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The Impact of Losing in a Competition on the Willingness to seek Further Challenges

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The Impact of Losing in a Competition on the Willingness to seek Further Challenges

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The impact of losing in a competition on the willingness to seek further challenges*

Thomas Buser[†]

July 7, 2014

Abstract

How do people react to setbacks and successes? I introduce a new measure of challenge-seeking to determine the effect of winning and losing in a competition on the willingness to seek further challenges. Participants in a lab experiment compete in two-person tournaments and are then informed of their score and the outcome of the competition. Conditional on the score, winning or losing is random. Participants then have to decide on a performance target for a second round: the higher the target, the higher the potential reward, but participants who do not reach the target earn nothing. I find that, conditional on first round scores, losers go for a more challenging target but perform worse, leading to lower earnings and a higher probability of failure. These findings could have important implications for our understanding of individual career paths. Early outcomes could alter the probability of success and failure in the long term.

JEL: C91, D03, J16, J01

Keywords: competition, challenge seeking, career decisions, laboratory experiment, gender

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1 Introduction

How does people's willingness to seek further challenges react to setbacks and successes? The answer to this question could be important for our understanding of individual career paths. If success and failure have an impact above the rational incorporation of feedback, this could lead to path dependence whereby initial outcomes influence future decision making and therefore change the likelihood of future success. Events early on in a professional career could then lead to exaggerated long-term consequences.

In this study, I specifically look at the case of winning and losing a winner-takes-all competition. Competitive, tournament-like situations regularly occur along typical career paths. Entrance exams to good universities, competitive university degrees, application procedures for sought-after jobs, on-the-job promotions, and an entrepreneur's competition with rival firms are all essentially tournaments in which there are clear winners and losers.

Following the contribution of Lazear and Rosen (1981), the properties of tournaments have been extensively studied, showing that they often provide good incentives for performance.¹ However, the economics literature on the effects of winning and losing in a tournament on subsequent decisions is small. Most relevant to this study is Gill and Prowse (2010) who find that in a series of two-person competitions, people tend to reduce their effort provision following a loss. Apicella, Dreber, and Möllerström (2014), on the other hand, find no effect of the outcome of a rock-paper-scissors competition on subsequent willingness to take risk. In two papers looking into the effect of competition on social preferences, Chen (2010) finds that relative to losers, winners are more likely to donate 10 cents to charity and Buser and Dreber (2013) find that, relative to losers, winners are slightly more generous in a subsequent public good game played with a separate set of people.

I use a lab experiment and introduce a new measure of challenge seeking to measure the impact of winning or losing a competition on the willingness to seek further challenges. In the first round, participants compete in a winner-takes-all competition in a simple arithmetic task against a randomly selected opponent. They then receive feedback both on their score and the outcome of the competition. I take advantage of the fact that, conditional on the score, the outcome of the competition is random. In the second round, I measure participants' willingness to seek challenges. Participants are paid individually and have to pick a performance target. The higher the target the higher the potential reward but participants who do not reach their chosen target receive nothing. One of the two rounds is randomly chosen for payment. This design allows me to test whether, conditional on the first-round score, the chosen challenge differs between losers and winners. I also look into differences in second-round performance, success, and earnings between losers and winners.

Psychologists find that individuals in a negative affective state are more risk seeking (albeit in non-incentivised tasks) than those in a positive affective state (Isen and Geva, 1987; Mittal and Ross Jr, 1998). Lerner and Keltner (2001) find that anger leads to more risk seeking while fear leads to less risk seeking. The choice of performance target is a risky one and, assuming that the losers are angrier or in a more negative affective state than the winners, this could mean a positive effect of losing on the willingness to seek challenges. Another literature finds that outcomes including task choice, effort

¹While the theoretical properties of tournaments make them attractive incentive mechanisms and lab experiments largely bare this out (Bull, Schotter, and Weigelt, 1987), causal field evidence for their efficacy is more scarce and much of the observational effect of tournaments on productivity seems to be due to sorting (Leuven et al., 2011).

expenditure, persistence and intrinsic motivation are affected by fear of failure (Elliot and Thrash, 2004). Individuals high on fear of failure seek to avoid failure in achievement settings because they experience shame when they fail. Shame in turn may lead to the desire to mentally escape the threatening situation by withdrawing effort (Elliot and Church, 1997). These findings indicate that the second-round performance of losers may be impaired relative to the performance of winners.

In economics, there is an extensive literature on strategic momentum in dynamic contexts where the outcome of one round changes the incentives for the next. Relative to losers, winners might then be more likely to choose to compete again, not because of a direct impact of winning on decision making but because it is more profitable to do so.² Economists have also explored how the outcome of a risky gamble influences future risk taking. People show increased willingness to take risk both when they gamble with previously gained money (the house money effect) and when they have the chance to make up for a previous loss (the break-even effect) (Thaler and Johnson, 1990). Both these mechanisms are excluded by my experimental setup. The outcome of the first-round competition has no bearing on the payoff structure in the second round and only one round is randomly paid out.

I will also look into gender differences in the reaction to winning and losing. A sizeable literature in experimental economics finds that men and women differ both in their reaction to (Gneezy, Niederle, and Rustichini, 2003) and their preference for (Niederle and Vesterlund, 2007) competition.³ These gender differences have been shown to carry over to differences in career choices (Buser, Niederle, and Oosterbeek, 2014). Moreover, Niederle and Yestrumskas (2008) find that conditional on performance levels, men are more likely to pick a hard task with higher potential rewards over an easier task. Finally, Gill and Prowse (2010) also detect a gender difference whereby following a loss, women reduce their effort independent of the size of the prize whereas men only reduce their effort if the prize they failed to win was large enough.

The psychological literature reveals a number of additional reasons to expect gender differences in the reaction to competition outcomes. Men tend to attribute success to internal factors (such as talent) and failure to external factors (such as effort or lack thereof) while women tend to do the opposite (Dweck et al., 1978). This is especially true for mathematical tasks (Ryckman and Peckham, 1987). As a consequence, women are more likely to exhibit impaired performance after failure (Dweck and Gilliard, 1975). Moreover, McGregor and Elliot (2005) find that women are more affected by fear of failure than men. This indicates a stronger negative reaction of women's performance to the competition outcome.

The results show significant effects of the competition outcome. I find that, conditional on first-round scores, losers pick a more challenging performance target. Losers also perform significantly worse. Together, these effects lead to a lower probability for losers of successfully reaching the chosen target and to lower average earnings for losers in the second round. As suspected, I find significant gender differences in the reaction to the competition outcome. The positive effect of losing on challenge seeking stems exclusively from the reaction of men while the negative effect on subsequent performance

²See Konrad (2009) for a survey of the theoretical literature and Dechenaux, Kovenock, and Sheremeta (2012) for a survey of the experimental literature on contests.

³These differences seem to be especially strong for male connotated tasks such as the arithmetic task used here (Dreber, von Essen, and Ranehill, 2014; Niederle and Vesterlund, 2011). The origins of these differences are still unclear, with both cultural (Gneezy, Leonard, and List, 2009; Cardenas et al., 2012) and biological determinants (Buser, 2012; Wozniak, Harbaugh, and Mayr, 2014) having been explored.

stems exclusively from the reaction of women. The rest of the paper is structured as follows: Section 2 explains the experimental design, Section 3 describes the data, Section 4 presents the results and Section 5 concludes.

