Supplement to "How success breeds success"

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Ambroise Descamps
Oxera Consulting

Changxia Ke
School of Economics and Finance, Queensland University of Technology

Lionel Page
Economics Discipline Group, University of Technology Sydney

Appendix A: Summary statistics

A.1 *Detailed summary statistics for all four treatments*

Ambroise Descamps: ambroise.descamps@oxera.com
Changxia Ke: changxia.ke@qut.edu.au
Lionel Page: lionel.page@uts.edu.au

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TABLE 7. Sessions with raw-performance pairing condition in the evaluation stage: Summary statistics on effort/performance measures, conditional on the outcome in round 1. The effort/performance is measured by the number of strings completed (#strings), how often the timeout "STOP" button has been used (Stop), the time spent on the task in the round (Time).

	Baseline			FutureInfo			PastInfo			PastWinUninformative		
	# Strings	*Stop*	*Time*	*# Strings*	*Stop*	*Time*	*# Strings*	*Stop*	*Time*	*# Strings*	*Stop*	*Time*
Piece-rate 1												
Mean	20.84	–	–	20.35	–	–	19.92	–	–	19.44	–	–
(sd)	(5.38)	–	–	(4.80)	–	–	(6.25)	–	–	(6.54)	–	–
Piece-rate 2												
Mean	–	–	–	21.13	–	–	–	–	–	–	–	–
(sd)	–	–	–	(5.188)	–	–	–	–	–	–	–	–
Contest—round 1		$N = 50$			$N = 46$			$N = 48$			$N = 54$	
Mean	19.96	48.00%	8 m 32 s				19.64	43.75%	8 m 53 s	17.56	59.26%	8 m 10 s
(sd)	(8.17)	(0.51)	(2.66)				(7.67)	(0.50)	(2.07)	(8.65)	(0.50)	(2.67)
Contest—round 2		$N = 50$			$N = 46$			$N = 48$			$N = 54$	
R1 Winners—Mean	22.28	36.00%	9 m 38 s	18.78	43.47%	8 m 42 s	19.92	54.17%	9 m 37 s	15.63	59.25%	8 m 54 s
(sd)	(5.82)	(0.49)	(1.11)	(7.06)	(0.51)	(2.27)	(5.26)	(0.51)	(0.75)	(9.05)	(0.50)	(1.76)
R1 Winners—Mean change	−0.16	−4.00%	1.20 s	–	–	–	0.63	12.50%	24.7 s	−0.07	0.00%	9.70 s
(sd)	(3.38)	(0.20)	(0.80)	–	–	–	(4.60)	(0.68)	(1.38)	(3.64)	(0.62)	(0.90)
R1 Losers—Mean	18.32	44.00%	8 m 6 s	18.48	47.83%	8 m 27 s	19.17	45.83%	8 m 52 s	19.52	59.26%	7 m 37 s
(sd)	(9.81)	(0.51)	(3.67)	(7.72)	(0.51)	(2.60)	(8.37)	(0.51)	(2.48)	(7.68)	(0.50)	(3.37)
R1 Losers—Mean change	0.84	−12.00%	38 s	–	–	–	−0.83	0.00%	17.82 s	0.11	0.00%	0.42 s
(sd)	(11.68)	(0.73)	(5.30)	–	–	–	(8.80)	(0.72)	(3.47)	(10.72)	(0.00)	(4.29)
Contest—round 3		$N = 22$			$N = 22$			$N = 22$			$N = 22$	
N												
R1 Winners—Mean	23	9.09%	9 m 32 s	22.45	64.00%	8 m 56 s						
(sd)	(5.10)	(0.30)	(0.06)	(7.01)	(0.50)	(1.91)						
R1 Winners—Mean change	2.46	−18.18%	17 s	1.00	9.09%	1.00 s						
(sd)	(3.57)	(0.60)	(0.92)	(3.98)	(0.54)	(1.17)						
R1 Losers—Mean	20.27	36.36%	9 m 58 s	23.82	45.00%	9 m 16 s						
(sd)	(5.44)	(0.50)	(0.88)	(7.69)	(0.52)	(1.98)						
R1 Losers—Mean change	0.55	0.00%	−1.00 s	2.18	9.09%	−1.50 s						
(sd)	(3.11)	(0.78)	(1.18)	(4.56)	(0.70)	(0.31)						

TABLE 8. Sessions with contest-performance pairing condition in the evaluation stage: Summary statistics on effort/performance measures, conditional on the outcome in round 1. The effort/performance is measured by the number of strings completed (#strings), how often the timeout "STOP" button has been used (Stop), the time spent on the task in the round (Time).

	Baseline			FutureInfo			PastInfo			PastWinUninformative		
	# Strings	*Stop*	*Time*	*# Strings*	*Stop*	*Time*	*# Strings*	*Stop*	*Time*	*# Strings*	*Stop*	*Time*
Contest 1												
Mean	13.12	68.18%	6 m 40 s	13.34	63.79%	7 m 40 s	12.81	63.79%	7 m 5 s	12.84	58.62%	7 m 17 s
(sd)	(9.36)	(0.47)	(3.50)	(7.56)	(0.49)	(2.97)	(6.52)	(0.49)	(3.00)	(6.75)	(0.50)	(3.11)
Contest 2												
Mean	–	–	–	16.24	62.07%	8 m 32 s	–	–	–	–	–	–
(sd)	–	–	–	(7.39)	(0.49)	(2.33)	–	–	–	–	–	–
Contest—round 1		$N = 66$			$N = 58$			$N = 58$			$N = 58$	
Mean	17.56	53%	8 m 09 s				18.31	50%	8 m 42 s	19.05	31%	9 m 25 s
(sd)	(9.89)	(0.50)	(2.92)				(7.43)	(0.50)	(2.36)	(6.27)	(0.47)	(1.65)
Contest—round 2		$N = 66$			$N = 58$			$N = 58$			$N = 58$	
R1 Winners—Mean	21.33	24.24%	9 m 21 s	19.52	37.93%	9 m 28 s	20.24	41.38%	9 m 21 s	16.45	44.83%	9 m 28 s
(sd)	(9.03)	(0.44)	(1.74)	(5.53)	(0.49)	(1.51)	(7.90)	(0.50)	(1.70)	(7.36)	(0.51)	(2.43)
R1 Winners—Mean change	1.18	−18.18%	28 s	–	–	–	0.69	−3.44%	32.9 s	−3.10	20.69%	−38.4 s
(sd)	(3.34)	(0.39)	(1.61)	–	–	–	(5.50)	(0.57)	(1.28)	(7.02)	(0.49)	(2.28)
R1 Losers—Mean	15.27	51.52%	7 m 18 s	17.10	58.62%	8 m 14 s	16.21	48.28%	8 m 41 s	15.59	58.62%	8 m 14 s
(sd)	(10.17)	(0.51)	(3.54)	(9.68)	(0.50)	(2.75)	(7.44)	(0.51)	(2.64)	(8.16)	(0.50)	(2.88)
R1 Losers—Mean change	0.30	−12.12%	−6 s	–	–	–	−0.86	−6.90%	5.8 s	−2.97	20.69%	−1 m 14 s
(sd)	(11.04)	(0.55)	(4.84)	–	–	–	(5.43)	(0.53)	(2.69)	(6.78)	(0.56)	(3.33)
Contest—round 3		$N = 22$			$N = 20$			$N = 30$			$N = 22$	
N												
R1 Winners—Mean	20.73	45.45%	9 m 2 s	19.20	60%	9 m 17 s						
(sd)	(10.16)	(0.52)	(2.11)	(5.14)	(0.52)	(1.14)						
R1 Winners—Mean change	−1.18	36.36%	−53.10 s	−0.10	10.00%	21 s						
(sd)	(3.57)	(0.50)	(1.99)	(6.87)	(0.74)	(2.68)						
R1 Losers—Mean	22.27	36.36%	9 m 30 s	22	40%	9 m 14 s						
(sd)	(7.59)	(0.50)	(1.04)	(7.80)	(0.52)	(2.07)						
R1 Losers—Mean change	1	0.00	43.50 s	0.00	−10.00%	19.60 s						
(sd)	(4.52)	(0.00)	(1.34)	(4.81)	(0.32)	(0.99)						

A.2 *Summary statistics on players' beliefs about their chances to win each round*

Table 9 presents summary statistics on the participants beliefs to win a round elicited at the beginning of each round. In round 1, we observe that this belief is close to 50% in each treatment, which indicate that, following our pairing procedure, participants do not expect to be better than their opponent on average. The participants who end up winning round 1 had similar beliefs about their chance of winning at the beginning of round 1. However, after the outcome of round 1, participants update their beliefs with round 1 winners updating theirs upwards and round 1 losers updating theirs downwards.[35] In both *Baseline*. The beliefs of round 1 winners (round 2 losers) and round 1 losers (round 1 winners) all go back to around 50% in round 3. The difference in confi-

TABLE 9. Summary statistics on players beliefs about their chances to win the round (in %), conditional on the outcome in round 1 and pooling both the raw-performance and contest-performance pairing.

	Baseline	FutureInfo	PastInfo	PastWinUn
Contest—round 1				
Mean	54.78	–	54.99	54.31
(sd)	(18.44)	–	(17.95)	(19.62)
R1 Winners—Mean	55.47	–	54.09	52.82
(sd)	(18.38)	–	(14.46)	(20.14)
R1 Losers—Mean	54.09	–	55.89	55.8
(sd)	(18.62)	–	(20.97)	(19.16)
Difference—p-value	0.69		0.61	0.42
Contest—round 2				
R1 Winners—Mean	61.09	58.40	60.47	55.80
(sd)	(18.53)	(14.20)	(17.45)	(17.54)
R1 Winners—Mean change	5.62	8.40	6.38	2.98
(sd)	(9.79)	(14.20)	(9.88)	(17.00)
R1 Losers—Mean	42.53	46.67	47.25	47.95
(sd)	(21.85)	(14.73)	(26.68)	(24.23)
R1 Losers—Mean change	−11.55	−3.33	−8.64	−7.86
(sd)	(17.34)	(14.73)	(20.85)	(20.92)
Contest—round 3				
R1 Winners, R2 Losers—Mean	54.00	54.81		
(sd)	(21.91)	(15.97)		
R1 Winners, R2 Losers—Mean change	−9.23	−2.71		
(sd)	(12.39)	(17.96)		
R1 Losers, R2 Winners—Mean	52.77	55.04		
(sd)	(23.52)	(19.97)		
R1 Losers, R2 Winners—Mean change	9.91	7.95		
(sd)	(13.42)	(16.07)		

[35]Note the mean change is calculated based on the difference between beliefs in round 2 minus 50% for the *FutureInfo* treatment.

