Online Appendix for:

Experimental Evidence on Misguided Learning

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A The Use of Tables by Biased Agents

In the following section we show how a myopic agent who only updates his beliefs about the state of the world, uses the tables in the multiple- and single-feedback rounds.

In the first example, we assume that the agent's relative performance parameter is $A = 47.5\%$ and he is guessing the number $\Phi = -1$ in a multiple-feedback round. The agent is *overconfident* and believes that his performance is 10% higher than it is, corresponding to the $55 - 60\%$ interval. Figure 3 illustrates this case: we depict the agent's actual performance and the number in red, and the agent's beliefs and actions in blue. The agent enters $e_1 = 0$ as his first guess. Afterward, the computer displays the feedback of 29.71, which consists of the payoff $\Pi_1 = 29.68$ and the added random component $\epsilon_1 = 0.03$. The agent believes that his relative performance lies in the $55 - 60\%$ interval, therefore he looks at the row outlined in blue, and searches for a value that is the closest to his feedback. There is only one such value (29.60), and the agent deduces that the number he is guessing is equal to $\phi_2 = -3$. The agent updates his beliefs about the number and enters $e_2 = -3$ as his second guess. The computer displays a new feedback: 29.45. The agent browses the tables looking for the one with the number -3 in the title (depicted in Figure 4). Once again he looks at the row with the relative performance between 55% and 60% and compares his feedback to the values in that row. The overconfident agent concludes that the number must be equal to $\phi_3 = -4$, so he chooses $e_3 = -4$ as his third guess. In the following step, he becomes even more mistaken, concluding that the number is $\phi_4 = -5$ and choosing $e_4 = -5$ as his last guess (presented in Figure 5). The overconfident agent's beliefs change in the following way: $\phi_1 = 0$, $\phi_2 = -3$, $\phi_3 = -4$, $\phi_4 = -5$. As predicted by the model, the learning process is self-defeating: the additional feedback drives the agent's beliefs further away from the true state.

In a single-feedback round, the agent's reasoning after the first guess is the same as in the multiple-feedback round. He forms a belief $\phi_2 = -3$ and enters the optimal action $e_2 = -3$. In contrast to the multiple-feedback round, any feedback the agent receives

afterward is based on his first guess, hence he should use the table with 0 in the title. The agent receives the feedback 29.59 (the noise component is $\epsilon_2 = -0.09$). The closest value in the table is again 29.68, so he should enter $e_3 = -3$. The last feedback differs only with respect to the noise term, inducing a belief $\phi_4 = -3$ and prompting the action $e_4 = -3$. In the single-feedback rounds, the agent's beliefs change as follows: $\phi_1 = 0$, $\phi_2 = -3$, $\phi_3 = -3$, $\phi_4 = -3$. Severing the link between the actions and output precludes self-defeating learning, as predicted by Hypothesis A1.

The next example considers an *underconfident* agent with the relative performance $A = 62.5\%$ who is guessing the number $\Phi = 4$ in a multiple-feedback round. The agent believes that his relative performance is 10% lower and lies in the $50 - 55\%$ interval. When he sees the feedback 35.85 (the actual payoff 35.96 with the added noise term $\epsilon_1 = -0.11$), he infers that the number is equal to $\phi_2 = 9$. We depict the first step in Figure 6. The agent's actual performance parameter and the number are in red, and his beliefs and choices are in blue. The underconfident agent enters $e_2 = 9$ as his second guess and obtains the feedback 35.57 that includes the noise term $\epsilon_2 = -0.01$. He goes to the table with the number 9 in the title (presented in Figure 7). The value closest to his feedback, i.e. $\Pi = 35.66$, points to the number $\phi_3 = 6$. The agent updates his beliefs, enters the optimal action $e_3 = 6$ and receives the feedback of 36.78 ($\epsilon_3 = 0.05$). In the last step, he turns to table 6 (presented in Figure 8), from which he infers that $\phi_4 = 6$ is the number he is looking for, and enters ir again $e_4 = 6$. The underconfident agent's beliefs follow the path: $\phi_1 = 0$, $\phi_2 = 9$, $\phi_3 = 6$, $\phi_4 = 6$. As predicted by the model, the underconfident agent first overshoots, and then corrects his actions. In the case of the single-feedback round, the agent would not update his beliefs after the second guess, thus entering $e_3 = e_4 = 9$ for his third and fourth guess.

