Online Appendix

Underestimating Learning by Doing

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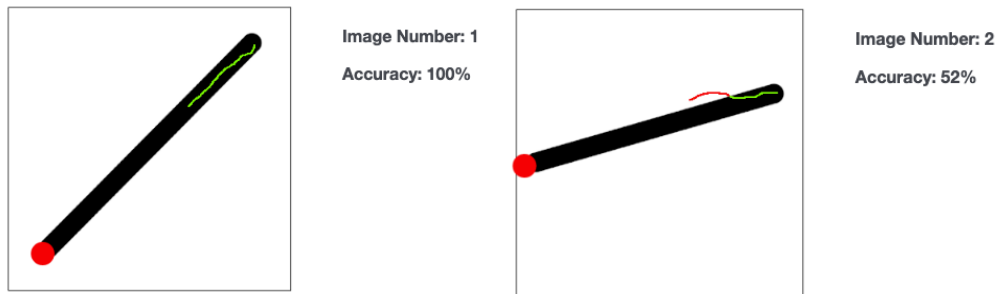
Appendix A.

Image Number: 1

Accuracy: 100%

Image Number: 2

Accuracy: 52%

Figure A1: *Two example screens of the mirror tracing mid-task with no error (left) and error (right).*

Latin Noun	Translation		Noun Endings	Ending Meaning
puella	girl		-	singular, doing the action
columba	dove			
advena	stranger		-m	singular, receiving the action
ancilla	maid			
nauta	sailor		-e	plural, doing the action
gallina	hen		-s	plural, receiving the action

Latin Verb	Translation		Verb Endings	Ending Meaning
pell-	hit		-o	I
vide-	see		-s	you
mone-	warn		-t	he/she/it
debe-	owe		-mus	we
doce-	teach		-tis	you all
time-	fear		-nt	they

Please select the correct translation of:

advenam moneo

○ you warn the stranger

○ I warn the stranger

○ we warn the stranger

○ you warn the strangers

Figure A2: *Example screen of the Latin Translation task.*

Panel A: Predicted Performance One Round Ahead.

Panel B: Predicted Performance Four Rounds Ahead.

Panel C: Learning.

Actual
Performer Predictions
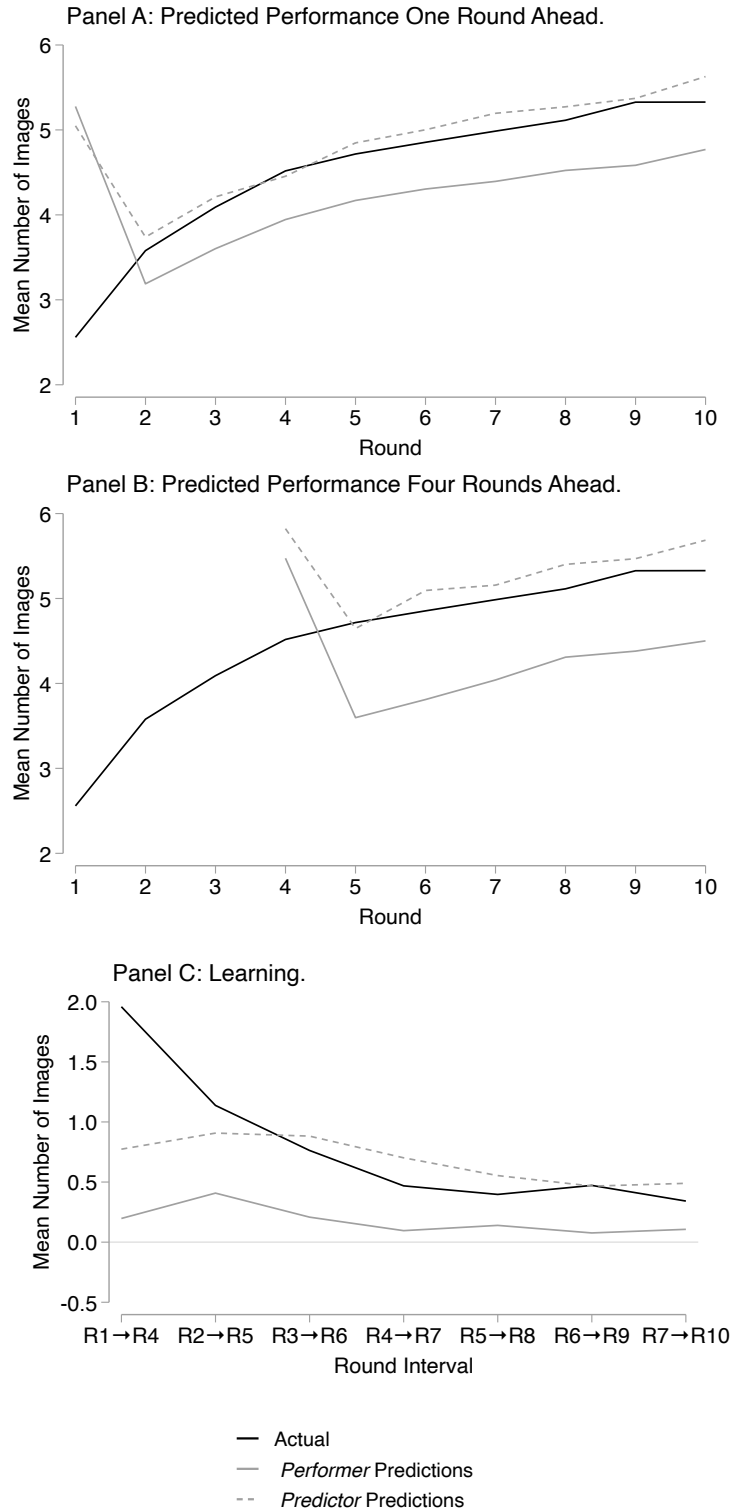*Predictor* Predictions