TABLE 10. Summary statistics on players beliefs about their relative performance in each round (in %) under the contest-performance paring condition, conditional on the outcome in round 1.

	Baseline	FutureInfo	PastInfo	PastWinUn
Contest—round 1				
Mean	59.67	–	58.02	58.60
(sd)	(19.89)	–	(19.54)	(20.91)
R1 Winners—Mean	62.67	–	59.24	56.31
(sd)	(17.29)	–	(15.63)	(23.66)
R1 Losers—Mean	56.67	–	56.79	60.90
(sd)	(22.05)	–	(23.03)	(17.87)
Difference—p-value	0.22		0.64	0.41
Contest—round 2				
R1 Winners—Mean	66.58	54.59	66.62	57.14
(sd)	(16.88)	(15.67)	(16.90)	(16.32)
R1 Winners—Mean change	3.91	4.59	7.38	0.83
(sd)	(10.40)	(15.67)	(8.34)	(24.68)
R1 Losers—Mean	44.45	46.31	50.79	58.69
(sd)	(23.78)	(19.00)	(24.73)	(28.42)
R1 Losers—Mean change	−12.21	−3.69	−6.00	−2.21
(sd)	(23.72)	(19.00)	(17.89)	(27.89)
Contest—round 3				
R1 Winners, R2 Losers—Mean	56.82	47.50		
(sd)	(22.28)	(15.32)		
R1 Winners, R2 Losers—Mean change	−12.73	−1.00		
(sd)	(12.52)	(14.68)		
R1 Losers, R2 Winners—Mean	45.27	57.00		
(sd)	(29.65)	(27.10)		
R1 Losers, R2 Winners—Mean change	2.55	8.50		
(sd)	(10.11)	(17.01)		

dence is another potential heterogeneity between players, besides raw skill. The matching procedure allows us to control for these differences by estimating the effect of winning, which comes from the purely random part of the contest on belief updating.

APPENDIX B: MATCHING

In order to recover the causal effect of winning, we want to estimate the (counterfactual) potential change in performance a player would experience after a win or a loss. Using the Rubin (1974) framework, let us denote Δe_i^1 and Δe_i^0 the potential outcomes in terms of change of effort for player i if, respectively, the player wins in round 1 ($\text{win}_{i1} = 1$) or not ($\text{win}_{i1} = 0$). Given that we know the exact winning probability determined by the performance of the player, conditional on this probability the win/loss outcome is purely

random (i.e., unrelated/exogenous to the player's characteristics).[36] As a consequence, the conditional independence assumption holds:

$$\left(\Delta e_i^1, \Delta e_i^0\right) \perp\!\!\!\perp \text{win}_{i1} | p_{i1}. \tag{4}$$

Conditioning on winning probability (using the matching approach) we can therefore identify the causal effect of winning. To do so, we match winners and losers who have similar ex ante winning probabilities. We implement a local linear regression matching which compares each winner to a weighted average of losers with similar probabilities (Heckman, Ichimura, and Todd (1998)). More weight is given to counterfactual observations with closer matching probability.[37]

Let us consider a game where n participants compete in pairs in a given round. Let $\mathcal{M}_i$ denote the matching neighborhood of observation i, which includes all observations j that had a different outcome win_{j1} (win/loss) in the first round and were located within a bandwidth h in regard to their winning probability:

$$\mathcal{M}_i = \left\{ j \in \{1, \ldots, n\} : \| p_i - p_j \| < h \cap \text{win}_{j1} \neq \text{win}_{i1} \right\}. \tag{5}$$

We estimate the following regression in a given matching neighborhood of observation i:

$$\min_{a_i, b_i} \sum_{j \in \mathcal{M}_i} \left(\Delta e_j - a_i - b_i \times (p_i - p_j) \right)^2 K\left(\frac{p_j - p_i}{h} \right).$$

Where a_i and b_i are the parameters of the local linear regression and K is a kernel weighting function with a bandwidth h (see Fan (1992)). The prediction of the above regression is a synthetic counterfactual to observation i ($\widehat{\Delta e_i}$). Figure 6 shows how this counterfactual is estimated.

Let $\widehat{\Delta e_i^1}$ and $\widehat{\Delta e_i^0}$ be these estimated counterfactual after a win and a loss, respectively. We can compute the individual effect ($\widehat{\beta}_i$) of winning as

$$\widehat{\beta}_i = \begin{cases} \Delta e_i - \widehat{\Delta e_i^0} & \text{if win}_{i1} = 1, \\ \widehat{\Delta e_i^1} - \Delta e_i & \text{if win}_{i1} = 0. \end{cases}$$

And the average treatment effects ($\widehat{\beta}$), henceforth denoted as ATE, is

$$\widehat{\beta} = \frac{1}{n} \sum_{i=1}^{N} \widehat{\beta}_i. \tag{6}$$

[36] Due to the endogeneity problem, players who ended up winning are on average stronger players (than those who lost). For that reason, looking at the performance in the second round of the first round winners is likely different from looking at the *potential* performance *any player* would have in the second round after winning the first round. This problem disappears when conditioning on the first round winning probability.

[37] As shown by Fan (1992), local linear regression performs strictly better than local weighted averaging like kernel regression.

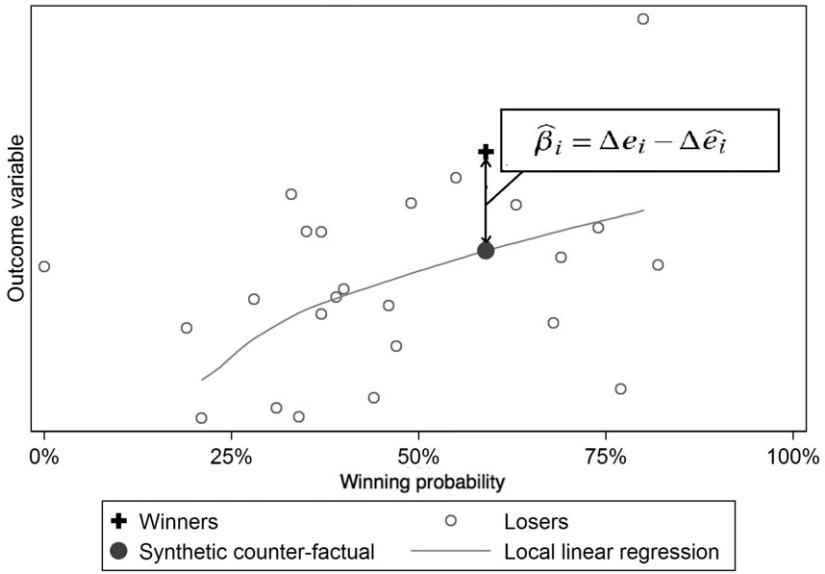


FIGURE 6. Representation of the construction of the counterfactual values of a variable of interest (Y) for winners. Counterfactual values of losing players are calculated similarly using winning players.

APPENDIX C: ROBUSTNESS CHECKS

C.1 *Balance tests across treatments*

TABLE 11. Comparisons of demographics between treatments. We asked subjects "Did you enjoy the task," "Do you think effort pays off in this game," and "On a 0-10 scale, do you see yourself as a person that usually takes risk (0 being never, 10 being always)." Answers to these questions are summarized in "% Enjoyed task," "% Effort pays off," and "Mean risk," respectively. P-values are from Kruskal–Wallis tests.

	Overall	*Baseline*	*FutureInfo*	*PastInfo*	*PastWinUn*	P-values
% Male	56%	60%	58%	48%	56%	$p = 0.279$
(sd)	(0.50)	(0.49)	(0.49)	(0.50)	(0.50)	
Mean age	22.82	23.55	22.88	22.44	22.37	$p = 0.721$
(sd)	(5.56)	(6.36)	(6.24)	(4.70)	(4.67)	
% Enjoyed task	75%	78%	73%	73%	76%	$p = 0.808$
(sd)	(0.43)	(0.42)	(0.44)	(0.45)	(0.43)	
% Effort pays off	68%	66%	70%	65%	71%	$p = 0.666$
(sd)	(0.47)	(0.48)	(0.46)	(0.48)	(0.45)	
Mean risk	6.12	6.61	6.22	5.99	6.25	$p = 0.625$
(sd)	(2.10)	(2.20)	(1.80)	(2.11)	(2.26)	

C.2 *Common support*

It is standard to check the size of the common support (set of observations where the matching scores overlap) when using a propensity score matching. In our case, our matching strategy is facilitated by the fact that the Tullock function produces winning probabilities concentrated around 50%. Therefore, most winners in our sample can be matched with losers with a similar winning probability and vice versa.

The empirical distribution of the round 1 winning probabilities is represented in Figure 7. *FutureInfo* is not represented since all the observations can be matched: the winning probability is 50% for all participants in round 1, by design. In *Baseline*, the common support includes participants having a chance to win the first round between 41% and 59% ($N = 32$) under raw-performance pairing and between 8% to 92% ($N = 58$) under contest-performance paring. In *PastInfo* and *PastWinUninformative*, the common support includes pairs whose propensity score range between 27% and 73% ($N = 46$) and between 36% to 70% ($N = 38$), respectively, under raw-performance pairing. These numbers become 28% to 72% ($N = 54$) and 30% to 70% ($N = 56$), respectively, under contest-performance pairing. Detailed summary statistics over the common support are presented in Tables 12 and 13.