2 Experimental design

Participants were informed upfront that they would be paid for their performance in a simple task and that they would perform this task twice, whereby one performance would be randomly picked for payment at the end of the experiment. They were also told that the manner in which they were be paid would be explained at the start of each round. The task consisted in adding up five randomly generated two-digit numbers. The participants received one point for each correct answer; wrong answers were not penalised. The participants could attempt as many of these problems as they managed in a four-minute window. Before the two incentivised performances, participants received the opportunity to practice the task for four minutes.

In the first round, participants competed in a winner-takes-all competition against a randomly selected opponent. The winner would get 2 Euros per correct answer while the loser would receive no payment for the task.⁴ After the performance, two-thirds of the subjects were informed about their score and whether they won or lost the competition, while one third was informed only about their score.

Conditional on one’s score, winning and losing is random as it depends only on the performance of the randomly allocated opponent. Participants are consequently allocated to one of three “treatments”: losing, winning and no information. Comparing the subsequent behaviour of winners and loser controlling for their performance therefore yields the causal effect of the competition outcome. Those who received no information on the outcome provide a benchmark to judge whether it is losing or winning that alters behaviour.

In the second round, I introduce a simple and intuitive measure of challenge seeking (see Table 1). Participants had to decide how they would like to be paid for their performance in the task. Specifically, they had to choose a target amount of points for their performance. If their performance was at least as good as their target, they would receive the target amount of points in Euros. If they did not achieve the target amount, they would receive nothing (so if a participant chose a target of 10 points, she would receive 10 Euros if she scored 10 or more and nothing otherwise).

It is important to note that conditional on beliefs about absolute ability, beliefs about relative ability have no bearing on the optimal choice of challenge. By focusing on an individual choice, the design eliminates the effect of beliefs about relative performance and the issue of ego-biased updating (Möbius et al., 2011; Eil and Rao, 2011). Randomly paying out one of the two rounds eliminates income effects as a potential confound. Also, the choice of performance target is a purely individual choice which does not affect anyone else’s payoff. An impact of the competition outcome on altruism (Buser and Dreber, 2013; Chen, 2010) should therefore not influence the results.

The second round was followed by a very brief questionnaire after which the participants were informed of their payment. The questionnaire elicited age and gender plus unincentivised measures of

⁴In case of a tie, the winner was randomly chosen.

Table 1: The challenge seeking measure

“How do you want to be paid for your performance?”
1 Euro if you score 1 or more, nothing otherwise
2 Euros if you score 2 or more, nothing otherwise
3 Euros if you score 3 or more, nothing otherwise
...
18 Euro if you score 19 or more, nothing otherwise
19 Euro if you score 19 or more, nothing otherwise
20 Euro if you score 20 or more, nothing otherwise

risk aversion and competitiveness. To elicit risk attitudes, I asked subjects “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?”. The answer is on a scale from 0 (“unwilling to take risks”) to 10 (“fully prepared to take risk”). Dohmen et al. (2011), using representative survey data from Germany, find that this simple question predicts both incentivised choices in a lottery task and risky behavior across a number of contexts including holding stocks, being self-employed, participating in sports, and smoking.⁵ I elicit competitiveness with an analogous question, “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’”.

The experiment was run at the CREED lab at the University of Amsterdam and all participants are students who enrolled in the mailing list of the lab. Participants received a 6 Euro show-up fee and earned 16.3 Euros on average. The experiment was run on computers using zTree (Fischbacher, 2007). The appendix presents screen shots containing all experimental instructions and the questionnaire.

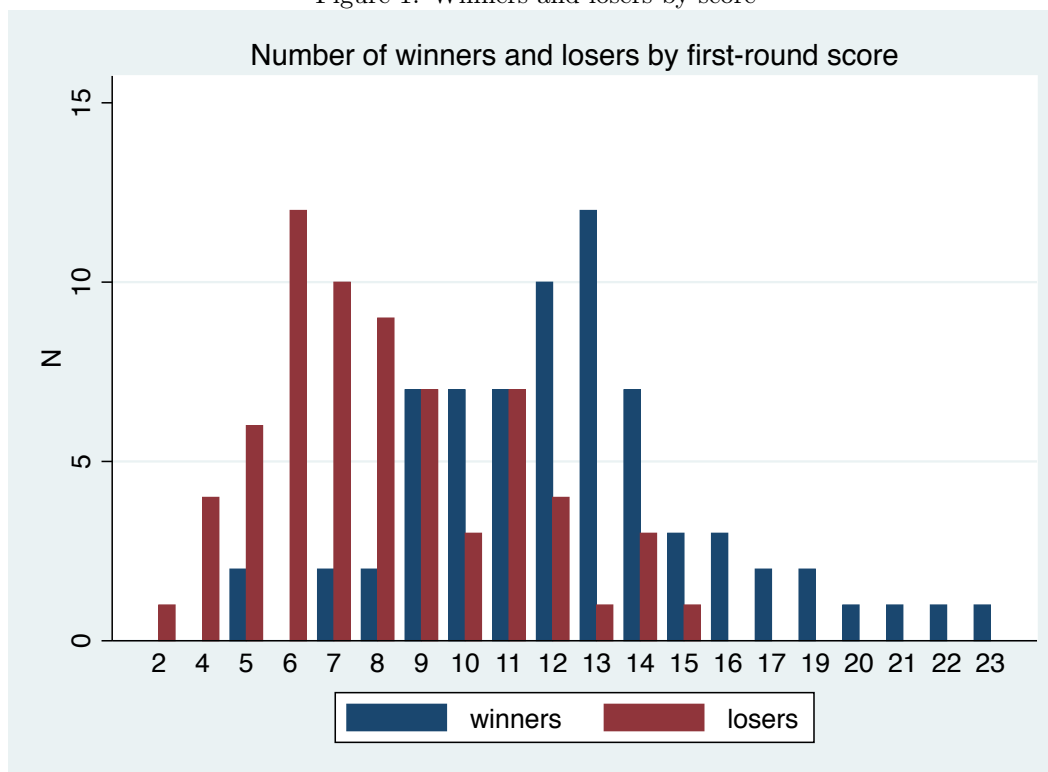
3 Data

The sample consists of 202 participants, 102 of which are male and 100 of which are female. Two-thirds of these (138) were randomly allocated to receive full feedback. For my estimation strategy to work, sufficient overlap in points scored between winners and losers is needed. Figure 1 shows the number of winners and losers who received full feedback by points scored. Participants scored a minimum of 2 and a maximum of 23 points. The lowest score for which there are both winners and losers is 5 and the highest is 15. The sample which I will use in my main analysis therefore consists of participants who scored between 5 and 15 points, which leaves me with a sample of 178 participants (122 of which received full feedback).

Table 2 shows further descriptive statistics. On average, participants scored 10.4 points in the competition round, chose a challenge of 9.3 and scored 10.5 points in the challenge round. 81 percent of subjects succeeded in their challenge, leading to average earnings in the challenge round of 7.3 Euros (this was only paid out if the second round was randomly chosen for payment). There are no gender differences in any of the experimental variables. In particular, women scored a similar amount of

⁵Lonnqvist et al. (2010) find the question to be more stable over time than lottery measures for risk attitudes. See also Charness, Gneezy, and Imas (2013) for a comparison of elicitation methods for risk attitudes.

Figure 1: Winners and losers by score



points, were equally likely to win the competition and picked on average the same challenge. However, women see themselves as significantly less risk-seeking and significantly less competitive.