Figure A3: *Mean actual and predicted performance (Panels A and B) and learning (Panel C) for Study 4. Lines represent mean predictions by Study 1 participants (Performers) and Study 4 participants (Predictors), as well as mean actual performance and learning by Performers.*

Table A1: Low-Difficulty Mirror Tracing (Study 1) Summary Statistics (N=365)

	(1) Actual	(2) Predicted 1 Round Before	(3)	(4) Predicted 4 Rounds Before	(5)
	Mean (SE)	Mean (SE)	Difference: Predicted- Actual (SE)	Mean (SE)	Difference: Predicted- Actual (SE)
Panel A: Performance					
Round 1	2.48 (0.10)	5.28 (0.15)	2.80 (0.17)		
Round 2	3.50 (0.13)	3.19 (0.10)	-0.32 (0.10)		
Round 3	3.99 (0.14)	3.60 (0.11)	-0.39 (0.09)		
Round 4	4.38 (0.14)	3.95 (0.12)	-0.43 (0.09)	5.47 (0.14)	1.10 (0.19)
Round 5	4.56 (0.14)	4.17 (0.13)	-0.39 (0.09)	3.60 (0.10)	-0.96 (0.13)
Round 6	4.70 (0.15)	4.30 (0.13)	-0.40 (0.09)	3.81 (0.11)	-0.89 (0.11)
Round 7	4.85 (0.15)	4.39 (0.13)	-0.46 (0.09)	4.04 (0.12)	-0.81 (0.11)
Round 8	4.96 (0.15)	4.52 (0.13)	-0.43 (0.09)	4.31 (0.13)	-0.65 (0.11)
Round 9	5.14 (0.15)	4.58 (0.14)	-0.56 (0.10)	4.38 (0.13)	-0.76 (0.11)
Round 10	5.14 (0.15)	4.77 (0.14)	-0.37 (0.09)	4.50 (0.14)	-0.64 (0.10)
Panel B: Learning					
Rounds 1 to 4	1.90 (0.10)	0.20 (0.10)	-1.70 (0.14)		
Rounds 2 to 5	1.06 (0.09)	0.41 (0.05)	-0.65 (0.11)		
Rounds 3 to 6	0.71 (0.10)	0.21 (0.04)	-0.50 (0.10)		
Rounds 4 to 7	0.48 (0.10)	0.10 (0.03)	-0.38 (0.10)		
Rounds 5 to 8	0.39 (0.10)	0.14 (0.04)	-0.25 (0.10)		
Rounds 6 to 9	0.44 (0.09)	0.08 (0.04)	-0.36 (0.10)		
Rounds 7 to 10	0.29 (0.09)	0.11 (0.04)	-0.18 (0.10)		

Notes: Panel A reports mean actual performance (Column 1), predicted performance one round before (Column 2) and four rounds before (Column 4), as well as the difference between predicted and actual performance for predictions made one round before (Column 3) and four rounds before (Column 5). Panel B reports mean learning, defined as the change in performance across rounds, (Column 1), predicted learning (Column 2) and the difference between predicted and actual learning (Column 3). All columns include standard errors in parentheses.

