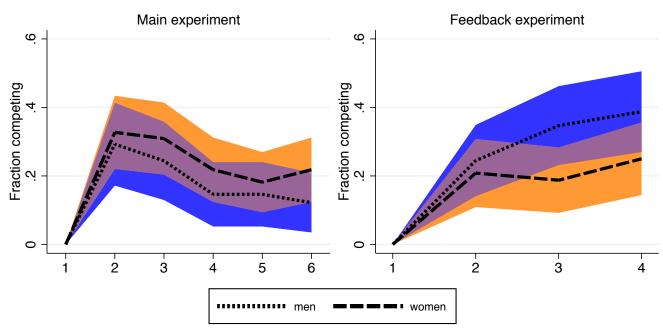


Figure A3: Willingness to compete by gender and round (participants who choose piece rate in round 1)

Note: Shaded areas represent 90-percent confidence intervals. The sample consists of those participants who choose piece rate in round 1. Main experiment: N=96 (55 women and 41 men). Feedback experiment: N=97 (48 women and 49 men). The main experiment consisted of 6 rounds of 3 minutes each and the feedback experiment consisted of 4 rounds of 4 minutes each.

### Interacted models

	(1)		(2)
Competition in rou	nd 1	Piece rate in round 1	
Female	-0.065	Female	0.001
	(0.056)		(0.062)
Round 1 loser	-0.240*	Round 1 winner/top	0.004
	(0.127)		(0.166)
Female $x$ loser	-0.349**	Female $x$ winner/top	0.167
	(0.145)		(0.143)
Female $x$ feedback	0.037	Female $x$ feedback	0.028
	(0.091)		(0.079)
Round 1 loser $x$ feedback	-0.045	Round 1 winner/top $x$ feedback	$0.560^{***}$
	(0.176)		(0.189)
Female $x$ loser $x$ feedback	0.076	Female $x$ winner/top $x$ feedback	-0.454**
	(0.192)		(0.183)
Score fixed effects			
Round 1 rank			
Observations	721		771
Individuals	179		193

Table A1: Difference of the effect of the round 1 outcome on subsequent choices across experiments

### Choices over the rounds by gender and competition outcome in round 1

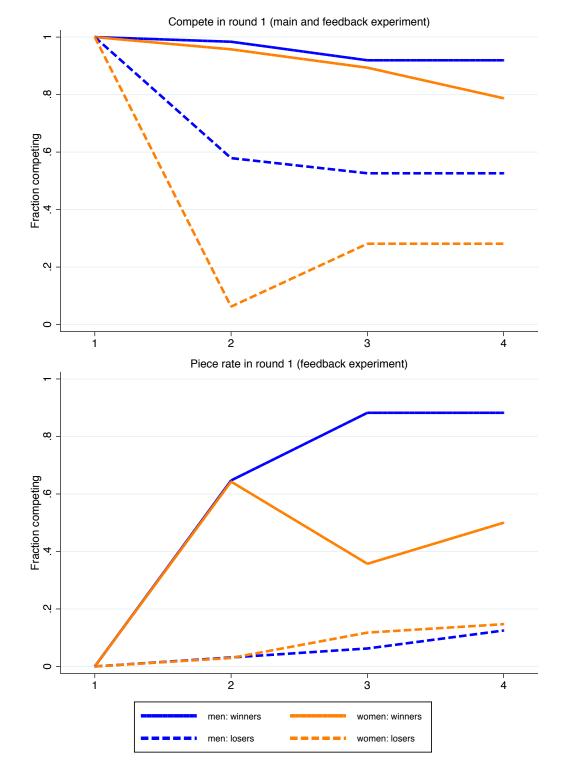


Figure A4: Willingness to compete by gender, round and competition outcome in round 1