A potential problem of the experimental design is censoring. The challenge menu only allowed for choices up to 20 points. This turned out not to be a problem with only one subject choosing the maximum challenge of 20.

4 Results

I will now turn to the main question of whether winners and losers who had the same performance in the competition round make different choices in the challenge round. The upper panel of Table 3 shows OLS regressions of experimental outcomes on a loser dummy and a third-order polynomial⁶ in the competition score for the sample of participants who received feedback on the outcome of the competition. The lower panel shows the same regressions but includes the sample of subjects who did not receive feedback on the competition outcome as a reference group. All regressions control for a third-order polynomial in the competition score. The table reports regressions with no further controls as well as regressions controlling for age, gender and session fixed effects and regressions that

⁶Controlling linearly for the competition score or for a second-order polynomial leads to the same conclusions. The appendix presents alternative specifications, including regressions controlling for score-fixed effects, again finding the same results. Controlling for score-fixed effects is the most complete way of controlling for first-round scores but necessitates estimating a larger amount of additional coefficients.

Table 2: Descriptive statistics

	(1)	(2)	(3)	(4)
	All	Men	Women	Gender p-val
N	202	102	100	
N feedback	138	72	66	
Competition score	10.41 (3.98)	10.67 (4.18)	10.14 (3.76)	0.46
Competition win	0.5 (0.50)	0.52 (0.50)	0.48 (0.50)	0.57
Chosen challenge	9.26 (3.22)	9.52 (3.34)	8.99 (3.10)	0.38
Challenge score	10.52 (3.86)	10.63 (3.68)	10.42 (4.06)	0.67
Challenge success	0.81 (0.40)	0.83 (0.37)	0.78 (0.42)	0.34
Challenge earnings	7.27 (4.56)	7.64 (4.51)	6.89 (4.60)	0.34
Age	22.59 (2.99)	22.45 (2.76)	22.74 (3.22)	0.65
Risk seeking	5.5 (2.35)	5.88 (2.23)	5.1 (2.41)	0.01
Competitiveness	7.16 (2.22)	7.61 (1.97)	6.71 (2.38)	0.01

P-values in column 4 are from ranksum tests. Standard deviations in parentheses.

additionally control for subjective risk seeking and competitiveness.

Columns 1 to 3 show regressions with the chosen second-round challenge as the dependent variable. The regressions show that conditional on their performance in the competition round, losers pick a significantly higher target than winners. The effect is roughly equal to half a point. The regressions in the lower panel show that the average choice of winners is close to participants who received no feedback while losers pick a higher target. This means that rather than being discouraged by losing, losers go on to choose a more challenging option. It is useful to note again that only one of the two rounds is randomly chosen for payment and that participants only find out which one at the very end of the experiment. Losers trying to make up for a financial loss can therefore not be an explanation for this finding.

In columns 4 to 6, I analyse the effect of winning and losing on subsequent performance. These regressions show that despite picking a higher challenge on average, losers actually perform significantly worse, scoring approximately 0.8 points lower than the winners. The results in the lower panel shows that it is the winners who improve their performance relative to the no-feedback sample while the losers perform at the same level.

I will now investigate how the effects of winning and losing on challenge seeking and performance translate into the likelihood of success and earnings. The effect of choosing a more challenging target on earnings could be both positive (in the case of actually reaching the target) or negative (if it leads to a higher rate of failure). A lower performance should lead to a lower chance of successfully reaching the target and therefore lower average earnings. In columns 7 to 9, I regress a binary variable indicating

Table 3: OLS regressions controlling for score polynomial

	Challenge:			Score:			Success:			Earnings:		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Losers (vs. winners)	0.518** (0.252)	0.573** (0.269)	0.596** (0.273)	-0.818** (0.406)	-0.814** (0.402)	-0.723* (0.405)	-0.170** (0.081)	-0.160* (0.082)	-0.168** (0.084)	-1.381* (0.826)	-1.334 (0.839)	-1.351 (0.880)
Female		-0.224 (0.249)	-0.156 (0.262)		-0.230 (0.359)	-0.168 (0.370)		-0.144** (0.059)	-0.149** (0.063)		-1.388** (0.573)	-1.392** (0.616)
Age		-0.023 (0.041)	-0.017 (0.040)		-0.077 (0.073)	-0.074 (0.074)		-0.003 (0.013)	-0.003 (0.013)		-0.019 (0.140)	-0.019 (0.138)
Risk			0.044 (0.057)			-0.015 (0.077)			0.002 (0.017)			0.009 (0.178)
Competitiveness			0.047 (0.059)			0.102 (0.095)			-0.009 (0.018)			-0.017 (0.173)
N	122	122	122	122	122	122	122	122	122	122	122	122
Losers (vs. no info)	0.357 (0.253)	0.345 (0.261)	0.375 (0.262)	0.027 (0.362)	0.008 (0.380)	0.051 (0.388)	-0.001 (0.078)	-0.007 (0.082)	-0.009 (0.083)	0.179 (0.703)	0.122 (0.736)	0.120 (0.747)
Winners (vs. no info)		-0.088 (0.225)	-0.103 (0.242)	0.959** (0.372)	0.917** (0.372)	0.888** (0.368)	0.155** (0.074)	0.152* (0.079)	0.149* (0.079)	1.568** (0.749)	1.601** (0.795)	1.573* (0.798)
Female		-0.183 (0.200)	-0.105 (0.205)		0.051 (0.296)	0.115 (0.307)		-0.086 (0.057)	-0.093 (0.061)		-0.937* (0.543)	-0.961* (0.566)
Age		-0.001 (0.034)	0.004 (0.034)		-0.060 (0.056)	-0.056 (0.055)		-0.001 (0.011)	-0.002 (0.011)		0.015 (0.109)	0.013 (0.109)
Risk			0.058 (0.052)			-0.019 (0.066)			-0.005 (0.016)			-0.043 (0.163)
Competitiveness			0.042 (0.051)			0.100 (0.082)			-0.004 (0.017)			0.011 (0.148)
Winners vs losers p-val.	0.083	0.067	0.071	0.018	0.020	0.034	0.042	0.050	0.058	0.069	0.065	0.080
N	178	178	178	178	178	178	178	178	178	178	178	178
3rd-order score polynomial	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Session FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Robust standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The sample in the upper panel regressions consists of all participants who scored between 5 and 15 points in the competition round and received feedback on the competition outcome. The sample in the lower panel regressions consists of all participants who scored between 5 and 15 points. The winners vs. losers p-values are from post-estimation Wald tests.

failure in the competition on a binary variable indicating challenge success. The combination of losers picking a higher challenge and performing worse leads to a 17 percent lower chance of success compared to the winners. This translates into a reduction of 1.3 Euros in expected earnings from the challenge round (columns 10 to 12) which is equivalent to 19 percent of average earnings. This confirms that initial failure affects decision making in such a way as to increase the likelihood of more failure whereas success leads to more success in the future.

In the analysis above, I have used OLS regressions because of the straightforward interpretation of the estimated coefficients. However, given that all outcomes are either discrete or binary, it might be more appropriate to use poisson and probit regressions. In the appendix, I include tables that demonstrate the robustness of the results to my modeling choices. Table 6 reports poisson and probit regressions controlling for a third-order score polynomial and Table 7 reports poisson and probit regressions controlling for score-fixed effects. All results are robust to these alternative estimation strategies.