The last example illustrates the behavior of an *unbiased* agent, who has the relative performance of $A = 72.5$ and is guessing the number $\Phi = -4$ in a multiple-feedback round. After entering $e_1 = 0$ the agent receives the feedback of 31.82 (the actual payoff is 31.85 and the added noise term $\epsilon_1 = -0.03$), which points to the correct number $\phi_2 = -4$. The agent enters $e_2 = -4$ and turns to the table with -4 in the title

(depicted in Figure 10). The feedback displayed on his screen is the payoff of 33.39 with a perturbation, which points to the number $\phi_3 = -4$. Regardless of the noise realization, the feedback will not be closer to any other value but 33.39. The agent chooses the optimal action $e_4 = -4$ as his fourth guess. The learning process of the unbiased individual is immediate and his belief is stable afterward. The beliefs and actions are the same in the single-feedback round.

Ihre Schätzung war: 0

Leistungsintervall	Mögliche Zufallzahl: −10	−9	−8	−7	−6	−5	−4	−3	−2	−1	0	1	2	3	4	5	6	7	8	9	10
95 – 100%	30.47	31.65	32.84	34.02	35.20	36.39	37.57	38.76	39.94	41.12	42.31	42.72	43.14	43.56	43.97	44.39	44.80	45.22	45.64	46.05	46.47
90 – 95%	29.32	30.51	31.69	32.88	34.06	35.24	36.43	37.61	38.80	39.98	41.16	41.58	42.00	42.41	42.83	43.24	43.66	44.08	44.49	44.91	45.32
85 – 90%	28.18	29.36	30.55	31.73	32.92	34.10	35.28	36.47	37.65	38.84	40.02	40.44	40.85	41.27	41.68	42.10	42.52	42.93	43.35	43.76	44.18
80 – 85%	27.04	28.22	29.40	30.59	31.77	32.96	34.14	35.32	36.51	37.69	38.88	39.29	39.71	40.12	40.54	40.96	41.37	41.79	42.20	42.62	43.04
75 – 80%	25.89	27.08	28.26	29.44	30.63	31.81	33.00	34.18	35.36	36.55	37.73	38.15	38.56	38.98	39.40	39.81	40.23	40.64	41.06	41.48	41.89
70 – 75%	24.75	25.93	27.12	28.30	29.48	30.67	31.85	33.04	34.22	35.40	36.59	37.00	37.42	37.84	38.25	38.67	39.08	39.50	39.92	40.33	40.75
65 – 70%	23.60	24.79	25.97	27.16	28.34	29.52	30.71	31.89	33.08	34.26	35.44	35.86	36.28	36.69	37.11	37.52	37.94	38.36	38.77	39.19	39.60
60 – 65%	22.46	23.64	24.83	26.01	27.20	28.38	29.56	30.75	31.93	33.12	34.30	34.72	35.13	35.55	35.96	36.38	36.80	37.21	37.63	38.04	38.46
55 – 60%	21.32	22.50	23.68	24.87	26.05	27.24	28.42	29.60	30.79	31.97	33.16	33.57	33.99	34.40	34.82	35.24	35.65	36.07	36.48	36.90	37.32
50 – 55%	20.17	21.36	22.54	23.72	24.91	26.09	27.28	28.46	29.64	30.83	32.01	32.43	32.84	33.26	33.68	34.09	34.51	34.92	35.34	35.76	36.17
45 – 50%	19.03	20.21	21.40	22.58	23.76	24.95	26.13	27.32	28.50	29.68	30.87	31.28	31.70	32.12	32.53	32.95	33.36	33.78	34.20	34.61	35.03
40 – 45%	17.88	19.07	20.25	21.44	22.62	23.80	24.99	26.17	27.36	28.54	29.72	30.14	30.56	30.97	31.39	31.80	32.22	32.64	33.05	33.47	33.88
35 – 40%	16.74	17.92	19.11	20.29	21.48	22.66	23.84	25.03	26.21	27.40	28.58	29.00	29.41	29.83	30.24	30.66	31.08	31.49	31.91	32.32	32.74
30 – 35%	15.60	16.78	17.96	19.15	20.33	21.52	22.70	23.88	25.07	26.25	27.44	27.85	28.27	28.68	29.10	29.52	29.93	30.35	30.76	31.18	31.60
25 – 30%	14.45	15.64	16.82	18.00	19.19	20.37	21.56	22.74	23.92	25.11	26.29	26.71	27.12	27.54	27.96	28.37	28.79	29.20	29.62	30.04	30.45
20 – 25%	13.31	14.49	15.68	16.86	18.04	19.23	20.41	21.60	22.78	23.96	25.15	25.56	25.98	26.40	26.81	27.23	27.64	28.06	28.48	28.89	29.31
15 – 20%	12.16	13.35	14.53	15.72	16.90	18.08	19.27	20.45	21.64	22.82	24.00	24.42	24.84	25.25	25.67	26.08	26.50	26.92	27.33	27.75	28.16
10 – 15%	11.02	12.20	13.39	14.57	15.76	16.94	18.12	19.31	20.49	21.68	22.86	23.28	23.69	24.11	24.52	24.94	25.36	25.77	26.19	26.60	27.02
5 – 10%	9.88	11.06	12.24	13.43	14.61	15.80	16.98	18.16	19.35	20.53	21.72	22.13	22.55	22.96	23.38	23.80	24.21	24.63	25.04	25.46	25.88
0 – 5%	8.73	9.92	11.10	12.28	13.47	14.65	15.84	17.02	18.20	19.39	20.57	20.99	21.40	21.82	22.24	22.65	23.07	23.48	23.90	24.32	24.73