#### Gender difference in expected forgone earnings

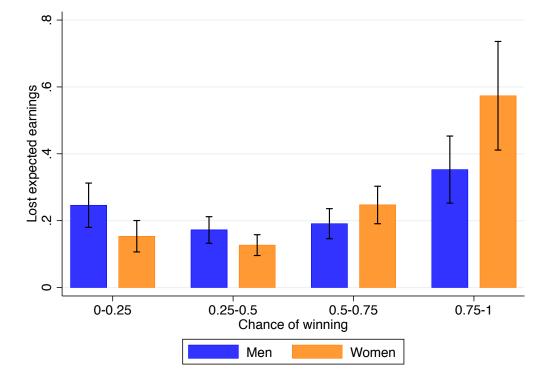
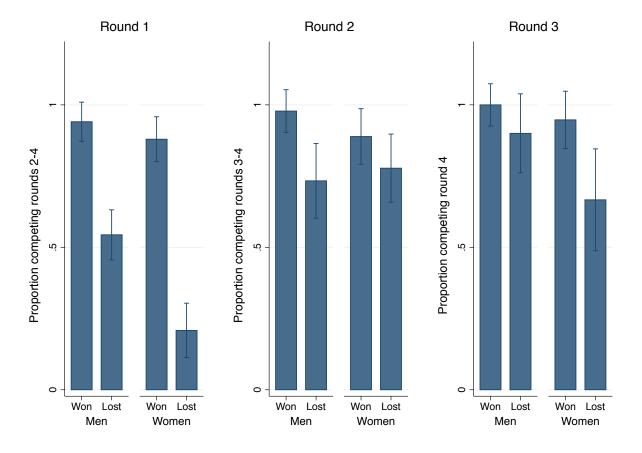


Figure A5: Average lost earnings over all rounds by gender and relative performance

Note: The graph shows average lost earnings relative to the expected earnings resulting from the optimal choice given performance. Pooled sample from the main and feedback experiments (rounds 2 to 4). Error bars represent 90% confidence intervals.

#### Effect of competition outcomes in later rounds

Figure A6: Average number of times competition is chosen in subsequent rounds by gender and competition outcome in each round (pooled sample)

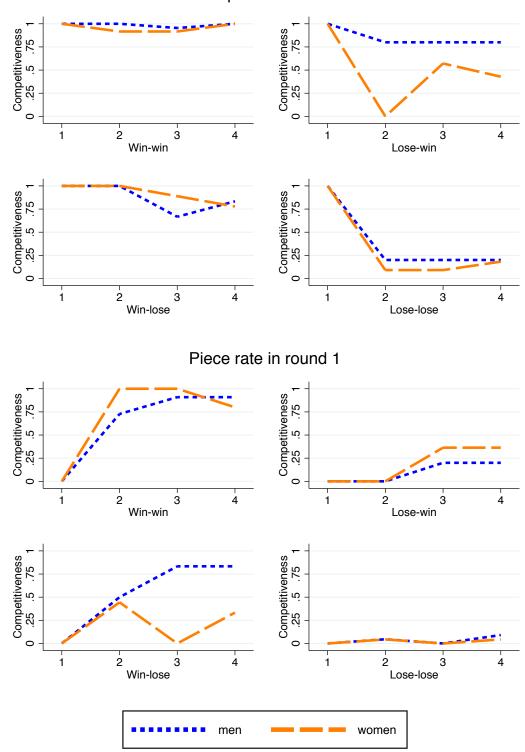


Note: The sample in each subgraph consists of participants who competed and won in all previous rounds. The bars show the average number of times that participants chose to compete over the subsequent rounds using the pooled sample from the main and feedback experiments (rounds 2 to 4). Error bars represent 90% confidence intervals.

	(1)	(2)	(3)	(4)	(5)	(6)
	Rou	nd 1	Rou	nd 2	Ro	und 3
	All	Top	All	Top	All	Top
Female	-0.064	-0.099*	-0.060	-0.096	0.015	-0.001
	(0.058)	(0.053)	(0.068)	(0.067)	(0.075)	(0.048)
Loser	-0.245***	-0.145*	-0.183**	-0.155*	-0.032	0.045
	(0.074)	(0.080)	(0.091)	(0.092)	(0.098)	(0.073)
Female $x$ loser	-0.337***	-0.383***	0.111	0.139	-0.242*	-0.305***
	(0.094)	(0.107)	(0.120)	(0.134)	(0.140)	(0.105)
Score FE						
Rank						
N	179	114	106	86	70	60

Table A2: Effect of competition outcomes in each round on subsequent competition entry