The simultaneous finding of a positive effect of losing on challenge seeking and a negative effect on performance seems somewhat contradictory.⁷ Table 4 reports OLS regressions separately for male and female participants. The striking finding is that the positive effect of losing on challenge seeking stems exclusively from male losers, who, conditional on their performance, choose a one point higher target compared to male winners. The gender difference in the effect of the competition outcome on subsequent challenge seeking is marginally significant with a p-value of around 0.1. The effect of the competition outcome on subsequent performance, on the other hand, stems exclusively from women. Female losers perform around 1.7 points worse than female winners. The gender difference in the effect of the competition outcome on performance in the challenge round is significant at the 5%-level. This result is in line with Gill and Prowse (2010) who, using a series of competitions, find that the negative effect of losing in a competition on performance in a subsequent competition is stronger for women. While men react to losing by becoming more challenge seeking and women react by lowering their performance, both these reactions have similar negative effects on the likelihood of success and expected earnings.

Although not the main point of interest, my data also serves to test whether there is an overall gender difference in challenge seeking independent of the outcome of the competition. Table 5 shows OLS regressions of the challenge decision on a gender dummy plus controls. The main result is that men and women do not differ in their willingness to seek challenges. This is in contrast to the gender difference in picking a difficult high-reward task over an easy low-reward task in Niederle and Yestrumskas (2008), although they only find the difference when participants have to pre-commit for more than one round. Interestingly, women do rate themselves as being significantly less competitive (see Table 2). This indicates that willingness to compete and willingness to seek (individual) challenges are two separate phenomena. This is underlined by the regressions in Table 5 which show that self-rated competitiveness is not a significant predictor of challenge seeking.

⁷A large psychological literature on goal setting finds that when there is no financial incentive for reaching a goal, more challenging goals make people strive harder (see Locke and Latham, 2002, for a survey). Overall, the data does indeed show a positive correlation of the chosen challenge on performance. Regressing second-round performance on the chosen challenge controlling for a third-order polynomial in the first-round score, the coefficient on the chosen challenge is 0.30 (s.e. 0.10; $p < 0.01$).

Table 5: Gender and challenge seeking

	(1)	(2)	(3)	(4)
Female	-0.147 (0.186)	-0.169 (0.191)	-0.095 (0.198)	-0.073 (0.193)
Age		-0.006 (0.031)	-0.003 (0.031)	-0.004 (0.031)
Risk			0.079* (0.048)	0.074 (0.048)
Competitiveness			0.025 (0.047)	0.034 (0.048)
N	202	202	202	202
3rd-order score polynomial	✓	✓	✓	✓
Session FE		✓	✓	✓
Treatment/success				✓

Coefficients are from OLS regressions with the chosen challenge as dependent variable. Robust standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5 Conclusions

My results demonstrate that success and failure in competitive situations can have an impact on subsequent choices such that success breeds further success and failure leads to further failure. Typical career paths are replete with both competition and situations where one has to decide whether or not to go for a challenging high-risk option. This is especially true at the top of the education and earnings distribution. My results indicate that studying how people react to success and failure might be useful for understanding individual career paths. If the findings translate to career decisions such as the decision of which job to apply for, this would introduce an important element of luck and path dependence into individual careers.

Although my results show that losers subsequently do worse financially, it is encouraging that losing does not have a negative effect on the willingness to seek challenges. Actually, losers pick a more challenging target on average. Although this leads in expectation to worse financial outcomes, it still means that high ability individuals who are unlucky will keep trying after a temporary setback and therefore might still end up on top. This is especially applies to men, who become more challenge seeking and keep up performance levels after losing in the competition.

The picture looks somewhat bleaker for women, who do not change their challenge seeking behaviour but who get discouraged in the sense of lowering their performance, potentially through providing less effort. If this finding translates to labour market behaviour, it could be a partial explanation for the low number of women in competitive top positions (Bertrand and Hallock, 2001) and amongst successful entrepreneurs (Klapper and Parker, 2011). This extrapolation fits with a wider literature exploring psychological differences as an explanation for gender differences in labour market outcomes (Bertrand, 2011; Buser, Niederle, and Oosterbeek, 2014; Reuben, Wiswall, and Zafar, 2013).

My results may also be relevant for the experimental literature on gender differences in competitiveness. Niederle and Vesterlund (2007), using the same arithmetic task used in this study, find that conditional on performance women are only half as likely as men to choose a competitive winner-takes-all tournament over a non-competitive piece-rate payment scheme. This result has been replicated many times (Niederle and Vesterlund, 2011). I find that the performance of women, but not of men, suffers after a loss. If women anticipate the impact of a potential loss on their future performance (or will-

ingness to perform) this could sway their decision in the direction of a non-competitive remuneration scheme.

A logical and interesting next step would be to investigate whether the effects of the competition outcome carry over to challenge seeking in different tasks and to other subsequent decisions. Furthermore, it could be fruitful to study the mechanisms that lie behind the effect of competition outcomes. As mentioned in the introduction, the psychological literature can give some hints. Following the findings of a positive correlation of negative affect and anger with risk taking, an effect of competition outcomes on risk preferences is a possible explanation for the effect of losing on challenge seeking. Moreover, the literature on fear of failure suggests that losers may feel shame which could lower their subsequent performance levels.

The psychological literature also reveals a number of plausible mechanisms for the gender difference in the reaction to competition outcomes. Women are more likely to attribute failure to internal factors such as a lack of ability. It is therefore possible that male participants in the experiment attribute losing to bad luck or lack of effort while female participants think it reflects badly on their own talent for the task, leading to impaired performance in the challenge round. Higher fear of failure and the resulting shame reaction are a further potential explanation why women lower their effort following a loss.

There is also an endocrinological literature which indicates that reactions to competition outcomes could be mediated by hormonal changes, in particular by the effects of the male sex hormone testosterone. Apicella, Dreber, and Möllerström (2014) find that testosterone levels of winners increase relative to losers following a rock-paper-scissors competition and that testosterone predicts subsequent willingness to take risk. Mehta and Josephs (2006), using a non-incentivised competitive task, find that losers who experience an increase in testosterone are more willing to compete again. Carré, Putnam, and McCormick (2009) find that testosterone reactions following a non-incentivised competitive task predict subsequent aggressive behavior in men. While it is important to note that none of these studies find a direct effect of winning and losing on subsequent behaviour, their findings indicate that individual differences in hormonal reactions might be able to explain individual differences in the reaction to competition outcomes.