Figure 1: The use of tables by the overconfident agent: the 2nd guess.

Ihre Schätzung war: −3

Leistungsintervall	Mögliche Zufallzahl: −10	−9	−8	−7	−6	−5	−4	−3	−2	−1	0	1	2	3	4	5	6	7	8	9	10
95 – 100%	31.62	32.80	33.99	35.17	36.36	37.54	38.72	39.91	40.32	40.74	41.16	41.57	41.99	42.40	42.82	43.24	43.65	44.07	44.48	44.90	45.32
90 – 95%	30.48	31.66	32.84	34.03	35.21	36.40	37.58	38.76	39.18	39.60	40.01	40.43	40.84	41.26	41.68	42.09	42.51	42.92	43.34	43.76	44.17
85 – 90%	29.33	30.52	31.70	32.88	34.07	35.25	36.44	37.62	38.04	38.45	38.87	39.28	39.70	40.12	40.53	40.95	41.36	41.78	42.20	42.61	43.03
80 – 85%	28.19	29.37	30.56	31.74	32.92	34.11	35.29	36.48	36.89	37.31	37.72	38.14	38.56	38.97	39.39	39.80	40.22	40.64	41.05	41.47	41.88
75 – 80%	27.04	28.23	29.41	30.60	31.78	32.96	34.15	35.33	35.75	36.16	36.58	37.00	37.41	37.83	38.24	38.66	39.08	39.49	39.91	40.32	40.74
70 – 75%	25.90	27.08	28.27	29.45	30.64	31.82	33.00	34.19	34.60	35.02	35.44	35.85	36.27	36.68	37.10	37.52	37.93	38.35	38.76	39.18	39.60
65 – 70%	24.76	25.94	27.12	28.31	29.49	30.68	31.86	33.04	33.46	33.88	34.29	34.71	35.12	35.54	35.96	36.37	36.79	37.20	37.62	38.04	38.45
60 – 65%	23.61	24.80	25.98	27.16	28.35	29.53	30.72	31.90	32.32	32.73	33.15	33.56	33.98	34.40	34.81	35.23	35.64	36.06	36.48	36.89	37.31
55 – 60%	22.47	23.65	24.84	26.02	27.20	28.39	29.57	30.76	31.17	31.59	32.00	32.42	32.84	33.25	33.67	34.08	34.50	34.92	35.33	35.75	36.16
50 – 55%	21.32	22.51	23.69	24.88	26.06	27.24	28.43	29.61	30.03	30.44	30.86	31.28	31.69	32.11	32.52	32.94	33.36	33.77	34.19	34.60	35.02
45 – 50%	20.18	21.36	22.55	23.73	24.92	26.10	27.28	28.47	28.88	29.30	29.72	30.13	30.55	30.96	31.38	31.80	32.21	32.63	33.04	33.46	33.88
40 – 45%	19.04	20.22	21.40	22.59	23.77	24.96	26.14	27.32	27.74	28.16	28.57	28.99	29.40	29.82	30.24	30.65	31.07	31.48	31.90	32.32	32.73
35 – 40%	17.89	19.08	20.26	21.44	22.63	23.81	25.00	26.18	26.60	27.01	27.43	27.84	28.26	28.68	29.09	29.51	29.92	30.34	30.76	31.17	31.59
30 – 35%	16.75	17.93	19.12	20.30	21.48	22.67	23.85	25.04	25.45	25.87	26.28	26.70	27.12	27.53	27.95	28.36	28.78	29.20	29.61	30.03	30.44
25 – 30%	15.60	16.79	17.97	19.16	20.34	21.52	22.71	23.89	24.31	24.72	25.14	25.56	25.97	26.39	26.80	27.22	27.64	28.05	28.47	28.88	29.30
20 – 25%	14.46	15.64	16.83	18.01	19.20	20.38	21.56	22.75	23.16	23.58	24.00	24.41	24.83	25.24	25.66	26.08	26.49	26.91	27.32	27.74	28.16
15 – 20%	13.32	14.50	15.68	16.87	18.05	19.24	20.42	21.60	22.02	22.44	22.85	23.27	23.68	24.10	24.52	24.93	25.35	25.76	26.18	26.60	27.01
10 – 15%	12.17	13.36	14.54	15.72	16.91	18.09	19.28	20.46	20.88	21.29	21.71	22.12	22.54	22.96	23.37	23.79	24.20	24.62	25.04	25.45	25.87
5 – 10%	11.03	12.21	13.40	14.58	15.76	16.95	18.13	19.32	19.73	20.15	20.56	20.98	21.40	21.81	22.23	22.64	23.06	23.48	23.89	24.31	24.72
0 – 5%	9.88	11.07	12.25	13.44	14.62	15.80	16.99	18.17	18.59	19.00	19.42	19.84	20.25	20.67	21.08	21.50	21.92	22.33	22.75	23.16	23.58