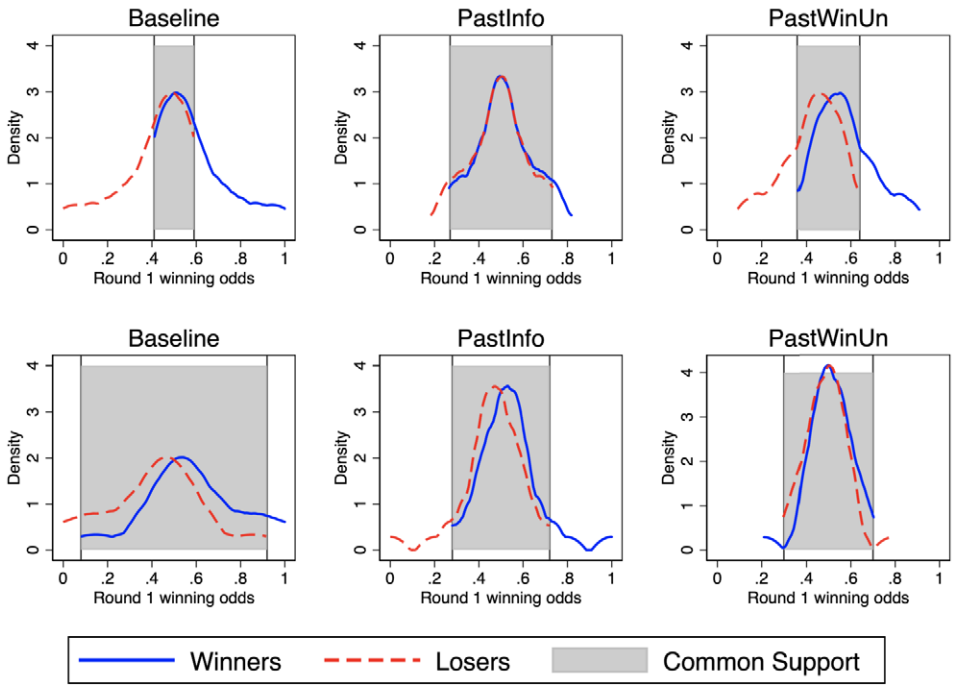


FIGURE 7. Distribution of winning probability in each treatment conditions. Top panels: Raw-performance pairing; Bottom panels: Contest-performance pairing.

TABLE 12. Summary statistics over the common support (raw-performance pairing). P-values are for Mann–Whitney tests between winners and losers.

		Change in # strings		Change in time spent		Change in productivity	
		Winners	Losers	Winners	Losers	Winners	Losers
Baseline	Mean	−0.25	−4.63	−0.066	−2	0	−0.58
	se	(0.955)	(2.427)	(0.232)	(1.035)	(0.075)	(0.261)
	MW test	$p = 0.279$		$p = 0.480$		$p = 0.151$	
PastInfo	Mean	0.86	−1.65	0.43	0.02	−0.02	−0.24
	se	(0.946)	(1.669)	(0.292)	(0.681)	(0.133)	(0.060)
	MW test	$p = 0.473$		$p = 0.432$		$p = 0.176$	
PastWinUninformative	Mean	−0.74	−2.95	0.18	−1.36	−1.12	−0.06
	se	(3.813)	(10.450)	(1.071)	(4.086)	(0.251)	(0.459)
	MW test	$p = 0.671$		$p = 0.744$		$p = 0.827$	

C.3 *Bandwidth selection*

We relax the assumption of a bandwidth of 2.5% for the local linear regression to check the robustness of our results. First, we use a leave-one-out cross-validation method (Härdle, Müller, Sperlich, and Werwatz (2012)) to determine the bandwidth minimizing the Asymptotic Mean Integrated Squared Errors (AMISE). This bandwidth is referred as the "optimal bandwidth" in typical applications. It is however not necessarily optimal in a matching estimation. The identification strategy requires observations to be matched with very close observations in order to ensure that they are similar. The best bandwidth in a matching approach may therefore be smaller than the one minimizing the AMISE. We therefore only use this different bandwidth as a robustness check, which might be different from our initial choice of a small bandwidth.

The leave-one-out cross-validation method consists in estimating the AMISE of the estimator by running the model on the whole sample minus one observation and com-

TABLE 13. Summary statistics over the common support (contest-performance pairing). P-values are for Mann–Whitney tests between winners and losers.

		Change in # strings		Change in time spent		Change in productivity	
		Winners	Losers	Winners	Losers	Winners	Losers
Baseline	Mean	1.52	−1.45	0.55	−0.90	0.01	−0.13
	Se	(3.313)	(10.294)	(1.708)	(4.473)	(0.235)	(0.776)
	MW test	p=0.096		p=0.129		$p = 0.22$	
PastInfo	Mean	0.85	−1.37	0.58	−0.13	−0.052	−0.14
	Se	(5.634)	(5.009)	(1.322)	(2.481)	(0.358)	(0.235)
	MW test	p=0.270		p=0.531		$p = 0.210$	
PastWinUninformative	Mean	−3.18	−2.89	−0.66	−1.19	−0.17	−0.16
	Se	(7.139)	(6.893)	(2.320)	(3.378)	(0.570)	(0.379)
	MW test	p=1.00		p=0.710		$p = 0.967$	

TABLE 14. Results using the cross-validation procedure with data from the raw-performance pairing condition. This table displays the estimated effect of winning round 1 on "effort" measures and winning probability in round 2, using the optimally chosen bandwidth for LLR with an Epanechnikov kernel weighting function. Standard errors are constructed by standard bootstrap (2000 replications). Confidence intervals at 95% are indicated in brackets.

		Strings completed	Time spent	Productivity	Winning prob.
Baseline	Optimal bw	0.037	0.037	0.089	0.044
	$\hat{\beta}$	4.07	1.84	0.58	0.24
	ci	[−0.72, 8.85]	[−0.18, 3.86]	[0.01, 1.14]	[0.07, 0.4]
PastInfo	Optimal bw	0.041	0.010	0.041	0.010
	$\hat{\beta}$	2.82	0.31	0.25	0.05
	ci	[−0.55, 6.2]	[−0.99, 1.6]	[−0.03, 0.53]	[−0.03, 0.13]
PastWinUninformative	Optimal bw	0.016	0.015	0.014	0.139
	$\hat{\beta}$	1.76	1.27	−0.01	0.11
	ci	[−3.43, 6.95]	[−0.74, 3.29]	[−0.28, 0.26]	[0, 0.22]

pare the model prediction for this observation with the actual value of the variable studied. By successively leaving out each observation in the sample once, one can estimate an error for each observation. The average of these errors provides an estimate of the AMISE of the model given its bandwidth. The "optimal bandwidth" is the one that minimizes the mean square error of the predictions. The optimal bandwidth identified through this procedure are displayed in Table 14 using data from raw-performance pairing and in Table 15 using data from contest-performance pairing. As shown, our main results (illustrated in Table 3 in the main text) still hold for these optimal bandwidths.

TABLE 15. Results using the cross-validation procedure with data from the contest-performance pairing condition. This table displays the estimated effect of winning round 1 on "effort" measures and winning probability in round 2, using the optimally chosen bandwidth for LLR with an Epanechnikov kernel weighting function. Standard errors are constructed by standard bootstrap (2000 replications). Confidence intervals at 95% are indicated in brackets.

		Strings completed	Time spent	Productivity	Winning prob.
Baseline	Optimal bw	0.420	0.016	0.354	0.056
	$\hat{\beta}$	4.33	2.33	0.30	0.17
	ci	[0.39, 8.26]	[0.49, 4.18]	[−0.02, 0.62]	[0.05, 0.28]
PastInfo	Optimal bw	0.037	0.146	0.037	0.219
	$\hat{\beta}$	2.28	0.69	0.09	0.08
	ci	[−0.66, 4.89]	[−0.36, 1.73]	[−0.07, 0.24]	[0.01, 0.13]
PastWinUninformative	Optimal bw	0.075	0.041	0.057	0.074
	$\hat{\beta}$	−0.07	0.16	0.06	0.02
	ci	[−4.19, 4.01]	[−1.5, 1.96]	[−0.24, 0.35]	[−0.1, 0.14]

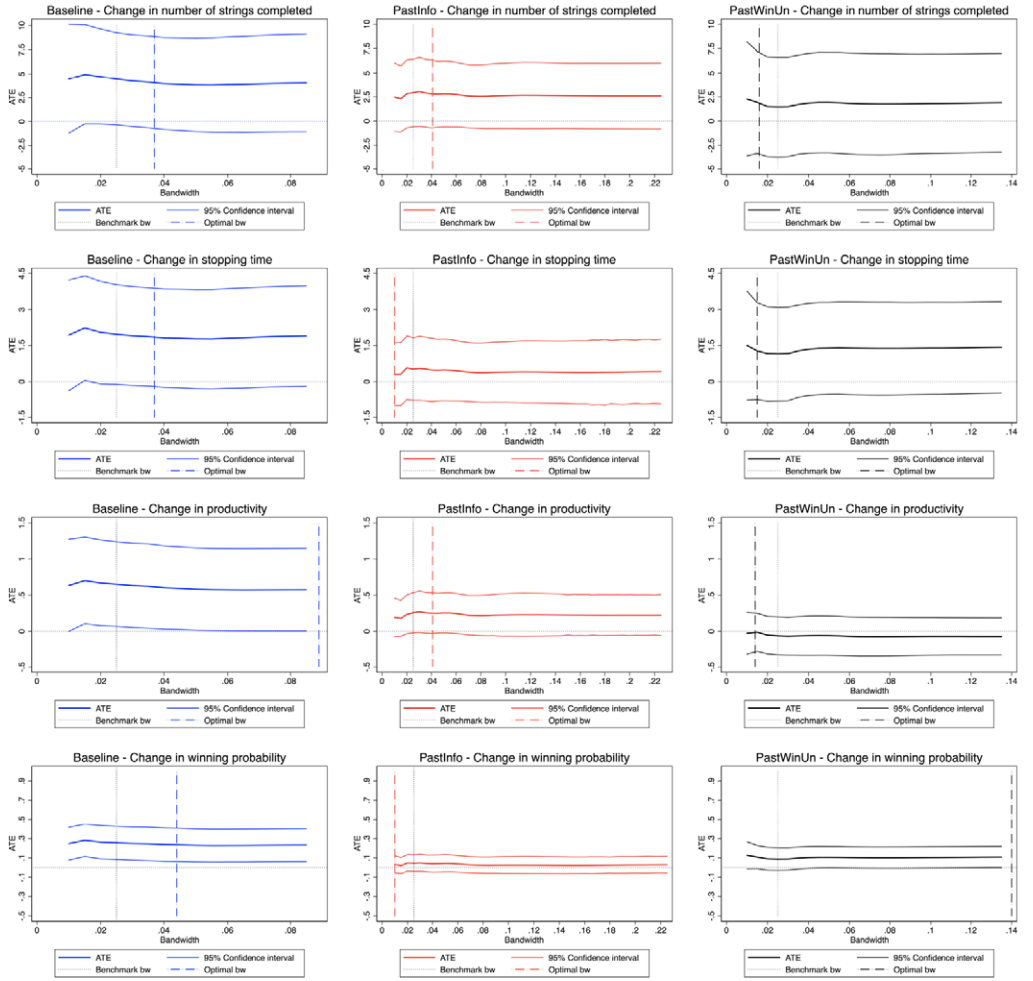


FIGURE 8. A display of the impact of varying bandwidth on the estimated effect of winning using data from raw-performance pairing.