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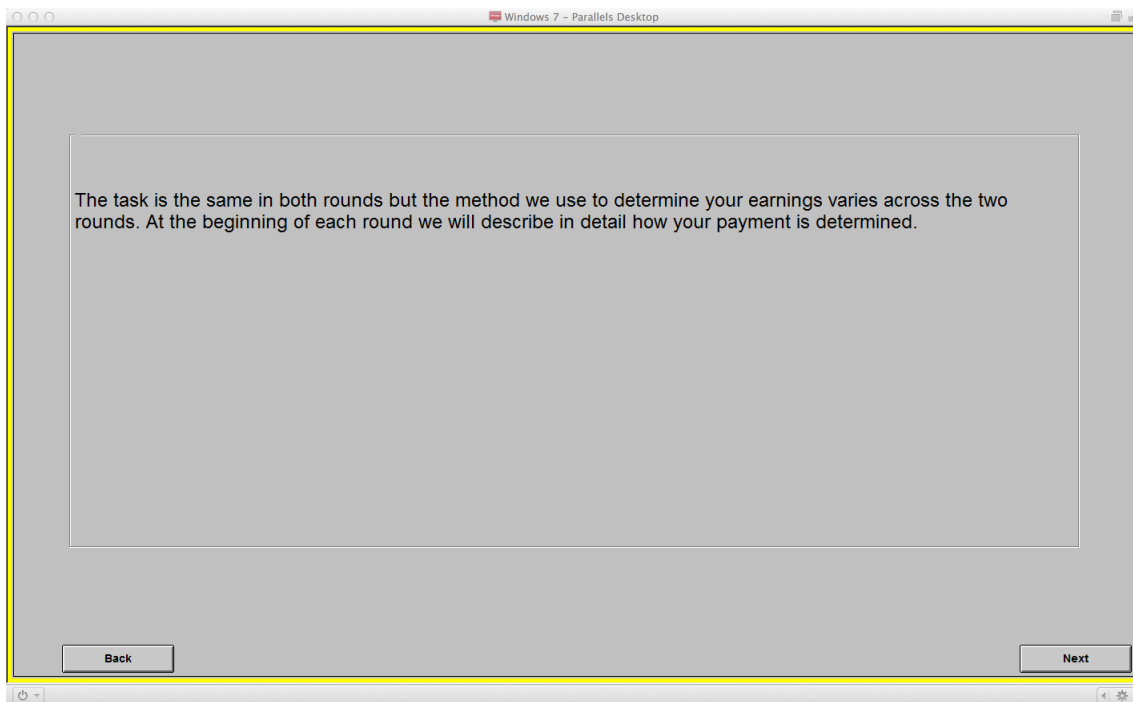
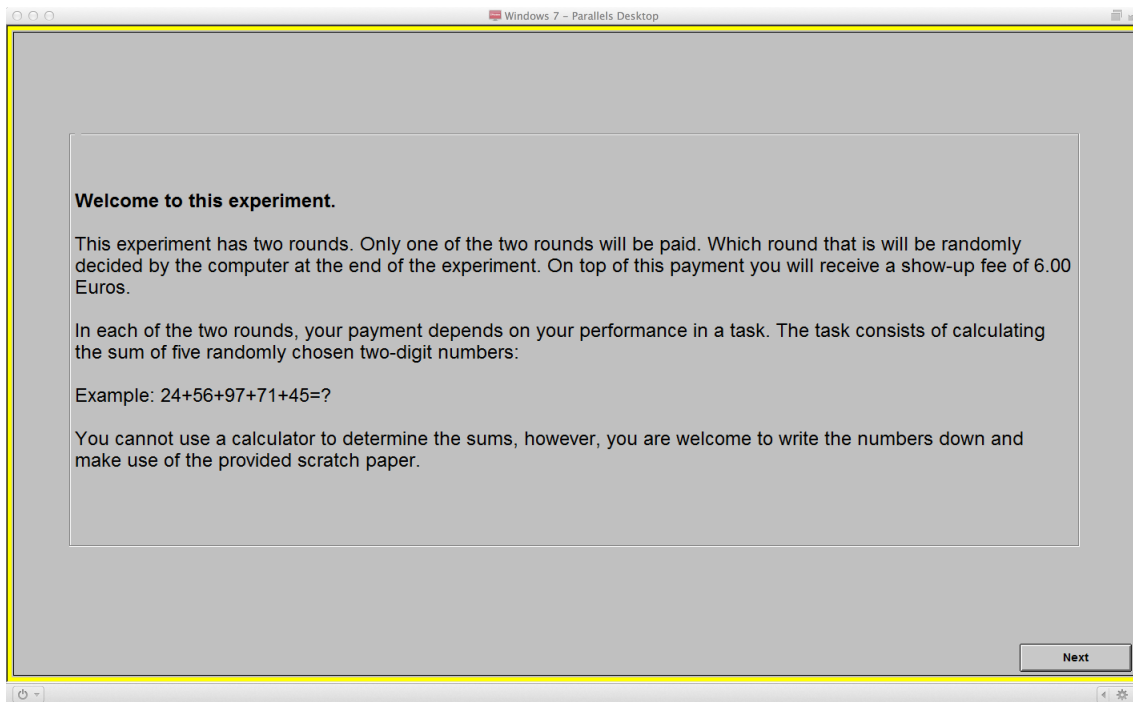
Appendix: robustness checks

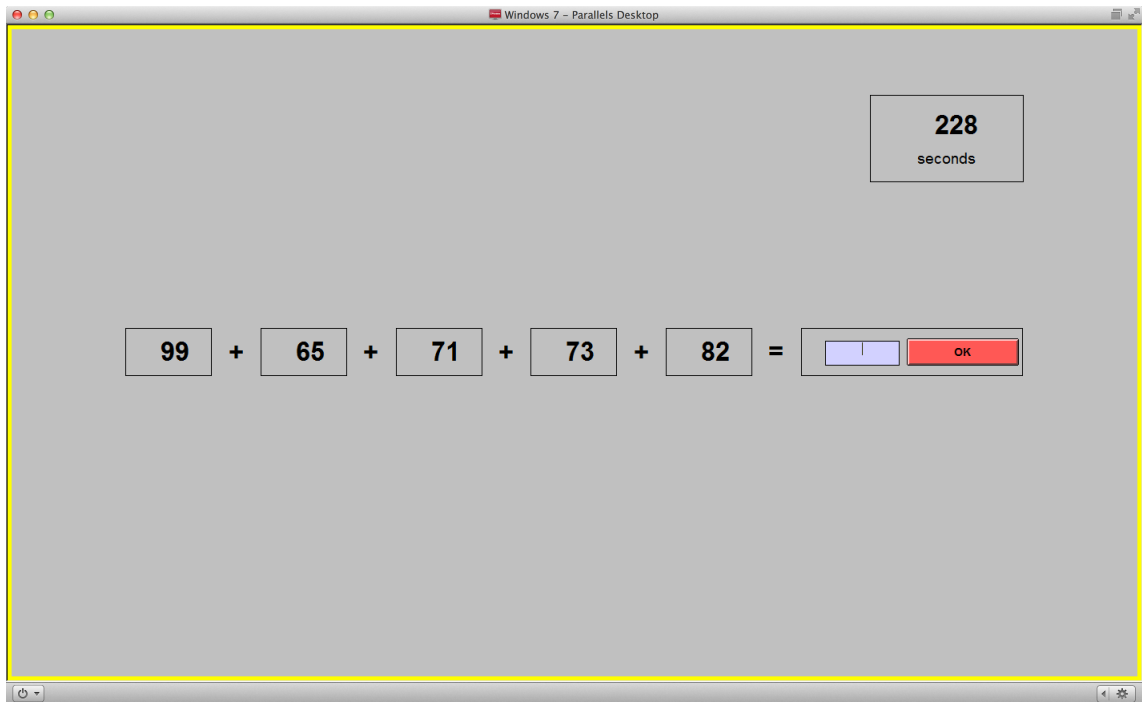
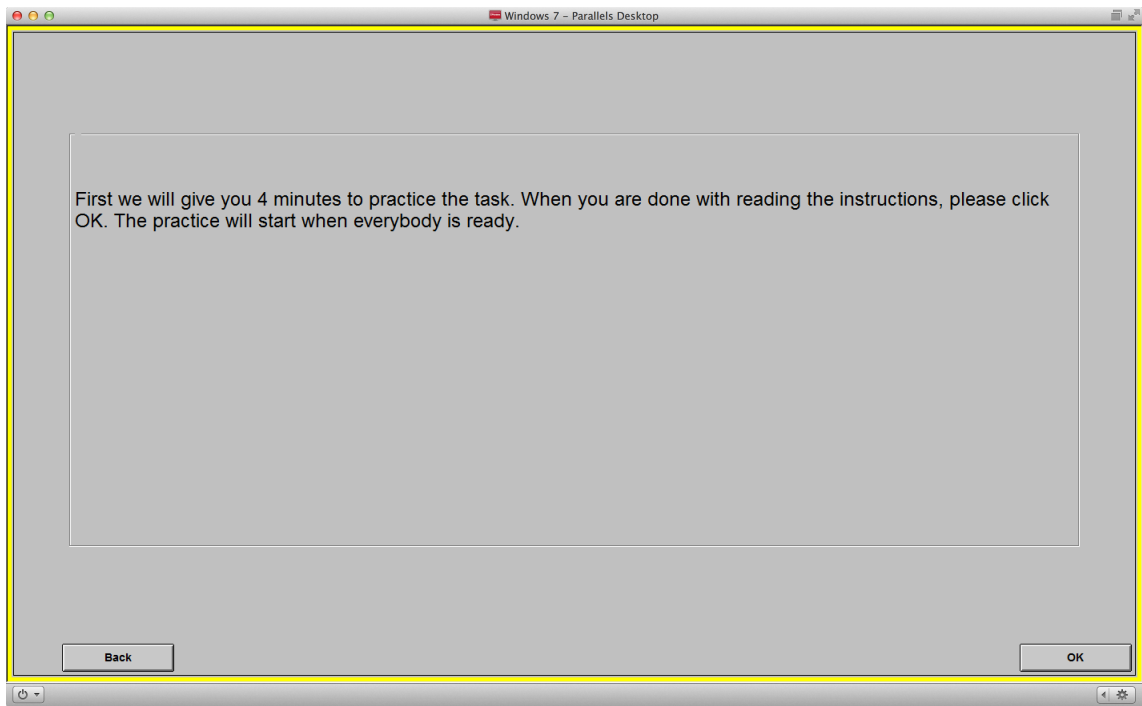
Table 7: Poisson and probit regressions controlling for score-fixed effects