Note: The table shows coefficients from OLS regressions of the average choice in subsequent rounds on a gender dummy, a dummy for having lost the competition and the interaction of the two. The sample in each column consists of participants who competed and won in all previous rounds. The sample is the pooled sample from the main and feedback experiments (rounds 2 to 4). The columns marked "Top" restrict the sample to participants who have a higher than 50 percent chance of winning based on their round 1 performance. Score fixed effects and rank mean score and normalised within-session rank in that particular round. Figure A7: Choices over the rounds by choice in round 1 and by competition outcomes in rounds 1 and 2 (feedback experiment)



Compete in round 1

### Beliefs and relative performance over the rounds by gender and competition outcome in round 1

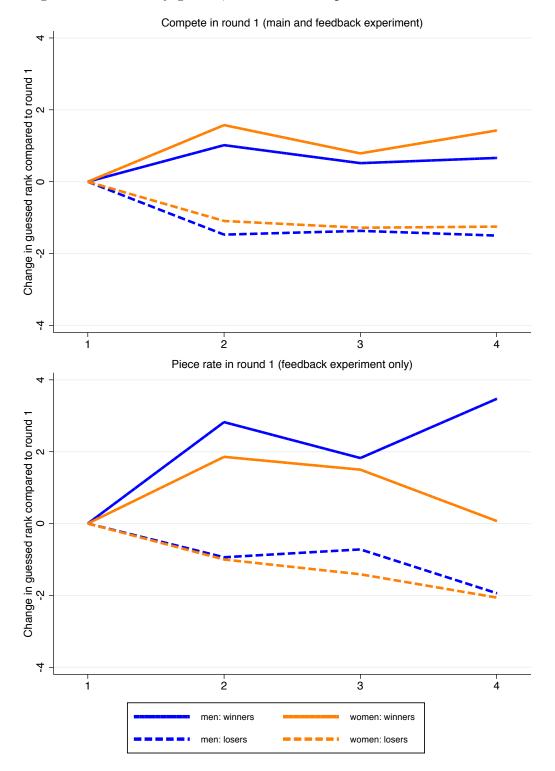


Figure A8: Beliefs by gender, round and competition outcome in round 1

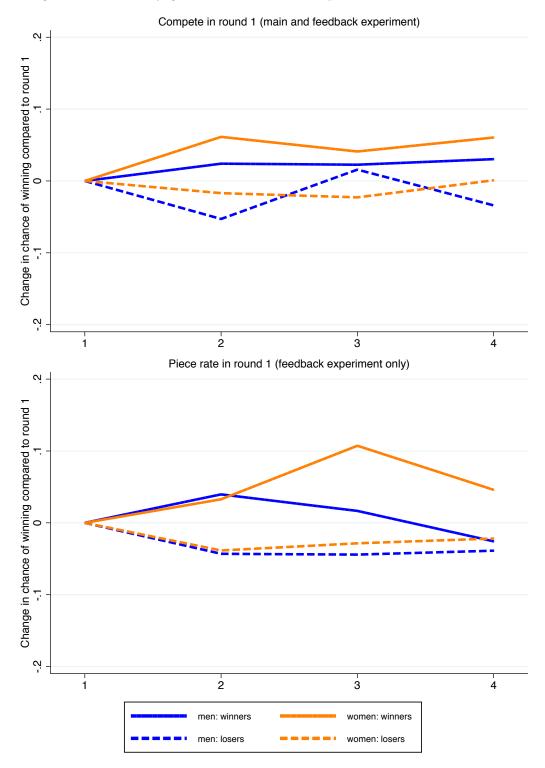


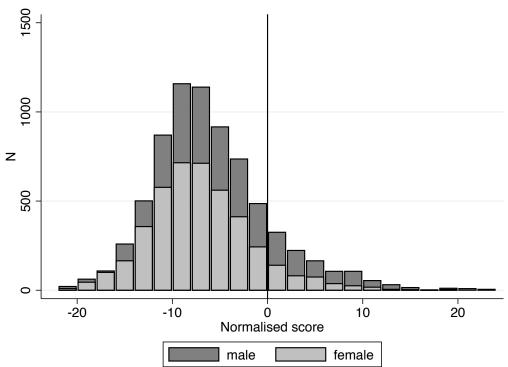
Figure A9: Rank by gender, round and competition outcome in round 1