We further assess the sensitivity of our results to bandwidth selection by looking at how our results vary with different bandwidths. We start by estimating the model with a bandwidth of 0.01, and progressively increase it up to the point where all observations on the common support are included. The estimated effects are displayed in Figure 8 (with data from the raw-performance paring condition) and Figure 9 (with data from the contest-performance pairing condition. Both figures suggest that our main findings are robust to changing bandwidth.

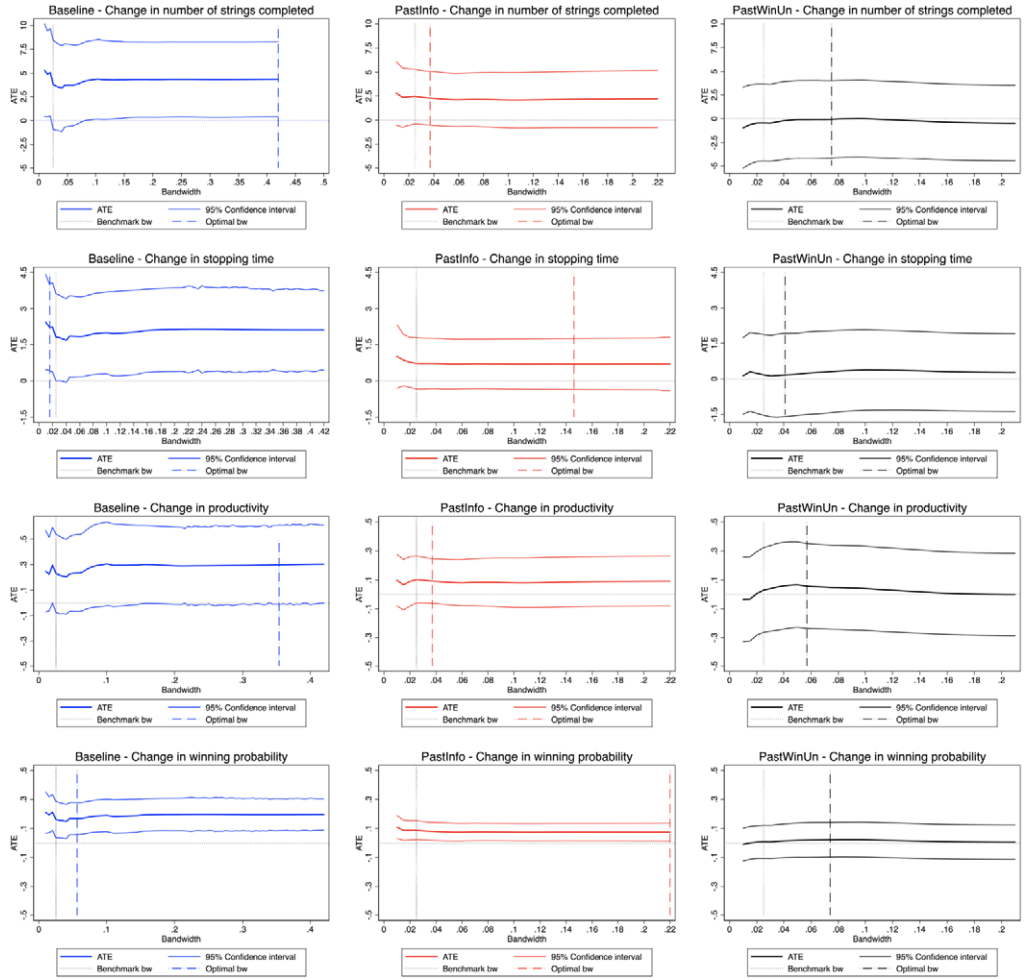


FIGURE 9. A display of the impact of varying bandwidth on the estimated effect of winning using data from contest-performance pairing.

C.4 *Resampling at the pair level*

TABLE 16. Effect of winning round 1 on "effort" measures and winning probability in round 2, estimated by LLR matching. For estimates with all observations, the matching is done within each condition. The bandwidth for the LLR is set to 0.025 with an Epanechnikov kernel weighting function. For estimates with all observations, the matching is done within each condition. Standard errors are indicated in brackets and constructed by bootstrap *at the pair-level* (2000 replications). N is the total number of observations in each treatment and N (supp.) is the total number of observations on the common support. Significance at * 10%, ** 5%, *** 1%.

Treatment	Strings completed	Time spent	Productivity	Winning prob.	N	N (supp.)
			Raw-performance pairing			
Baseline	4.46	1.96	0.65	0.26	50	32
	[−1.49, 9.01]	[−0.4, 4.01]	[−0.38, 0.84]	[−0.08, 0.4]		
FutureInfo	0.30	0.28	−0.03	0.02	46	46
	[−2.71, 3.32]	[−1.11, 1.66]	[−0.22, 0.17]	[−0.09, 0.13]		
PastInfo	2.93	0.52	0.26	0.08	48	46
	[−1.3, 5.24]	[−1.13, 1.53]	[−0.01, 0.47]	[−0.08, 0.17]		
PastWinUn	1.46	1.15	−0.06	0.09	54	38
	[−2.81, 5.74]	[−0.66, 2.96]	[−0.33, 0.2]	[−0.08, 0.25]		
			Contest-performance pairing			
Baseline	3.76	1.81	0.23	0.16	66	58
	[−1.13, 8.66]	[0.04, 3.57]	[−0.13, 0.6]	[−0.02, 0.34]		
FutureInfo	1.38	0.75	0.04	0.06	58	58
	[−1.81, 4.56]	[−0.66, 2.15]	[−0.16, 0.24]	[−0.06, 0.19]		
PastInfo	2.46	0.72	0.10	0.09	58	54
	[−0.16, 5.08]	[−0.22, 1.65]	[−0.07, 0.28]	[−0.01, 0.18]		
PastWinUn	−0.44	0.17	0.03	0.01	58	56
	[−4.91, 4.04]	[−1.56, 1.9]	[−0.28, 0.34]	[−0.15, 0.17]		
			All observations			
Baseline	4.01	1.86	0.38	0.20	116	90
	[0.42, 7.6]	[0.51, 3.21]	[0.05, 0.72]	[0.05, 0.34]		
FutureInfo	0.90	0.54	0.01	0.05	104	104
	[−1.31, 3.11]	[−0.46, 1.54]	[−0.13, 0.15]	[−0.04, 0.13]		
PastInfo	2.67	0.63	0.17	0.08	106	100
	[0.8, 4.54]	[−0.09, 1.34]	[0.03, 0.32]	[0.01, 0.15]		
PastWinUn	0.33	0.56	−0.01	0.04	112	94
	[−2.75, 3.41]	[−0.67, 1.79]	[−0.22, 0.2]	[−0.07, 0.15]		

TABLE 17. Effect of winning round 1 on elicited confidence in round 2's winning chances and performance, estimated by LLR matching. For estimates with all observations, the matching is done within each condition. For estimates with all observations, the matching is done within each condition. The bandwidth for the LLR is set to 0.025 with an Epanechnikov kernel weighting function. Standard errors are constructed by bootstrap *at the pair level* (2000 replications) and indicated in brackets. Significance at * 10%, ** 5%, *** 1%.

Treatment	Win. chances	Performance	*N*
	Raw-performance pairing		
Baseline	18.58		50
	[13.67, 29.5]		
FutureInfo	9.96		46
	[2.19, 17.72]		
PastInfo	14.76		48
	[2.63, 27.27]		
PastWinUninformative	7.23		54
	[−3.35, 17.81]		
	Contest-performance pairing		
Baseline	21.58	19.47	66
	[13.84, 29.33]	[12.31, 26.64]	
FutureInfo	13.14	8.28	58
	[6.3, 19.98]	[1.68, 14.87]	
PastInfo	17.51	13.48	58
	[7.29, 27.73]	[4.16, 22.8]	
PastWinUninformative	12.01	−0.24	58
	[2.19, 21.83]	[−14.32, 13.83]	
	All observations		
Baseline	20.52		116
	[15.01, 26.02]		
FutureInfo	11.73		104
	[6.65, 16.81]		
PastInfo	16.24		106
	[8.31, 24.18]		
PastWinUninformative	10.08		112
	[2.62, 17.53]		

APPENDIX D: LOOKING AT BEHAVIOR IN ROUND 3

Our identification strategy is designed to study what happens in round 2, by matching on winning probability in round 1. One could be tempted to use the observations in round 3 to also investigate the existence of a momentum. We explain here why round 3 observations do not allow us to identify cleanly a momentum. For this reason, we only provide summary statistics of the round 3 observations in Table 7 and 8.

Matching not possible Our matching approach cannot be used to look at round 3 behavior. The reason is simple, the matching is intended to compare two players with similar past performance but different histories of winning. In round 2, matching on the probability of winning in round 1 achieves these two goals. Matched players indeed had

similar past performance (equal winning probabilities) but they had different outcomes in the round 1 (win/loss).