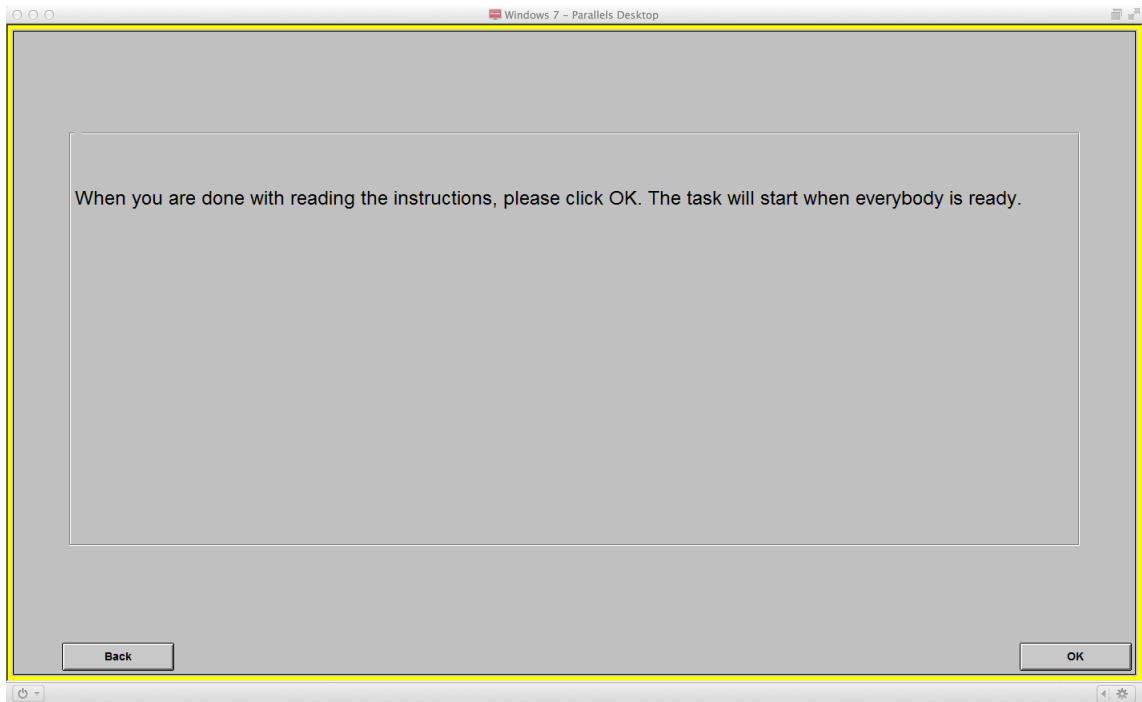
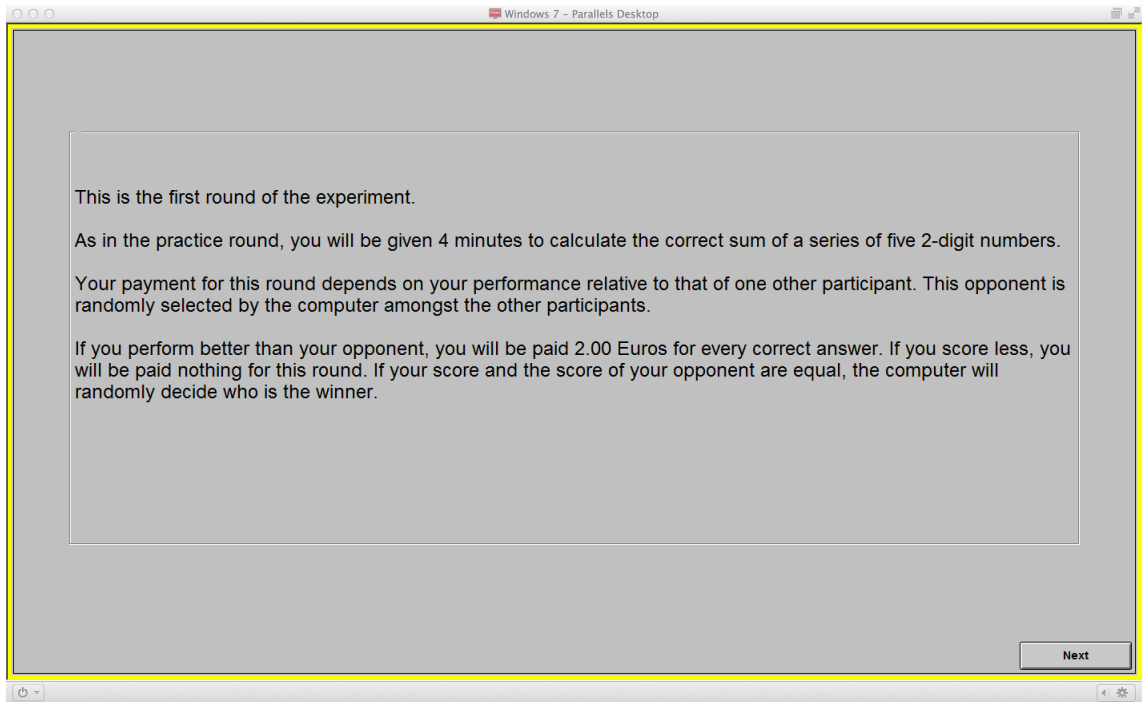
	Challenge:			Score:			Success:			Earnings:		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Losers (vs. winners)	0.060** (0.031)	0.068** (0.028)	0.071** (0.030)	-0.084** (0.039)	-0.083** (0.036)	-0.075** (0.036)	-0.787** (0.391)	-1.001** (0.441)	-1.050** (0.433)	-0.221* (0.125)	-0.222* (0.119)	-0.237* (0.122)
Female		-0.036 (0.027)	-0.026 (0.029)		-0.021 (0.037)	-0.004 (0.039)		-1.110*** (0.396)	-1.128*** (0.400)		-0.212** (0.092)	-0.206** (0.101)
Age		-0.003 (0.004)	-0.002 (0.004)		-0.005 (0.007)	-0.005 (0.008)		-0.006 (0.060)	-0.001 (0.059)		0.003 (0.020)	0.005 (0.019)
Risk			0.003 (0.007)		0.002 (0.007)	0.002 (0.007)		0.038 (0.078)	0.038 (0.078)			0.013 (0.025)
Competitiveness			0.006 (0.007)		0.012 (0.009)	0.012 (0.009)		-0.045 (0.101)	-0.045 (0.101)			-0.009 (0.021)
N	122	122	122	122	122	122	122	122	122	122	122	122
Losers (vs. no info)	0.048 (0.031)	0.049 (0.031)	0.053* (0.031)	-0.006 (0.039)	-0.007 (0.040)	-0.001 (0.040)	-0.103 (0.286)	-0.050 (0.292)	-0.062 (0.298)	0.004 (0.110)	0.005 (0.114)	0.001 (0.114)
Winners (vs. no info)	-0.002 (0.024)	-0.005 (0.024)	-0.000 (0.026)	0.088*** (0.034)	0.085** (0.033)	0.082** (0.033)	0.622* (0.324)	0.739** (0.324)	0.725** (0.324)	0.222** (0.105)	0.238** (0.106)	0.237** (0.106)
Female		-0.025 (0.022)	-0.015 (0.023)		0.011 (0.029)	0.022 (0.031)		-0.409 (0.254)	-0.431 (0.268)		-0.153* (0.081)	-0.160* (0.086)
Age		-0.001 (0.004)	-0.000 (0.003)		-0.005 (0.006)	-0.005 (0.005)		0.005 (0.044)	0.002 (0.042)		0.006 (0.015)	0.006 (0.015)
Risk			0.007 (0.005)		-0.001 (0.006)	-0.001 (0.006)		-0.019 (0.064)	-0.019 (0.064)		-0.002 (0.022)	-0.002 (0.022)
Competitiveness			0.004 (0.006)		0.011 (0.009)	0.011 (0.009)		-0.011 (0.075)	-0.011 (0.075)		-0.005 (0.021)	-0.005 (0.021)
Winners vs losers p-val.	0.103	0.066	0.083	0.014	0.012	0.022	0.046	0.029	0.034	0.052	0.039	0.044
N	178	178	178	178	178	178	178	178	178	178	178	178
Score FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Session FE		✓	✓		✓	✓		✓	✓		✓	✓