Figure 2: The use of tables by the overconfident agent: the 3rd guess.

Ihre Schätzung war: −4

Leistungsintervall	Mögliche Zufallzahl: −10	−9	−8	−7	−6	−5	−4	−3	−2	−1	0	1	2	3	4	5	6	7	8	9	10
95 – 100%	32.00	33.19	34.37	35.56	36.74	37.92	39.11	39.52	39.94	40.36	40.77	41.19	41.60	42.02	42.44	42.85	43.27	43.68	44.10	44.52	44.93
90 – 95%	30.86	32.04	33.23	34.41	35.60	36.78	37.96	38.38	38.80	39.21	39.63	40.04	40.46	40.88	41.29	41.71	42.12	42.54	42.96	43.37	43.79
85 – 90%	29.72	30.90	32.08	33.27	34.45	35.64	36.82	37.24	37.65	38.07	38.48	38.90	39.32	39.73	40.15	40.56	40.98	41.40	41.81	42.23	42.64
80 – 85%	28.57	29.76	30.94	32.12	33.31	34.49	35.68	36.09	36.51	36.92	37.34	37.76	38.17	38.59	39.00	39.42	39.84	40.25	40.67	41.08	41.50
75 – 80%	27.43	28.61	29.80	30.98	32.16	33.35	34.53	34.95	35.36	35.78	36.20	36.61	37.03	37.44	37.86	38.28	38.69	39.11	39.52	39.94	40.36
70 – 75%	26.28	27.47	28.65	29.84	31.02	32.20	33.39	33.80	34.22	34.64	35.05	35.47	35.88	36.30	36.72	37.13	37.55	37.96	38.38	38.80	39.21
65 – 70%	25.14	26.32	27.51	28.69	29.88	31.06	32.24	32.66	33.08	33.49	33.91	34.32	34.74	35.16	35.57	35.99	36.40	36.82	37.24	37.65	38.07
60 – 65%	24.00	25.18	26.36	27.55	28.73	29.92	31.10	31.52	31.93	32.35	32.76	33.18	33.60	34.01	34.43	34.84	35.26	35.68	36.09	36.51	36.92
55 – 60%	22.85	24.04	25.22	26.40	27.59	28.77	29.96	30.37	30.79	31.20	31.62	32.04	32.45	32.87	33.28	33.70	34.12	34.53	34.95	35.36	35.78
50 – 55%	21.71	22.89	24.08	25.26	26.44	27.63	28.81	29.23	29.64	30.06	30.48	30.89	31.31	31.72	32.14	32.56	32.97	33.39	33.80	34.22	34.64
45 – 50%	20.56	21.75	22.93	24.12	25.30	26.48	27.67	28.08	28.50	28.92	29.33	29.75	30.16	30.58	31.00	31.41	31.83	32.24	32.66	33.08	33.49
40 – 45%	19.42	20.60	21.79	22.97	24.16	25.34	26.52	26.94	27.36	27.77	28.19	28.60	29.02	29.44	29.85	30.27	30.68	31.10	31.52	31.93	32.35
35 – 40%	18.28	19.46	20.64	21.83	23.01	24.20	25.38	25.80	26.21	26.63	27.04	27.46	27.88	28.29	28.71	29.12	29.54	29.96	30.37	30.79	31.20
30 – 35%	17.13	18.32	19.50	20.68	21.87	23.05	24.24	24.65	25.07	25.48	25.90	26.32	26.73	27.15	27.56	27.98	28.40	28.81	29.23	29.64	30.06
25 – 30%	15.99	17.17	18.36	19.54	20.72	21.91	23.09	23.51	23.92	24.34	24.76	25.17	25.59	26.00	26.42	26.84	27.25	27.67	28.08	28.50	28.92
20 – 25%	14.84	16.03	17.21	18.40	19.58	20.76	21.95	22.36	22.78	23.20	23.61	24.03	24.44	24.86	25.28	25.69	26.11	26.52	26.94	27.36	27.77
15 – 20%	13.70	14.88	16.07	17.25	18.44	19.62	20.80	21.22	21.64	22.05	22.47	22.88	23.30	23.72	24.13	24.55	24.96	25.38	25.80	26.21	26.63
10 – 15%	12.56	13.74	14.92	16.11	17.29	18.48	19.66	20.08	20.49	20.91	21.32	21.74	22.16	22.57	22.99	23.40	23.82	24.24	24.65	25.07	25.48
5 – 10%	11.41	12.60	13.78	14.96	16.15	17.33	18.52	18.93	19.35	19.76	20.18	20.60	21.01	21.43	21.84	22.26	22.68	23.09	23.51	23.92	24.34
0 – 5%	10.27	11.45	12.64	13.82	15.00	16.19	17.37	17.79	18.20	18.62	19.04	19.45	19.87	20.28	20.70	21.12	21.53	21.95	22.36	22.78	23.20