We cannot achieve the same two goals in round 3 by matching winners and losers in round 2 with similar winning probabilities. The matching would compare players with similar performance in round 2, but it would not control for differences in performance in round 1. By design of the best-of-three contest, the performances in round 2 will systematically vary with the outcome in round 1. To reach the round 3, winners in round 2 must have lost in round 1, losers in round 2 must have won in round 1. Even though matching may control for the performance in round 2, the players would still systematically differ in their round 1 performance.

Simple comparison of past winner/loser has hidden selection Another approach has been suggested to use round 3 observations to study a psychological momentum. Both Malueg and Yates (2010) and Mago, Sheremeta, and Yates (2013) looked at round 3 when both players have won a round (1-1) and compared the winner in round 2 to the loser in round 2. This approach is similar to a matching on round 2 performance with a large bandwidth (e.g., 100%) such that all winners are compared to all losers.

This approach faces the same issue as described above. It relies on the assumption that players are perfectly homogeneous in ability to start with. If so, they have then identical characteristics in 1-1, independently of their past performance (win-loss or loss-win). As there should not be any strategic momentum in 1-1, any momentum can be seen as a sign of psychological momentum. However, whenever unobserved differences exist between players, there is no reason to expect that players who won and then loss have *on average* the same ability as players who lost and then won.

Players who caught back in a second round may had to overcome momentum against them. They may be stronger on average than players who lost an early advantage while benefiting from a momentum. This hidden selection creates a bias, which can create a spurious momentum in 1-1. For this reason, in spite of their apparent symmetric appeal, the 1-1 situations do not provide an good setting to cleanly isolate a momentum effect in a best-of-three contest.

Appendix E: Instructions: Raw-performance pairing

E.1 *Instructions for the evaluation stage*

Welcome to our experiment! You will receive AUD 5 for showing up on time. Please read these instructions carefully and completely. Properly understanding the instructions will help you to make better decisions and, hence, to earn more money. If you read these instructions carefully and perform well in the experiment, you can earn a significant amount of money (which will be paid out to you in cash at the end of the experiment).

Please keep in mind that you are not allowed to communicate with other participants during the experiment. You are not allowed to use your mobile phone at any time either. If you do not obey these rules you will be asked to leave the laboratory and will not be paid. Whenever you have a question, please raise your hand; an experimenter will come to assist you.

This experiment consists of two parts. You will receive separate instructions for each part. Your final payment will be the sum of your earnings in both parts, plus your show-up fee.

Part 1

In this experiment you will be asked to reverse strings of characters that will appear on your screen. Each string is randomly generated and has 20 characters.

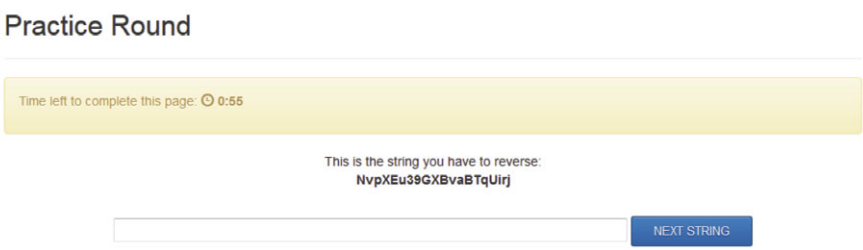
For example, if you see:

NvpXEu39GXBvaBTqUirj

You have to enter:

jriUqTBavBXG93uEXpvN

You will be doing this task for 10minutes. For each string you correctly reverse you will get 20cts. A typical screen that you will be seeing is as follows:



Your payoff will be computed as follows:

Number of tasks completed correctly × 20cts

For instance, if you completed 8 tasks, you will earn: 8 × AUD 0.2 = AUD 1.6.

To make sure that you understand the task and know how to work, you will have the opportunity to practice for 1 minute without payment.

E.2 *Instructions for best-of-three contests*

Part 2 (for Baseline treatment)

Matching

In this part, the computer will rank all the participants in this session according to the number of tasks completed in Part 1. Then it will match the two participants with the closest ranks into a pair.

For instance, a participant with rank 1 will be paired with a participant with rank 2, and a participant with rank 3 will be paired with the one in rank 4, etc.

The ranking and pairing assignments remain anonymous throughout the entire experiment. You will not be informed about the identity of the participant in this room you have been paired with. You will also not be able to learn your actual rank or the rank of anyone else. All you should keep in mind is that your opponent has the closest rank to you (based on performance records from Part 1).

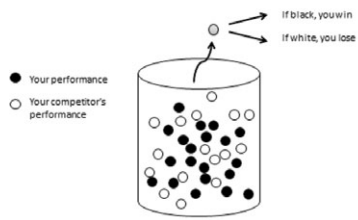
Competition

In this part, the two participants in a pair will compete against each other. The competition consists of maximum three independent rounds. The one who wins two out of the three rounds wins the competition and will be awarded a prize of AUD 20.

The competition in each round is organized as follows: both you and your competitor will work simultaneously and independently on the same 10-minute task as in Part 1.You will **NOT** learn how many tasks you or your opponent has completed during the competition. Nonetheless, the more tasks you complete, the more likely you are to win in each round.

The winner of each round is determined according to the following procedure:

Imagine that you are facing an urn. Each time you complete a task correctly, you earn one black ball that will go into the urn. Each time your competitor completes a task correctly, he/she earn a white ball that goes into the urn. At the end of the round, the computer randomly picks a ball from the urn. If it is black you win that round, if it is white your competitor wins that round. This procedure is depicted in the following figure.



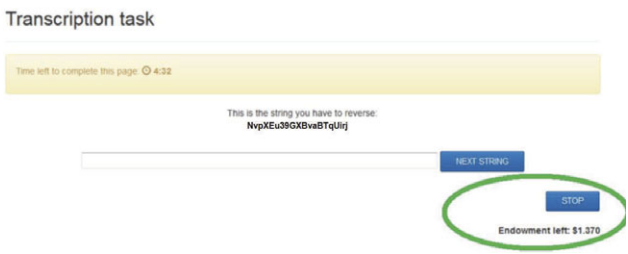
This means that your probability to win a round depends on both your performance and your competitor's performance in that round. Specifically, it is computed as:

$$Your\ Probability\ to\ win = \frac{total\ number\ of\ tasks\ completed\ correctly\ by\ you}{total\ number\ of\ tasks\ completed\ by\ you\ and\ your\ competitor}$$

For example, if you and your competitor complete equal number of tasks (including if you both solve 0 tasks) you have 50% chance of winning. If you solve more (or less) tasks than your competitor, you have more than (or less than) 50% chance to win.

Time is money

Spending time to work on the tasks in this competition is costly. In each round, you are endowed with AUD 3. As soon as you enter a round, your endowment starts depleting. You pay AUD 0.005 (i.e., half a cent) per second for the time you spend working on the tasks. You are free to stop working at any point during the competition though. Once you decide that you have worked enough for the competition, you could simply click the "STOP" button displayed at the right-bottom of the screen (see the screen shot below).



All the tasks you completed correctly before hitting the Stop button will be accounted for, when the winner is determined (i.e., the black balls you have earned stay in the urn).

For instance, if you stop as soon as the round starts, you will receive the full endowment AUD 3 for that round, but you will lose that round for sure if your competitor completes at least one task correctly; If you work for 5 minutes (300 seconds) and then press the Stop button, your initial endowment will be reduced by: AUD 1.50 (=300 x AUD 0.005) and the remaining endowment will be included in your final payment; At the same time, your chance of winning that round is determined by the total number of tasks you have completed correctly within that 5 minutes, together with the total number of tasks your competitor has completed.

Please note that once the “stop” button is hit, you cannot come back to the task anymore.
Remember that you will not see the number of correct tasks completed by you and your competitor during each round. This is also true when the round is finished. However, you will be informed who the winner is at the end of each round. After two rounds of competition, if you and your competitor each have won one round, you will need to compete in a third round to break the tie. The competition in the third round works the same as in the first and second round and the winner of the third round receives the prize. If you have won (or lost) both rounds, you have won (or lost) the prize. There is no need to compete in the third round. Nevertheless, you will receive the full endowment AUD 3 for that round, as you will not spend any time in competing.

After the competition

After everyone in this room has finished the competition, you will need to finish a simple exit questionnaire. All the information you provide in this questionnaire, as well as your performance data in the experiment will only be used for statistical analysis and will be kept anonymous and strictly confidential.

Once the questionnaire is done, your total payment from this experiment will be calculated as the following:

If you win:
Total payment=show-up fee (AUD 5) + earnings from Part 1 + prize (AUD 20) + total endowment you kept in all three rounds

If you lose:
Total payment=show-up fee (AUD 5) + earnings from Part 1 +total endowment you kept in all three rounds

At the end of this session, your performance and your competitor's performance in each round, as well as your payoff will be displayed to you. See the following screenshot as an example.

The participation fee is $5.
Your total payoffs are: $22.45

Summary

Round number	Your performance	Your opponent's performance	Number of wins	Time left on counter	Payoff
Part 1	9	NA	NA	NA	$2.25
Part 2-round1	0	3	0	39	$0.20
Part 2-round2	10	0	1	0	$0.00
Part 2-round3	13	9	2	0	$20.00

Part 2 (for FutureInfo treatment)

Matching

In this part, the computer will rank all the participants in this session according to the number of tasks completed in the *first round* of Part 1. Then it will match the two participants with the closest ranks into a pair.
For instance, a participant with rank 1 will be paired with a participant with rank 2, and a participant with rank 3 will be paired with the one in rank 4, etc.
The ranking and pairing assignments remain anonymous throughout the entire experiment. You will not be informed about the identity of the participant in this room you have been paired with. You will also

not be able to learn your actual rank or the rank of anyone else. All you should keep in mind is that your competitor has the closest rank to you (based on performance records from Part 1).