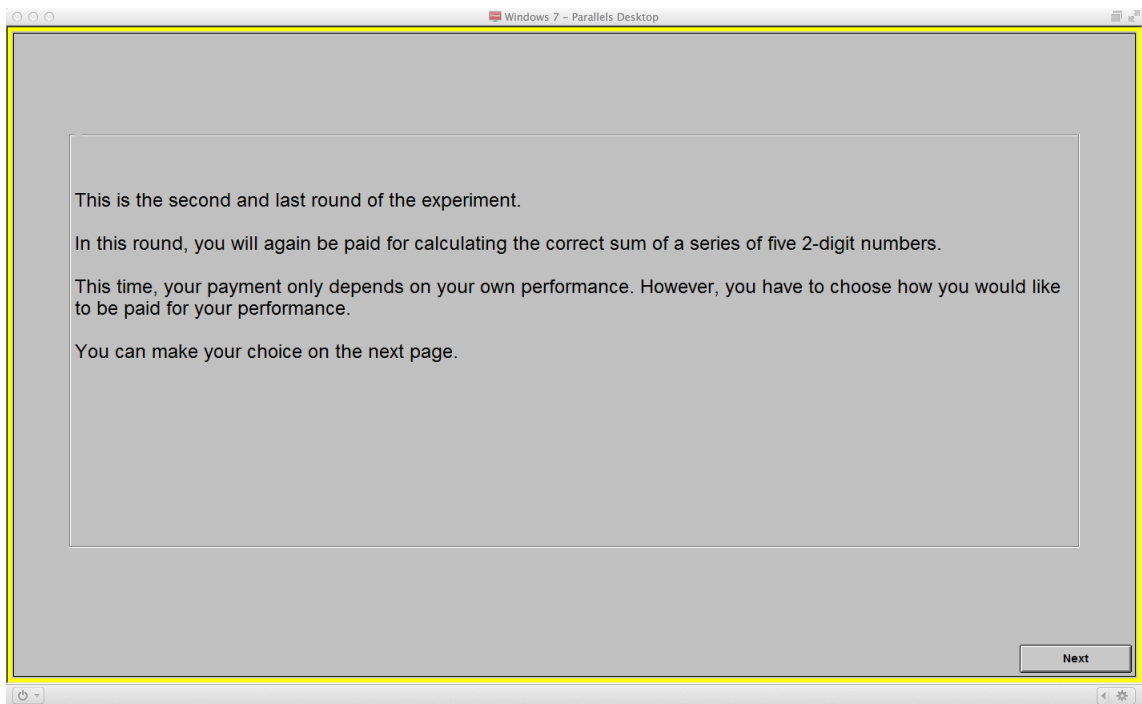
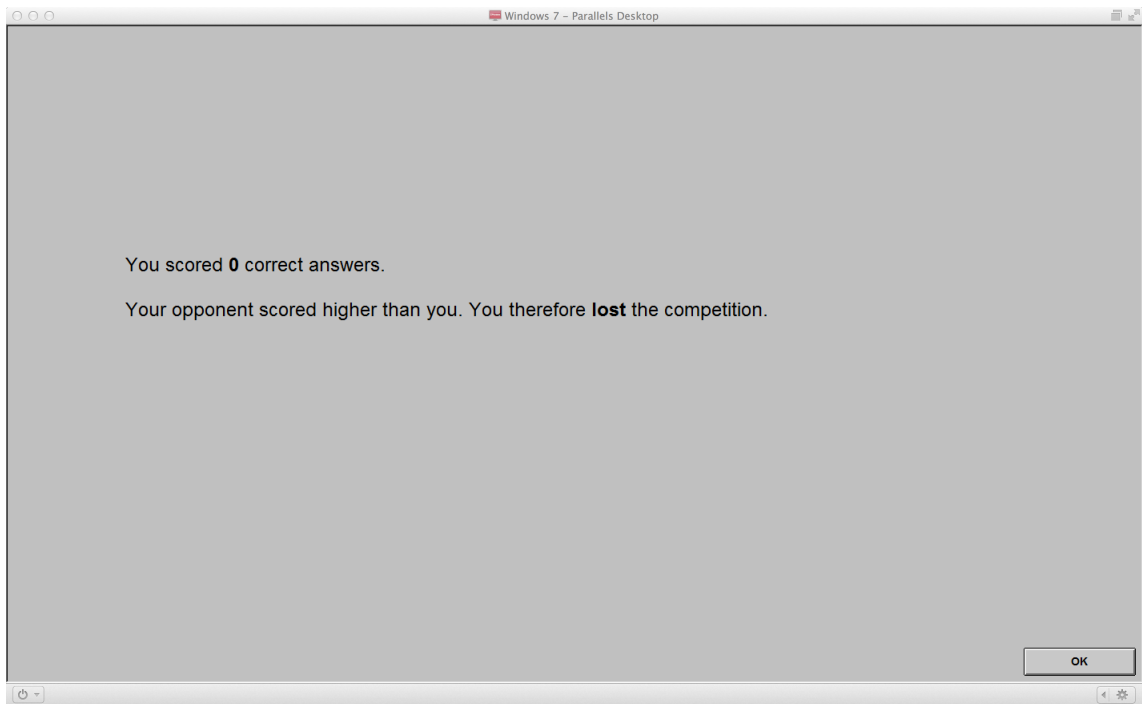
Robust standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Coefficients are from poisson regressions except for coefficients in columns 7 to 9 which are from probit regressions. The sample in the upper panel regressions consists of all participants who scored between 5 and 15 points in the competition round and received feedback on the competition outcome. The sample in the lower panel regressions consists of all participants who scored between 5 and 15 points. The winners vs. losers p-values are from post-estimation Wald tests.