Figure 3: The use of tables by the overconfident agent: the 4$^{\text{th}}$ guess.

Ihre Schätzung war: 0

Leistungsintervall	Mögliche Zufallzahl: −10	−9	−8	−7	−6	−5	−4	−3	−2	−1	0	1	2	3	4	5	6	7	8	9	10
95 – 100%	30.47	31.65	32.84	34.02	35.20	36.39	37.57	38.76	39.94	41.12	42.31	42.72	43.14	43.56	43.97	44.39	44.80	45.22	45.64	46.05	46.47
90 – 95%	29.32	30.51	31.69	32.88	34.06	35.24	36.43	37.61	38.80	39.98	41.16	41.58	42.00	42.41	42.83	43.24	43.66	44.08	44.49	44.91	45.32
85 – 90%	28.18	29.36	30.55	31.73	32.92	34.10	35.28	36.47	37.65	38.84	40.02	40.44	40.85	41.27	41.68	42.10	42.52	42.93	43.35	43.76	44.18
80 – 85%	27.04	28.22	29.40	30.59	31.77	32.96	34.14	35.32	36.51	37.69	38.88	39.29	39.71	40.12	40.54	40.96	41.37	41.79	42.20	42.62	43.04
75 – 80%	25.89	27.08	28.26	29.44	30.63	31.81	33.00	34.18	35.36	36.55	37.73	38.15	38.56	38.98	39.40	39.81	40.23	40.64	41.06	41.48	41.89
70 – 75%	24.75	25.93	27.12	28.30	29.48	30.67	31.85	33.04	34.22	35.40	36.59	37.00	37.42	37.84	38.25	38.67	39.08	39.50	39.92	40.33	40.75
65 – 70%	23.60	24.79	25.97	27.16	28.34	29.52	30.71	31.89	33.08	34.26	35.44	35.86	36.28	36.69	37.11	37.52	37.94	38.36	38.77	39.19	39.60
60 – 65%	22.46	23.64	24.83	26.01	27.20	28.38	29.56	30.75	31.93	33.12	34.30	34.72	35.13	35.55	35.96	36.38	36.80	37.21	37.63	38.04	38.46
55 – 60%	21.32	22.50	23.68	24.87	26.05	27.24	28.42	29.60	30.79	31.97	33.16	33.57	33.99	34.40	34.82	35.24	35.65	36.07	36.48	36.90	37.32
50 – 55%	20.17	21.36	22.54	23.72	24.91	26.09	27.28	28.46	29.64	30.83	32.01	32.43	32.84	33.26	33.68	34.09	34.51	34.92	35.34	35.76	36.17
45 – 50%	19.03	20.21	21.40	22.58	23.76	24.95	26.13	27.32	28.50	29.68	30.87	31.28	31.70	32.12	32.53	32.95	33.36	33.78	34.20	34.61	35.03
40 – 45%	17.88	19.07	20.25	21.44	22.62	23.80	24.99	26.17	27.36	28.54	29.72	30.14	30.56	30.97	31.39	31.80	32.22	32.64	33.05	33.47	33.88
35 – 40%	16.74	17.92	19.11	20.29	21.48	22.66	23.84	25.03	26.21	27.40	28.58	29.00	29.41	29.83	30.24	30.66	31.08	31.49	31.91	32.32	32.74
30 – 35%	15.60	16.78	17.96	19.15	20.33	21.52	22.70	23.88	25.07	26.25	27.44	27.85	28.27	28.68	29.10	29.52	29.93	30.35	30.76	31.18	31.60
25 – 30%	14.45	15.64	16.82	18.00	19.19	20.37	21.56	22.74	23.92	25.11	26.29	26.71	27.12	27.54	27.96	28.37	28.79	29.20	29.62	30.04	30.45
20 – 25%	13.31	14.49	15.68	16.86	18.04	19.23	20.41	21.60	22.78	23.96	25.15	25.56	25.98	26.40	26.81	27.23	27.64	28.06	28.48	28.89	29.31
15 – 20%	12.16	13.35	14.53	15.72	16.90	18.08	19.27	20.45	21.64	22.82	24.00	24.42	24.84	25.25	25.67	26.08	26.50	26.92	27.33	27.75	28.16
10 – 15%	11.02	12.20	13.39	14.57	15.76	16.94	18.12	19.31	20.49	21.68	22.86	23.28	23.69	24.11	24.52	24.94	25.36	25.77	26.19	26.60	27.02
5 – 10%	9.88	11.06	12.24	13.43	14.61	15.80	16.98	18.16	19.35	20.53	21.72	22.13	22.55	22.96	23.38	23.80	24.21	24.63	25.04	25.46	25.88
0 – 5%	8.73	9.92	11.10	12.28	13.47	14.65	15.84	17.02	18.20	19.39	20.57	20.99	21.40	21.82	22.24	22.65	23.07	23.48	23.90	24.32	24.73