### Additional RD analyses

Table	e A3: Number of p	participants an	d winners per	year	
	2010	2011	2012	2013	2014
All participants:					
Participants	4150	5258	5612	7424	9161
Invited to 2nd round	696	799	817	801	1008
Participated in 2nd round	599	742	751	744	941
Sample:					
Participants	1534	1987	2054	2777	3239
Invited to 2nd round	252	290	310	275	312
Participated in 2nd round	219	262	282	256	285
Proportion female:					
Participants	0.33	0.37	0.34	0.38	0.40
Invited to 2nd round	0.28	0.28	0.22	0.26	0.31
Participated in 2nd round	0.28	0.28	0.22	0.26	0.29

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Figure A10: Distribution of first-round scores by gender



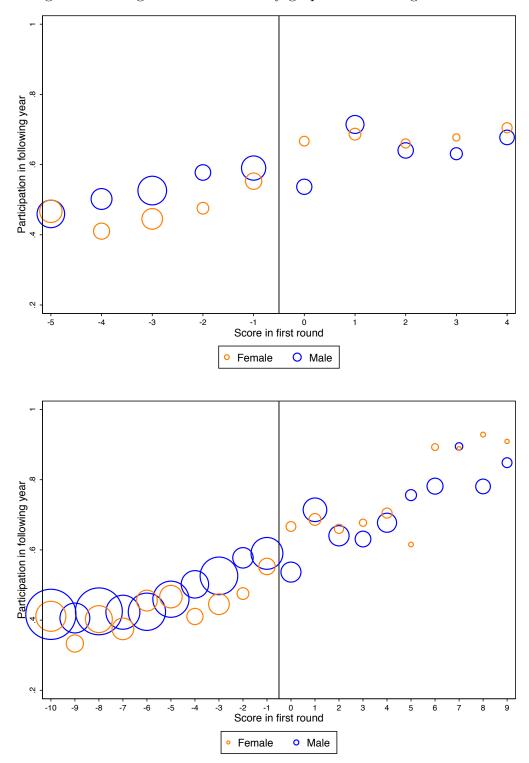
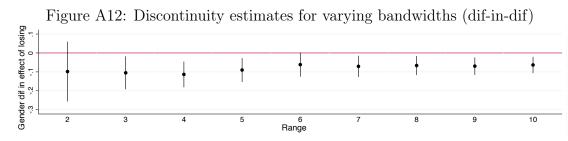


Figure A11: Regression discontinuity graphs without regression lines

Note: The x-axis shows the score in the first round of the Olympiad. Scores are normalised such that a score of 0 or higher means advancing to the second round. The y-axis shows the likelihood for participants in a certain bin to participate again in the first round one year later. The upper panel shows a scatter plot of observations within a range of 5 points of the cutoff separately for male and female participants. The lower panel shows a scatter plot of observations within a range of 10 points of the cutoff. The size of the markers is proportional to the amount of observations in that particular bin (score and gender).



Note: Error bars represent 90% confidence intervals.

	Table A4: Re	gression discontinuit	y results	
	(1)	(2)	(3)	(4)
Range (in points)	-/+ 4	-/+ 8	-/+ 11	-/+ 20
		Dif-in-dif:		
Female	0.036	0.030	0.037	0.026
	(0.034)	(0.024)	(0.022)	(0.021)
Lost	-0.094*	-0.198***	-0.235***	-0.268***
	(0.043)	(0.037)	(0.033)	(0.031)
Female $x$ lost	-0.113**	-0.066**	-0.070**	-0.065***
	(0.036)	(0.029)	(0.025)	(0.024)
	Firs	st-order polynomial:		
Female	0.103	0.004	-0.055	-0.025
	(0.167)	(0.095)	(0.066)	(0.062)
Lost	-0.011	-0.014	-0.045	-0.067
	(0.067)	(0.052)	(0.047)	(0.040)
Female $x$ lost	-0.102	-0.123**	-0.092*	-0.085*
	(0.066)	(0.057)	(0.053)	(0.044)
	Seco	nd-order polynomial:		
Female		0.043	0.002	-0.058
		(0.094)	(0.067)	(0.066)
Lost		0.035	0.025	-0.013
		(0.068)	(0.057)	(0.050)
Female $x$ lost		-0.181**	-0.170**	-0.127**
		(0.077)	(0.063)	(0.062)
N	2646	6356	8709	11545

Table A4: Regression discontinuity results

Note: The table shows coefficients from regressions of a binary indicator for participating again a year later on a female dummy, a dummy for not having made the second round ("lost") and the interaction of the two. Range means the sample selection in terms of points left and right of the cutoff. First-order and second-order regressions also control for within-gender performance percentiles. Clustered standard errors in parentheses.