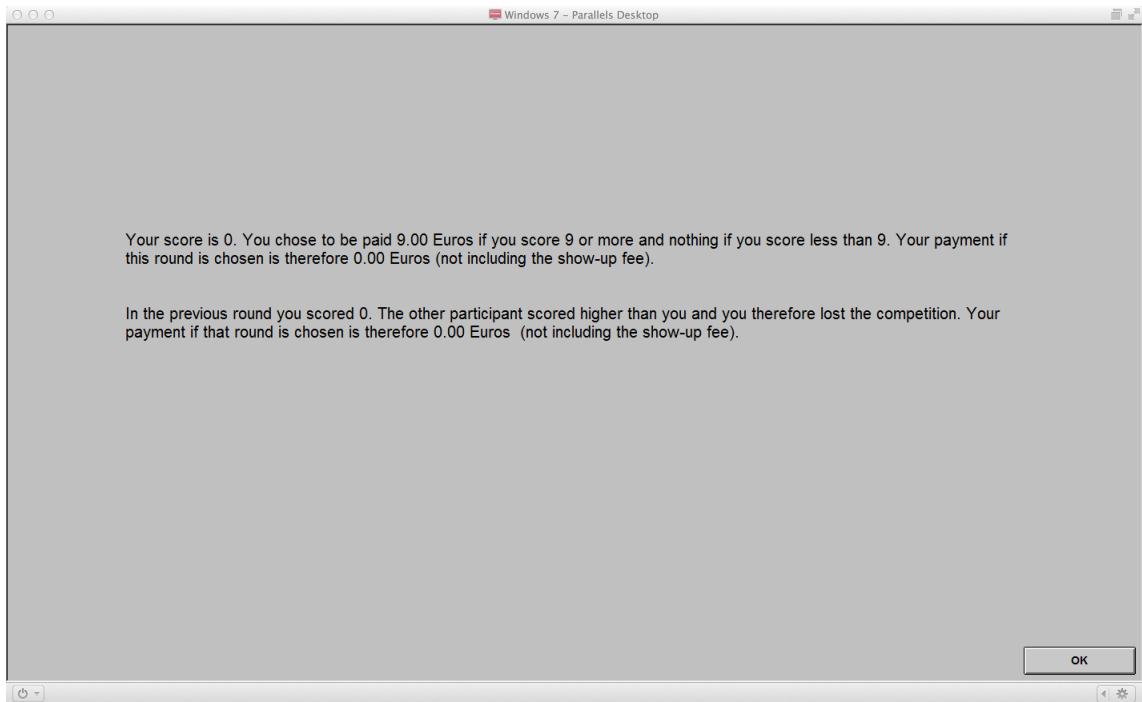
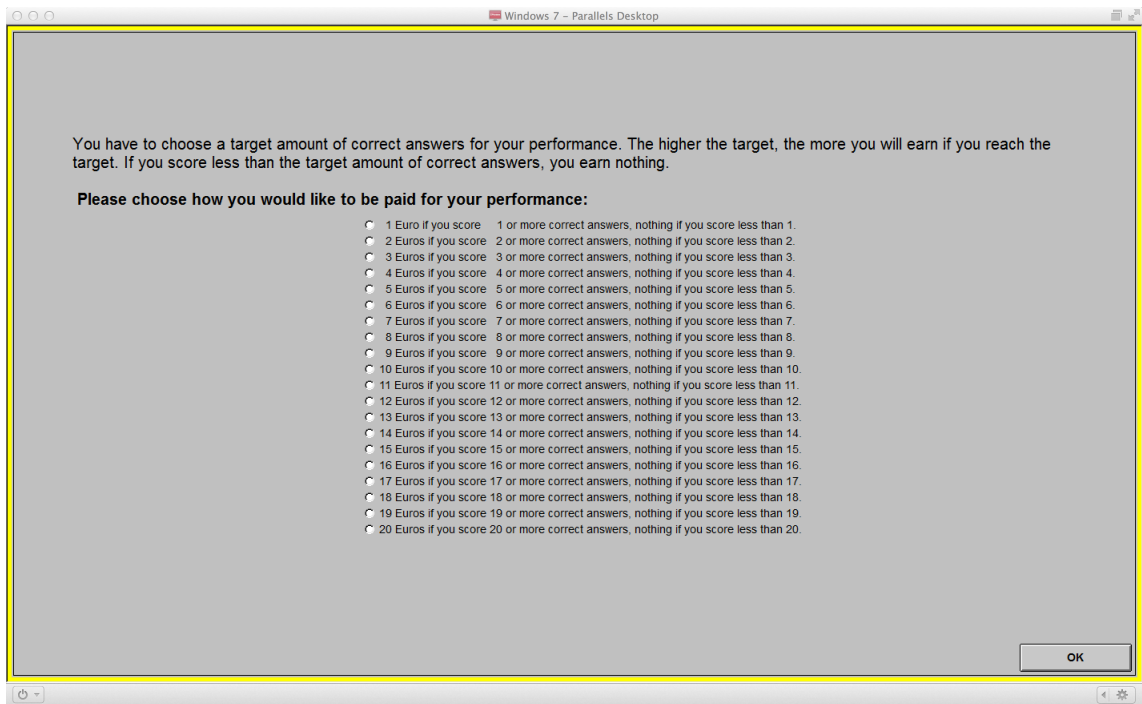
Appendix: screen shots











Windows 7 - Parallels Desktop

Before we inform you which round was randomly chosen for your payment, we would like to ask you a few short questions.

What is your gender? Male
 Female

What is your age:

OK

Windows 7 - Parallels Desktop

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 10=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 10=Very competitive

OK