Competition

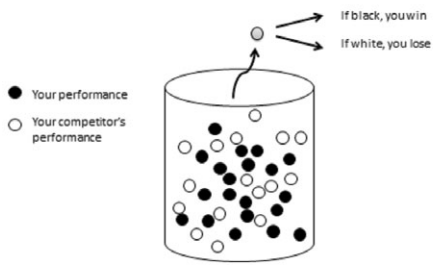
In this part, the two participants in a pair will compete against each other. The competition consists of maximum three independent rounds. The one who wins two out of the three rounds wins the competition and will be awarded a prize of AUD 20.

In round 1, the winner is decided by a rolling die. First, the computer will randomly assign you and your competitor to odd numbers and even numbers respectively. And then the computer will throw a rolling die (with numbers 1, 2, 3, 4, 5, 6 on each side of the die). If the number showing up on the die is an odd number (either 1, or 3, or 5), then the one who has been assigned to odd numbers will win round 1; if the number showing up on the die is an even number (either 2, or 4, or 6), then the one who has been assigned to even numbers will win round 1.

In round 2 and 3, both you and your competitor will work simultaneously and independently on the same 10-minute task as in Part 1. You will **NOT** learn how many tasks you or your competitor has completed during the competition. Nonetheless, the more tasks you complete, the more likely you are to win in each round.

The winner of each round is determined according to the following procedure:

Imagine that you are facing an urn. Each time you complete a task correctly, you earn one black ball that will go into an urn. Each time your competitor completes a task correctly, he/she earn a white ball that goes into the urn. At the end of the round, the computer randomly picks a ball from the urn. If it is black you win that round, if it is white your competitor wins that round. This procedure is depicted in the following figure.



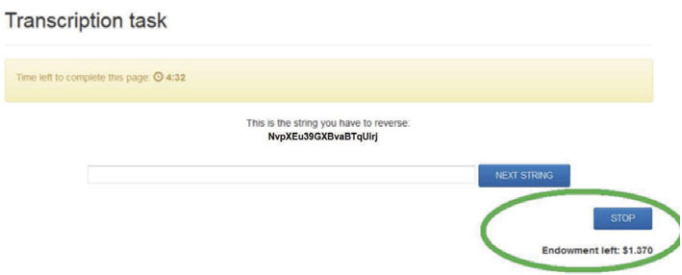
This means that your probability to win a round depends on both your performance and your competitor's performance in that round. Specifically, it is computed as:

$$Your\ Probability\ to\ win = \frac{total\ number\ of\ tasks\ completed\ correctly\ by\ you}{total\ number\ of\ tasks\ completed\ by\ you\ and\ your\ competitor}$$

For example, if you and your competitor complete equal number of tasks (including if you both solve 0 tasks) you have 50% chance of winning. If you solve more (or less) tasks than your competitor, you have more than (or less than) 50% chance to win.

Time is money

Spending time to work on the tasks in this competition is costly. In round 2 and 3, you are endowed with AUD 3. As soon as you enter a round, your endowment starts depleting. You pay AUD 0.005 (i.e., half a cent) per second for the time you spend working on the tasks. You are free to stop working at any point during the competition though. Once you decide that you have worked enough for the competition, you could simply click the "STOP" button displayed at the right-bottom of the screen (see the screen shot below).



All the tasks you completed correctly before hitting the Stop button will be accounted for, when the winner is determined (i.e., the black balls you have earned stay in the urn).

For instance, if you stop as soon as the round starts, you will receive the full endowment AUD 3 for that round, but you will lose that round for sure if your competitor completes at least one task correctly; If you work for 5 minutes (300 seconds) and then press the Stop button, your initial endowment will be reduced by: AUD 1.50 (=300 x AUD 0.005) and the remaining endowment will be included in your final payment; At the same time, your chance of winning that round is determined by the total number of tasks you have completed correctly within that 5 minutes, together with the total number of tasks your competitor has completed.

Please note that once the “stop” button is hit, you cannot come back to the task anymore.

Remember that you will not see the number of correct tasks completed by you and your competitor during each round. This is also true when the round is finished. However, you will be informed who the winner is at the end of each round. After two rounds of competition, if you and your competitor each have won one round, you will need to compete in a third round to break the tie. The competition in the third round works the same as in the second round and the winner of the third round receives the prize. If you have

won (or lost) round 1 and round 2, you have won (or lost) the prize. There is no need to compete in the third round. Nevertheless, you will receive the full endowment AUD 3 for that round, as you will not spend any time in competing.

After the competition

After everyone has finished the competition, you will need to finish a simple exit questionnaire. All the information you provide in this questionnaire, as well as your performance data in the experiment will only be used for statistical analysis and will be kept anonymous and strictly confidential.

Once the questionnaire is done, your total payment from this experiment will be calculated as follows:

If you win:
Total payment=show-up fee (AUD 5) + earnings from Part 1 + prize (AUD 20) + total endowment you kept round 2 and 3

If you lose:
Total payment=show-up fee (AUD 5) + earnings from Part 1 +total endowment you kept round 2 and 3

At the end of this session, your performance and your competitor's performance in each round, as well as your payoff will be displayed to you. See the following screenshot as an example.

The participation fee is $5.
Your total payoffs are: $ **28.96**

Round number	Your performance	Your competitor's performance	Number of wins	Time left on counter (in s.)	Payoff
Part 1 - Round 1	9	6	-	-	1.80
Part 1 - Round 2	6	8	-	-	1.20
Part 2 - Round 1 (die)	-	-	1	-	-
Part 2 - Round 2	1	9	2	591	$22.96
Part 2 - Round 3	-	-	-	-	$3.00

Part 2 (for PastInfo & PastWinUninformative treatments)

Matching

In this part, the computer will rank all the participants in this session according to the number of tasks completed in Part 1. Then it will match the two participants with the closest ranks into a pair.
For instance, a participant with rank 1 will be paired with a participant with rank 2, and a participant with rank 3 will be paired with the one in rank 4, etc.
The ranking and pairing assignments remain anonymous throughout the entire experiment. You will not be informed about the identity of the participant in this room you have been paired with. You will also not be able to learn your actual rank or the rank of anyone else. All you should keep in mind is that your opponent has the closest rank to you (based on performance records from Part 1).

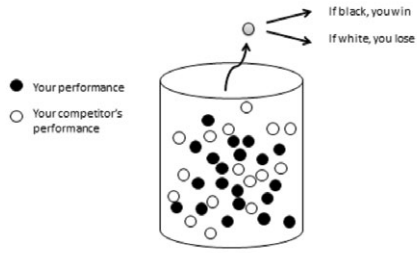
Competition

In this part, the two participants in a pair will compete against each other. The competition consists of maximum three independent rounds. The one who wins two out of the three rounds wins the competition and will be awarded a prize of AUD 20.

The competition in the first two rounds is organized as follows: both you and your competitor will work simultaneously and independently on the same 10-minute task as in Part 1. [**PastInfo**: You will **NOT** learn how many tasks you or your opponent has completed during the competition.] Nonetheless, the more tasks you complete, the more likely you are to win in each round.

The winner of round 1 and round 2 is determined according to the following procedure:

Imagine that you are facing an urn. Each time you complete a task correctly, you earn one black ball that will go into the urn. Each time your competitor completes a task correctly, he/she earn a white ball that goes into the urn. At the end of the round, the computer randomly picks a ball from the urn. If it is black you win that round, if it is white your competitor wins that round. This procedure is depicted in the following figure.



This means that your probability to win a round depends on both your performance and your competitor's performance in that round. Specifically, it is computed as:

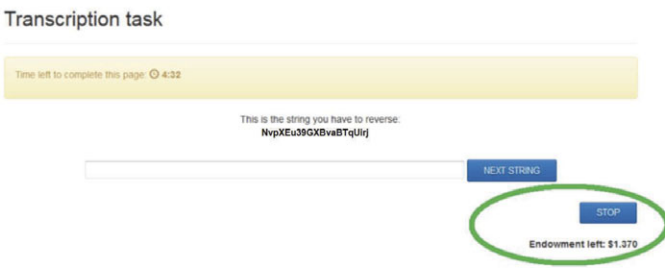
$$Your\ Probability\ to\ win = \frac{total\ number\ of\ tasks\ completed\ correctly\ by\ you}{total\ number\ of\ tasks\ completed\ by\ you\ and\ your\ competitor}$$

For example, if you and your competitor complete equal number of tasks (including if you both solve 0 tasks) you have 50% chance of winning. If you solve more (or less) tasks than your competitor, you have more than (or less than) 50% chance to win.

Time is money

Spending time to work on the tasks in this competition is costly. In the first two rounds, you are endowed with AUD 3 for each round. As soon as you enter a round, your endowment starts depleting. You pay

AUD 0.005 (i.e., half a cent) per second for the time you spend working on the tasks. You are free to stop working at any point during the competition though.
Once you decide that you have worked enough for the competition, you could simply click the "STOP" button displayed at the right-bottom of the screen (see the screen shot below).



All the tasks you completed correctly before hitting the Stop button will be accounted for, when the winner is determined (i.e., the black balls you have earned stay in the urn).

For instance, if you stop as soon as the round starts, you will receive the full endowment AUD 3 for that round, but you will lose that round for sure if your competitor completes at least one task correctly; If you work for 5 minutes (300 seconds) and then press the Stop button, your initial endowment will be reduced by: AUD 1.50 (=300 x AUD 0.005) and the remaining endowment will be included in your final payment; At the same time, your chance of winning that round is determined by the total number of tasks you have completed correctly within that 5 minutes, together with the total number of tasks your competitor has completed.

Please note that once the “stop” button is hit, you cannot come back to the task anymore.

Tie breaking rule

[**PastInfo**: Remember that you will not see the number of correct tasks completed by you and your competitor during each round. This is also true when the round is finished. However, you will be informed who the winner is at the end of each round.]
[**PastWinUninformative**: You will learn whether you won at the end of each round.]
After two rounds of competition, if you have won (or lost) both rounds, you have won (or lost) the prize. There is no need to compete in the third round. However, if you and your competitor each have won one round, you will enter a third round to break the tie and the winner of the third round receives the prize.