# Online appendix: Experimental screenshots

### Main experiment

Welcome to this experiment. In this experiment, you will earn money for your performance in a task. The experiment has 6 rounds and the ta is the same in all rounds. Your earnings will be expressed in points. Each point is worth 25 cents.	
In this experiment, you will earn money for your performance in a task. The experiment has 6 rounds and the ta is the same in all rounds.	
In this experiment, you will earn money for your performance in a task. The experiment has 6 rounds and the ta is the same in all rounds.	
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is the same in all rounds.	
	ask
Your earnings will be expressed in points. Each point is worth 25 cents.	
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The task consists of ca	Iculating the sum of five randomly chosen two-digit numbers.	
Example: 24+56+97+7		
	ulator to determine the sums, however, you are welcome to write the numbers down and	t
Back		Next

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Before we	start with the experi	ment, we will give yo	ou 3 minutes to pra-	ctice the task. When everybody is ready.	you are done with	
reading the	e instructions, pleas	e click or. The plac	ace win statt when	everybody is ready.		

			Windows 7				* ☆
92 +	67 +	29 +		44	=	139 seconds	* *

You scored 0 correct answers.

ок

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Now that you know the task, we would like you to guess how good you are at the task compared to the other people who are present in the lab with you.	
We ask you to predict your rank among all participants in the next round. There are 1 people in the lab today including yourself.	
You will receive a bonus of 2 points if your guess is accurate. If your predicted rank is within a range of plus-minus 1 of your true rank in the next round, you receive the bonus.	
What will be your rank in the next round? Please choose a value between 1 (best) and 1 (worst).	
	ок

Windows 7

Next

This is round 1 of the experiment.

Again, you will be given 3 minutes to calculate the correct sum of a series of five 2-digit numbers.

You will be able to choose how you want to be payed for your performance. Depending on your choice, your payment for this round will depend only on your own performance in the task or on your performance compared to the performance of an opponent. This opponent is randomly selected by the computer among the other participants who are in the lab with you. In each round, a new opponent is selected.

On the next screen, y You have the followin	ou will be able to choose how you would like to be paid for your performance in this round. g two options:
1. Piece-rate pay: You	receive 1 point for every correct answer in the task.
	ponent and zero points otherwise (in case of equal performance, the winner is randomly nform you immediately after the task whether you performed better than your opponent or

• • • •	Windows 7	* ☆
	Which compensation scheme do you choose for this round?	
	Piece-rate pay (1 point per correct answer)	
	Competition pay (2 points per correct answer if you win, nothing otherwise)	
	Click OK when you're ready to begin with the task.	
		ок

 Windows 7	× ☆
You scored 1 correct answers.	
You scored higher than your opponent. You therefore won against your opponent.	
	ок

ок

You scored 0 correct answers.

You scored lower than your opponent. You therefore lost against your opponent.

• • • •	Windows 7	* ☆
You scored 1 correct answers.		
		ок

Windows 7

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Next

This is round 2 of the experiment.

Again, you will be given 3 minutes to calculate the correct sum of a series of five 2-digit numbers.

As in the previous round, you will be able to choose how you want to be payed for your performance. Depending on your choice, your payment for this round will depend only on your own performance in the task or on your performance compared to the performance of an opponent. This opponent is randomly selected by the computer among the other participants who are in the lab with you. In each round, a new opponent is selected.