Table A2: Latin Translation (Study 2) Summary Statistics (N=378)

	(1)	(2)	(3)	(4)	(5)
	Actual	Predicted 1 Round Before		Predicted 3 Rounds Before	
	Mean (SE)	Mean (SE)	Difference: Predicted-Actual (SE)	Mean (SE)	Difference: Predicted-Actual (SE)
Panel A: Performance					
Round 1	3.23 (0.09)	4.97 (0.12)	1.75 (0.14)		
Round 2	4.19 (0.11)	4.27 (0.10)	0.08 (0.11)		
Round 3	4.73 (0.11)	4.41 (0.10)	-0.32 (0.10)	5.53 (0.12)	0.80 (0.14)
Round 4	4.95 (0.12)	4.60 (0.10)	-0.35 (0.10)	4.61 (0.11)	-0.34 (0.13)
Round 5	5.24 (0.11)	4.75 (0.10)	-0.49 (0.09)	4.59 (0.10)	-0.65 (0.11)
Round 6	5.37 (0.12)	4.85 (0.10)	-0.52 (0.09)	4.70 (0.10)	-0.67 (0.10)
Round 7	5.69 (0.12)	4.98 (0.11)	-0.71 (0.09)	4.86 (0.10)	-0.83 (0.10)
Panel B: Learning					
Rounds 1 to 3	1.50 (0.09)	0.56 (0.07)	-0.94 (0.11)		
Rounds 2 to 4	0.76 (0.09)	0.34 (0.04)	-0.43 (0.10)		
Rounds 3 to 5	0.51 (0.09)	0.18 (0.03)	-0.33 (0.09)		
Rounds 4 to 6	0.42 (0.10)	0.10 (0.04)	-0.32 (0.10)		
Rounds 5 to 7	0.45 (0.09)	0.11 (0.03)	-0.34 (0.09)		

Notes: Panel A reports mean actual performance (Column 1), predicted performance one round before (Column 2) and three rounds before (Column 4), as well as the difference between predicted and actual performance for predictions made one round before (Column 3) and three rounds before (Column 5). Panel B reports mean learning, defined as the change in performance across rounds, (Column 1), predicted learning (Column 2) and the difference between predicted and actual learning (Column 3). All columns include standard errors in parentheses.

Table A3: High-Difficulty Mirror Tracing (Study 3) Summary Statistics (N=313)

	(1)	(2)	(3)	(4)	(5)
	Actual	Predicted 1 Round Before		Predicted 4 Rounds Before	
	Mean (SE)	Mean (SE)	Difference: Predicted-Actual (SE)	Mean (SE)	Difference: Predicted-Actual (SE)
Panel A: Performance					
Round 1	3.17 (0.14)	3.98 (0.13)	0.82 (0.16)		
Round 2	4.13 (0.16)	3.56 (0.12)	-0.58 (0.10)		
Round 3	4.68 (0.16)	4.12 (0.15)	-0.56 (0.09)		
Round 4	5.04 (0.17)	4.50 (0.16)	-0.54 (0.10)	4.35 (0.14)	-0.69 (0.20)
Round 5	5.35 (0.17)	4.72 (0.17)	-0.63 (0.10)	3.89 (0.13)	-1.46 (0.13)
Round 6	5.64 (0.18)	4.96 (0.17)	-0.67 (0.10)	4.32 (0.16)	-1.32 (0.12)
Panel B: Learning					
Rounds 1 to 4	1.88 (0.10)	0.37 (0.09)	-1.50 (0.13)		
Rounds 2 to 5	1.22 (0.09)	0.34 (0.05)	-0.88 (0.11)		
Rounds 3 to 6	0.96 (0.10)	0.19 (0.04)	-0.77 (0.11)		

Notes: Panel A reports mean actual performance (Column 1), predicted performance one round before (Column 2) and four rounds before (Column 4), as well as the difference between predicted and actual performance for predictions made one round before (Column 3) and four rounds before (Column 5). Panel B reports mean learning, defined as the change in performance across rounds, (Column 1), predicted learning (Column 2) and the difference between predicted and actual learning (Column 3). All columns include standard errors in parentheses.