In the third round, the computer will first randomly assign you and your opponent to odd numbers and even numbers respectively. And then the computer will throw a rolling die (with numbers 1, 2, 3, 4, 5, 6 on each side of the dice). If the number showing up on the die is an odd number (either 1, or 3, or 5), then the one who has been assigned to odd numbers will win round 3; if the number showing up on the dice is an even number (either 2, or 4, or 6), then the one who has been assigned to even numbers will win round 3. The winner in this round will be awarded the prize.

After the competition

After everyone has finished the competition, you will need to finish a simple exit questionnaire. All the information you provide in this questionnaire, as well as your performance data in the experiment will only be used for statistical analysis and will be kept anonymous and strictly confidential.

Once the questionnaire is done, your total payment from this experiment will be calculated as the following:

If you win:
Total payment=show-up fee (AUD 5) + earnings from Part 1 + prize (AUD 20) + total endowment you kept

If you lose:
Total payment=show-up fee (AUD 5) + earnings from Part 1 +total endowment you kept

At the end of this session, your performance and your competitor's performance in each round, as well as your payoff will be displayed to you. See the following screenshot as an example.

The participation fee is $5.
Your total payoffs are: $22.73

Round number	Your performance	Your competitor's performance	Number of wins	Time left on counter (in s.)	Payoff
Part 1	5	-	-	-	$1.00
Part 2-round1	5	5	1	0.0	$0.00
Part 2-round2	5	3	1	346.0	$1.73
Part 2-round3	-	-	2	-	$20.00

Appendix F: Instructions: Contest-performance pairing

F.1 *Instructions for the evaluation stage*

Welcome to our experiment! You will receive AUD 10 for showing up on time. Please read these instructions carefully and completely. Properly understanding the instructions will help you to make better decisions, and hence earn more money. Your earnings will be paid out to you in cash at the end of the experiment.

Please keep in mind that you are not allowed to communicate with other participants during the experiment. You are not allowed to use your mobile phone at any time either. If you do not obey these rules you will be asked to leave the laboratory and will not be paid. Whenever you have a question, please raise your hand and an experimenter will come to assist you.

This experiment consists of several parts. You will receive separate instructions for each part. Your final payment will be the sum of your earnings from all parts, plus your show-up fee (AUD 10).

Part 1

Competition
In this part of the experiment, the computer will randomly pair you with another participant in this room. The pairing will remain anonymous throughout the entire experiment. You will not be informed about the identity of the participant you have been paired with.

You will then be asked to individually reverse strings of characters that will appear on your screen. Each string is randomly generated and has 20 characters.

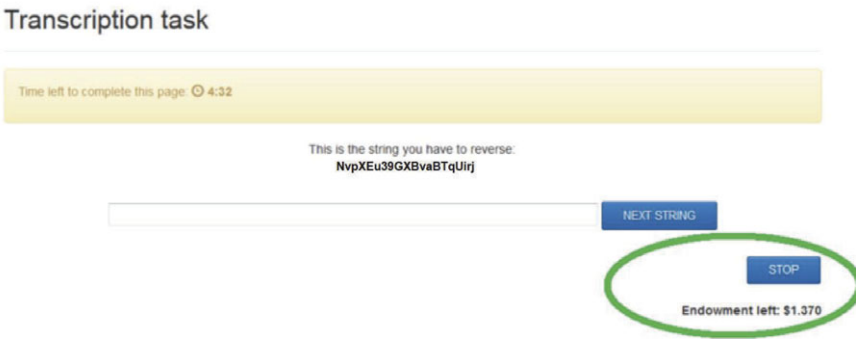
For example, if you see:

NvpXEu39GXBvaBTqUirj

You have to enter:

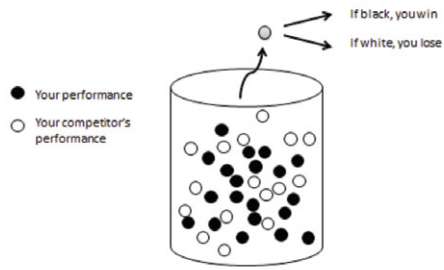
jriUqTBavBXG93uEXpvN

You will be working on this task independently for a maximum of 10 minutes. You will have the option to stop working at any point during these 10 minutes. If you decide you have worked enough, you can simply click the "STOP" button displayed at the bottom-right of the screen (see the screenshot below). You will **NOT** learn how many strings you or your competitor have completed during the competition. Nonetheless, the more strings you complete correctly, the more likely you are to win a prize of AUD 7.



The winner of this part is determined according to the following procedure:

Imagine that you are facing an urn. Each time you complete a task correctly, you earn one black ball that will go into the urn. Each time your competitor completes a task correctly, he/she earns a white ball that goes into the urn. At the end of the round, the computer randomly picks a ball from the urn. If it is black you win that round, if it is white your competitor wins that round. This procedure is depicted in the following figure.



This means that your probability to win depends on both your performance and your competitor's performance in this part. Specifically, it is computed as:

$$Your\ Probability\ to\ win = \frac{total\ number\ of\ tasks\ completed\ correctly\ by\ \boldsymbol{you}}{total\ number\ of\ tasks\ completed\ correctly\ by\ \boldsymbol{you\ and\ your\ competitor}}$$

For example, if you and your competitor complete equal number of tasks (including if you both solve 0 tasks) you have 50% chance of winning. If you solve more (or less) tasks than your competitor, you have more than (or less than) 50% chance to win.

Time is money

Spending time to work on the tasks in this competition is costly. At the beginning of this competition, you are endowed with AUD 3. As soon as you begin to reverse the strings, your

endowment starts depleting. You pay AUD 0.005 (i.e., half a cent) per second for the time you spend working on the tasks. You are free to stop working at any point during the competition though. Once you decide that you have worked enough for the competition, you could simply click the "STOP" button displayed at the right-bottom of the screen (see the screen shot above).

All the tasks you completed correctly before hitting the “STOP” button will be accounted for when the winner is determined (i.e., the black balls you have earned stay in the urn).

For instance, if you stop as soon as the round starts, you will receive the full endowment AUD 3 for that round, but you will lose that round for sure if your competitor completes at least one task correctly; If you work for 5 minutes (300 seconds) and then press the “STOP” button, your initial endowment will be reduced by: AUD 1.50 (=300 x AUD 0.005) and the remaining endowment will be included in your final payment; At the same time, your chance of winning that round is determined by the total number of tasks you have completed correctly within that 5 minutes, together with the total number of tasks your competitor has completed correctly.

Please note that once the “STOP” button is hit, you cannot go back to the task anymore.
Remember that you will not see the number of correct tasks completed by you or your competitor **during** competition. This is also true when you finish the competition. This information, together with the winner selected by the computer will be revealed to you at the **end** of today’s experiment.

Your earnings
Your payoff for this part will be calculated as follows:

If you win:
*Your earnings= prize (AUD 7) + endowment kept (=remaining time * AUD 0.005)*

If you lose:
*Your earnings= 0 + endowment kept (=remaining time * AUD 0.005)*

To make sure that you understand the task and know how to compete, you will first have the opportunity to practice on the task for 1 minute without payment and then answer a couple of questions about the instructions for this part.

F.2 *Instructions for best-of-three contests*

Part 2 (for Baseline treatment)

Matching

In this part, the computer will rank all the participants in this session according to the number of tasks completed correctly in Part 1. Then it will match the two participants with the closest ranks into a pair. For instance, a participant with rank 1 will be paired with a participant with rank 2, and a participant with rank 3 will be paired with the one in rank 4, etc.

The ranking and pairing assignments remain anonymous throughout the entire experiment. You will not be informed about the identity of the participant in this room you have been paired with. You will also not be able to learn your actual rank or the rank of anyone else. All you should keep in mind is that your competitor has the closest rank to you (based on performance records from Part 1).

Competition

In this part, the competition between you and your newly paired competitor consists of **a maximum of three** independent rounds. Whoever wins two out of the three rounds first wins the competition and will be awarded a prize of AUD 20.

The competition in each round follows the same procedure as the competition in Part 1: both you and your competitor will work simultaneously and independently for a maximum of 10 minutes on the same string-reversion task. For each of these three rounds, you are endowed with AUD 3. As soon as you begin to reverse the strings, your endowment starts depleting. You pay AUD 0.005 (i.e., half a cent) per second for the time you spend working on the tasks. You are free to stop working at any point during the competition though. You will **NOT** learn how many tasks you or your opponent has completed during the competition. Nonetheless, the more tasks you complete correctly, the more likely you are to win in each round. The winner of each round is determined according to the same procedure as well.

$$\textit{Your Probability to win} = \frac{\textit{total number of tasks completed correctly by } \boldsymbol{you}}{\textit{total number of tasks completed correctly by } \boldsymbol{you \text{ and } your \text{ competitor}}}$$

You will be informed who the winner is at the end of each round.

At the end of round 2, If you have won (or lost) both rounds, you have won (or lost) the prize. There is no need to compete in the third round. You will still receive the full initial endowment AUD 3 for that round, as you will not spend any time working on the task. However, if you and your competitor each have won one round after two rounds, you will need to compete in a third round to break the tie. The competition in the third round works the same as in the first and second round and the winner of the third round receives the prize.

Your earnings

Your payment in Part 2 will be calculated as the following:

If you win:
*Your earnings= prize (AUD 20) + total endowment you kept in **all three rounds***

If you lose:
*Your earnings=0+ total endowment you kept in **all three rounds***

After everyone in this room has finished the competition, you will need to answer a few more questions to finish the experiment. All the information you provide in these questions, as well as your performance data in the experiment will only be used for statistical analysis and will be kept anonymous and strictly confidential.

At the end of today's session, your performance and your competitor's performance in every competition, as well as your payoffs will be displayed to you. To make sure you understand the instructions clearly, you will be asked to answer a couple of questions before we start this part of the experiment.

Part 2 (for FutureInfo treatment)

Matching
In this part, the computer will rank all the participants in this session according to the number of tasks completed correctly in the **first competition in Part 1**. Then it will match the two participants with the closest ranks into a pair. For instance, a participant with rank 1 will be paired with a participant with rank 2, and a participant with rank 3 will be paired with the one in rank 4, etc.

The ranking and pairing assignments remain anonymous throughout the entire experiment. You will not be informed about the identity of the participant in this room you have been paired with. You will also not be able to learn your actual rank or the rank of anyone else. All you should keep in mind is that your opponent has the closest rank to you (based on performance records from the **first competition in Part 1**).