On the next screen, you You have the following t		o be paid for your performance in this round.
1. Piece-rate pay: You re	eceive 1 point for every correct answer in the	e task.
randomly selected oppo	receive 2 points for every correct answer in nent and zero points otherwise (in case of e orm you immediately after the task whether	

 Windows 7	* ☆
Which compensation scheme do you choose for this round?	
Piece-rate pay (1 point per correct answer)	
C Competition pay (2 points per correct answer if you win, nothing otherwise)	
Click OK when you're ready to begin with the task.	
olick of when you're ready to begin with the task.	
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Before we inform you of your earnings, we would like to ask you a few short questions.	
What is your gender? C Male	
What is your age	
	ок

\* ☆

How do you see yourself: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?	
Please choose a value on the scale below, where the value 0 means "unwilling to take risks" and the value 10 means "fully prepared to take risk".	
0=Unwilling to take risks CCCCCCCCCCCCC10=Fully prepared to take risk	
How competitive do you consider yourself to be?	
Please choose a value on the scale below, where the value 0 means "not competitive at all" and the value 10 means "very competitive".	
0=Not competitive at all ocococococoto 10=Very competitive	
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## Feedback experiment

)	Windows 7	
Welcome to this e	experiment.	
In this experiment, is the same in all r	you will earn money for your performance in a task. The experiment has 4 rounds and the task punds.	·
Your earnings will	be expressed in points. Each point is worth 25 cents.	
		Nex

	Windows 7	v \$
The task consists of calc	culating the sum of five randomly chosen two-digit numbers.	
Example: 24+56+97+71-	+45=?	
You cannot use a calcul make use of the provide	lator to determine the sums, however, you are welcome to write the numbers down and d scratch paper.	d
Back		Next

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Before we start with the experiment, we will give you 4 minutes to practice the task. When you are done with reading the instructions, please click OK. The practice will start when everybody is ready.	
reading the institutions, please there or. The plattice will start when everybody is ready.	
Back	ĸ

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Next

This is round 1 of the experiment.

Again, you will be given 4 minutes to calculate the correct sum of a series of five 2-digit numbers.

You will be able to choose how you want to be payed for your performance. Depending on your choice, your payment for this round will depend only on your own performance in the task or on your performance compared to the performance of an opponent. This opponent is randomly selected by the computer among the other participants who are in the lab with you. In each round, a new opponent is selected.

	n, you will be able to choose how you would like to be paid for your performance in this round
You have the follow	wing two options: You receive 1 point for every correct answer in the task.
2. Competition pay	You receive 2 points for every correct answer in the task if you perform better than your opponent and zero points otherwise.
We will inform you	after the task whether you performed better than your opponent or not.

 Windows 7	▼ ‡
Which compensation scheme do you choose for this round?	
Piece-rate pay (1 point per correct answer)     Competition pay (2 points per correct answer if you win, nothing otherwise)	
Click OK when you're ready to begin with the task.	
	ок

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You scored 4 correct answers.	
You scored higher than your opponent. You therefore would have won against your opponent.	
	ок

You scored 0 correct answers.

You did not score higher than your opponent. You therefore would have lost against your opponent.

ок

#### **Risk experiment**

0	Windows 7	
This is round 1 of the e	experiment.	
Again, you will be giver	n 0 minutes to calculate the correct sum of a series of five 2-digit numbers.	
You will be able to cho for this round will depe by the computer.	oose how you want to be paid for your performance. Depending on your choice, yo and only on your own performance in the task or on your performance and a rando	our payment om decision
		4
•	Windows 7	
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1. Piece-rate pay: You receive 1 point for every correct answer in the task.

2. Random pay: With a probability of 70 percent, you receive 2 points for every correct answer in the task. With a probability of 30 percent, you receive nothing.

If you choose random pay, the computer will randomly pick a number from 1 to 100. If this number is smaller than or equal to 70, you win and receive 2 points for every correct answer in the task. If the number picked by the computer is higher than 70, you lose and receive zero points. Each number from 1 to 100 is equally likely to be picked. This means that your chance of winning is exactly 70 percent. We will inform you immediately after the task whether you won or lost.

Back

• • • •	Windows 7	* ‡
	Which compensation scheme do you choose for this round?	
	<ul> <li>Piece-rate pay (1 point per correct answer)</li> <li>Random pay (2 points per correct answer if you win, nothing otherwise)</li> </ul>	
	Click OK when you're ready to begin with the task.	
	Click OK when you're ready to begin with the task.	
		ок

 Windows 7	* ☆
You scored 0 correct answers.	
The random number picked by the computer is 42. You therefore won.	
	ок