Table A4: Study 4 Summary Statistics (N=433)

	(1)	(2)	(3)	(4)	(5)
	Actual	Predicted 1 Round Before		Predicted 4 Rounds Before	
	Mean (SE)	Mean (SE)	Difference: Predicted-Actual (SE)	Mean (SE)	Difference: Predicted-Actual (SE)
Panel A: Performance					
Round 1	2.63 (0.09)	5.05 (0.14)	2.42 (0.16)		
Round 2	3.64 (0.12)	3.74 (0.11)	0.10 (0.12)		
Round 3	4.17 (0.12)	4.21 (0.12)	0.04 (0.10)		
Round 4	4.64 (0.13)	4.45 (0.12)	-0.18 (0.10)	5.82 (0.15)	1.18 (0.19)
Round 5	4.85 (0.13)	4.85 (0.13)	0.00 (0.11)	4.65 (0.13)	-0.20 (0.15)
Round 6	4.98 (0.13)	5.00 (0.14)	0.02 (0.10)	5.09 (0.16)	0.11 (0.15)
Round 7	5.10 (0.13)	5.20 (0.14)	0.10 (0.11)	5.16 (0.14)	0.06 (0.13)
Round 8	5.25 (0.13)	5.27 (0.15)	0.03 (0.13)	5.40 (0.14)	0.15 (0.13)
Round 9	5.48 (0.14)	5.37 (0.15)	-0.11 (0.13)	5.47 (0.15)	-0.02 (0.13)
Round 10	5.48 (0.13)	5.63 (0.16)	0.14 (0.13)	5.69 (0.15)	0.20 (0.13)
Panel B: Learning					
Rounds 1 to 4	2.01 (0.10)	0.77 (0.10)	-1.24 (0.14)		
Rounds 2 to 5	1.21 (0.09)	0.91 (0.09)	-0.30 (0.12)		
Rounds 3 to 6	0.81 (0.09)	0.88 (0.08)	0.07 (0.13)		
Rounds 4 to 7	0.46 (0.09)	0.70 (0.06)	0.24 (0.11)		
Rounds 5 to 8	0.40 (0.09)	0.55 (0.06)	0.15 (0.11)		
Rounds 6 to 9	0.50 (0.09)	0.47 (0.05)	-0.04 (0.11)		
Rounds 7 to 10	0.39 (0.09)	0.49 (0.06)	0.10 (0.11)		

Notes: Column 1 reports mean actual performance (Panel A) and learning (Panel B) for Study 1 participants (*Performers*). As each *Predictor* was assigned a *Performer* from the pool of all Study 1 participants with replacement, the performance statistics differ slightly from those presented in Table A1. Panel A, Columns 2 and 4 report mean predicted (by *Predictors*—i.e., Study 4 participants) performance for predictions made one and four rounds prior, respectively, while Columns 3 and 5 report the difference between predicted and actual performance for the equivalent prediction horizons. Panel B reports predicted learning (Column 2) and the mean difference between predicted and actual learning (Column 3). All columns include standard errors clustered at the individual level in parentheses.

Table A5: Differences between Predicted and Actual Performance and Learning for Original Low-Pay Study 1 (N=342).

	(1)	(2)	(3)
	Predicted - Actual Performance		Predicted - Actual Learning
	Round T+1	Round T+4	Round T+1 to T+4
Panel A: Mean Accuracy (Predicted - Actual) Aggregated across All Time Periods			
All	-0.41	-0.74	-0.64
	(0.06)	(0.08)	(0.05)
Panel B: Mean Accuracy (Predicted - Actual) for Individual Time Periods			
T0	2.76	0.57	-2.20
	(0.18)	(0.20)	(0.17)
T1	-0.26	-0.79	-0.52
	(0.10)	(0.12)	(0.10)
T2	-0.41	-0.76	-0.35
	(0.09)	(0.12)	(0.11)
T3	-0.27	-0.65	-0.38
	(0.10)	(0.11)	(0.10)
T4	-0.41	-0.67	-0.27
	(0.09)	(0.11)	(0.10)
T5	-0.39	-0.83	-0.44
	(0.10)	(0.11)	(0.11)
T6	-0.42	-0.73	-0.30
	(0.09)	(0.11)	(0.11)
T7	-0.42	-	-
	(0.11)	-	-
T8	-0.66	-	-
	(0.10)	-	-
T9	-0.47	-	-
	(0.10)	-	-
Panel C: Regressions of Accuracy on Time Period			
Time Period	-0.03	0.00	0.21
	(0.01)	(0.03)	(0.03)
Constant	-0.26	-0.74	-1.27

Notes: Cells in Panels A and B report the means of the difference between predicted and actual performance (Columns 1-3) or Learning (Column 4). Standard errors clustered at the individual level are in parentheses. Panel C presents the coefficients and standard errors of the coefficients resulting from a regression of the difference between predicted and actual performance (Columns 1-3) or learning (Column 4) on time period (as a continuous variable) with standard errors clustered at the individual level. Performance accuracy in *T0* is not included in the Panel A or Panel C analysis, in line with the study pre-registration.