Competition
In this part, the competition between you and your newly paired competitor consists of **a maximum of three** independent rounds. Whoever wins two out of the three rounds first wins the competition and will be awarded a prize of AUD 20.

The computer will randomly draw a winner in **the first round**. You could imagine the random draw process as the following: the computer will first randomly assign you and your opponent to odd and even numbers, respectively. And then the computer will throw a rolling die (with numbers 1, 2, 3, 4, 5, 6 on each side of the dice). If the number showing up on the die is an odd number (either 1, or 3, or 5), then who has been assigned to odd numbers will **win round 1**; if

the number showing up on the dice is an even number (either 2, or 4, or 6), then who has been assigned to even numbers will **win round 1**.

After that, the competitions in **round 2** and **round 3** follows the same procedure as the competition in Part 1: both you and your competitor will work simultaneously and independently for a maximum of 10 minutes on the same string-reversion task. For **each of these two rounds**, you are endowed with AUD 3. As soon as you begin to reverse the strings, your endowment starts depleting. You pay AUD 0.005 (i.e., half a cent) per second for the time you spend working on the tasks. You are free to stop working at any point during the competition though. You will **NOT** learn how many tasks you or your opponent has completed correctly during the competition. Nonetheless, the more tasks you complete correctly, the more likely you are to win in each round. The winner of each round is determined according to the same procedure as well.

$$Your\ Probability\ to\ win = \frac{total\ number\ of\ tasks\ completed\ correctly\ by\ \boldsymbol{you}}{total\ number\ of\ tasks\ completed\ by\ correctly\ \boldsymbol{you\ and\ your\ competitor}}$$

You will be informed who the winner is at the end of each round.

At the end of round 2, if you have won (or lost) both rounds, you have won (or lost) the prize. There is no need to compete in the third round. You will still receive the full initial endowment AUD 3 for that round, as you will not spend any time working on the task.

However, if you and your competitor each have won one round after two rounds, you will need to compete in a third round to break the tie. The competition in the third round works the same as in the second round and the winner of the third round receives the prize.

Your earnings

Your payment in Part 2 will be calculated as the following:

If you win:

*Your earnings= prize (AUD 20) + total endowment you kept in **the last two rounds***

If you lose:

*Your earnings=0 + total endowment you kept in **the last two rounds***

After everyone in this room has finished the competition, you will need to answer a few more questions to finish the experiment. All the information you provide in this questionnaire, as well as your performance data in the experiment will only be used for statistical analysis and will be kept anonymous and strictly confidential.

At the end of this session, your performance and your competitor's performance in every competition, as well as your payoff will be displayed to you.

To make sure you understand the instructions clearly, you will be asked to answer a few questions before we start this part of the experiment.

Part 2 (for PastInfo & PastWinUninformative treatments)

Matching

In this part, the computer will rank all the participants in this session according to the number of tasks completed correctly in Part 1. Then it will match the two participants with the closest ranks into a pair. For instance, a participant with rank 1 will be paired with a participant with rank 2, and a participant with rank 3 will be paired with the one in rank 4, etc.

The ranking and pairing assignments remain anonymous throughout the entire experiment. You will not be informed about the identity of the participant in this room you have been paired with. You will also not be able to learn your actual rank or the rank of anyone else. All you should keep in mind is that your opponent has the closest rank to you (based on performance records from Part 1).

Competition

In this part, the competition between you and your newly paired competitor consists of **a maximum of three** independent rounds. Whoever wins two out of the three rounds first wins the competition and will be awarded a prize of AUD 20.

The competition in the **first two rounds** follows the same procedure as the competition in Part 1: both you and your competitor will work simultaneously and independently for a maximum of 10 minutes on the same string-reversion task. For **each of these two rounds**, you are endowed with AUD 3. As soon as you begin to reverse the strings, your endowment starts depleting. You pay AUD 0.005 (i.e., half a cent) per second for the time you spend working on the tasks. You are free to stop working at any point during the competition though. [**PastInfo:** You will **NOT** learn how many tasks you or your opponent has completed during the competition.] Nonetheless, the more tasks you complete correctly, the more likely you are to win in each round. The winner of each round is determined according to the same procedure as well.

$$Your\ Probability\ to\ win = \frac{total\ number\ of\ tasks\ completed\ correctly\ by\ \boldsymbol{you}}{total\ number\ of\ tasks\ completed\ by\ correctly\ \boldsymbol{you\ and\ your\ competitor}}$$

You will be informed who the winner is at the end of each round.

At the end of round 2, if you have won (or lost) both rounds, you have won (or lost) the prize. There is no need to compete in the third round. However, if you and your competitor each have

won one round after two rounds, you will enter a third round in which the computer will randomly draw a winner and the winner of the third round receives the prize.

You could imagine the random draw process in the third round as the following: the computer will first randomly assign you and your opponent to odd and even numbers, respectively. And then the computer will throw a rolling die (with numbers 1, 2, 3, 4, 5, 6 on each side of the dice). If the number showing up on the die is an odd number (either 1, or 3, or 5), then who has been assigned to odd numbers will win round 3; if the number showing up on the dice is an even number (either 2, or 4, or 6), then who has been assigned to even numbers will win round 3. The winner in this round will be awarded the prize.

Your earnings
Your payment in Part 2 will be calculated as the following:

If you win:
*Your earnings= prize (AUD 20) + total endowment you kept in the **first two rounds***

If you lose:
*Your earnings=0 + total endowment you kept in the **first two rounds***

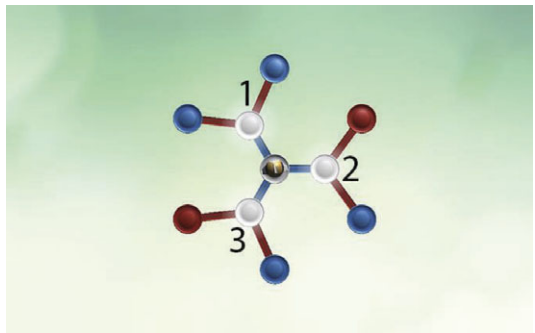
After everyone in this room has finished the competition, you will need to answer a few more questions to finish the experiment. All the information you provide in this questionnaire, as well as your performance data in the experiment will only be used for statistical analysis and will be kept anonymous and strictly confidential.

At the end of this session, your performance and your competitor's performance in every competition, as well as your payoff will be displayed to you.

To make sure you understand the instructions clearly, you will be asked to answer a few questions before we start this part of the experiment.

F.3 *Instructions for backward-induction games*

You have finished the main part of the experiment! We will ask you to answer a few more questions, and you are able to make up to $4 if you answer all the questions correctly. Imagine you will play four games (similar to the following one) against the computer. For each game you win, you will receive one dollar. You will have 1 minute for each game. By the end of 1 minute, if you fail to choose, the next game will be shown to you.



You are the first mover. You and the computer move the Robotoken alternately. Please keep in mind that the computer will always play optimally. This means it will take the best move trying to beat you. You win a game if the Robotoken ends on a blue node. The computer wins if the Robotoken ends on a red node. You need to decide which first move to make in order to ensure you will win. In this example, you have three choices, 1, 2, 3 for you first move. Your correct choice should be 1. We will walk through this together. You start in the middle and make the first move. By moving to option 1, this gives the computer the choice of moving left or right, both times ending on a blue node, you will always win if you choose 1. If you were to choose option 2, the computer would then move to the left, meaning that the Robotoken ends on red and you will lose the game. If you were to choose option 3, the computer is going to move to the right, meaning that the Robotoken again ends on red. Therefore, the only possible move to ensure you win, is option 1.

F.4 *Four games of backward induction*

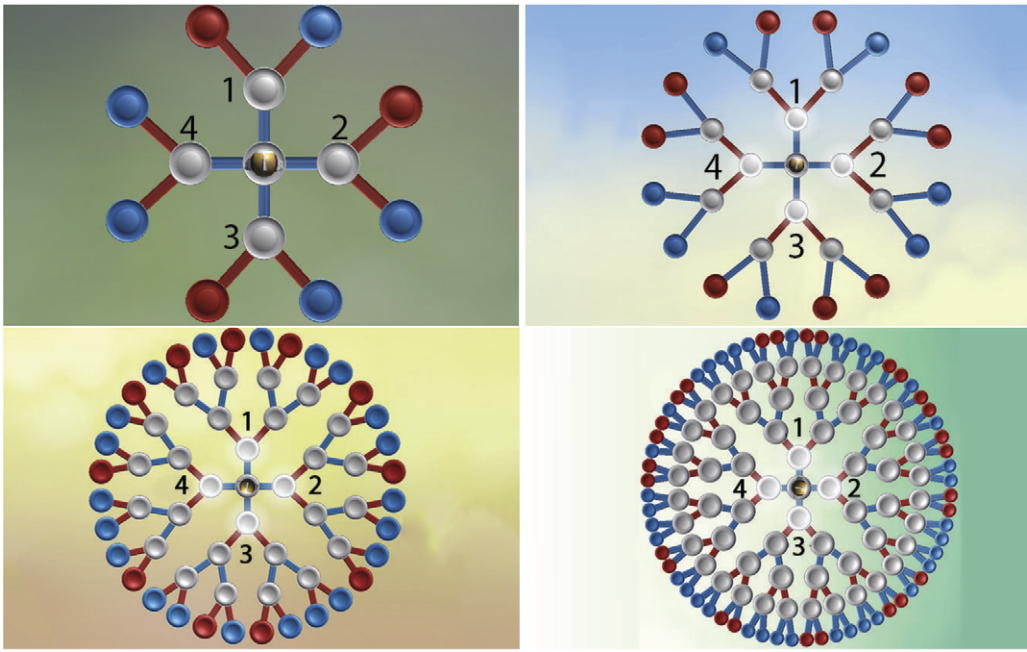


FIGURE 10. Games of backward inductions with 1 step (top left), 2 steps (top right), 3 steps (bottom left), and 4 steps (bottom right) of backward induction. In each game, only one of the four first choices ensures a win.

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