Figure 4: The use of tables by the underconfident agent: the 2$^{\text{nd}}$ guess.

Ihre Schätzung war: 9

Leistungsintervall	Mögliche Zufallzahl:																				
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	0	1	2	3	4	5	6	7	8	9	10
95 – 100%	27.01	28.20	29.38	30.56	31.75	32.93	34.12	35.30	36.48	37.67	38.85	40.04	41.22	42.40	43.59	44.77	45.96	47.14	48.32	49.51	49.92
90 – 95%	25.87	27.05	28.24	29.42	30.60	31.79	32.97	34.16	35.34	36.52	37.71	38.89	40.08	41.26	42.44	43.63	44.81	46.00	47.18	48.36	48.78
85 – 90%	24.72	25.91	27.09	28.28	29.46	30.64	31.83	33.01	34.20	35.38	36.56	37.75	38.93	40.12	41.30	42.48	43.67	44.85	46.04	47.22	47.64
80 – 85%	23.58	24.76	25.95	27.13	28.32	29.50	30.68	31.87	33.05	34.24	35.42	36.60	37.79	38.97	40.16	41.34	42.52	43.71	44.89	46.08	46.49
75 – 80%	22.44	23.62	24.80	25.99	27.17	28.36	29.54	30.72	31.91	33.09	34.28	35.46	36.64	37.83	39.01	40.20	41.38	42.56	43.75	44.93	45.35
70 – 75%	21.29	22.48	23.66	24.84	26.03	27.21	28.40	29.58	30.76	31.95	33.13	34.32	35.50	36.68	37.87	39.05	40.24	41.42	42.60	43.79	44.20
65 – 70%	20.15	21.33	22.52	23.70	24.88	26.07	27.25	28.44	29.62	30.80	31.99	33.17	34.36	35.54	36.72	37.91	39.09	40.28	41.46	42.64	43.06
60 – 65%	19.00	20.19	21.37	22.56	23.74	24.92	26.11	27.29	28.48	29.66	30.84	32.03	33.21	34.40	35.58	36.76	37.95	39.13	40.32	41.50	41.92
55 – 60%	17.86	19.04	20.23	21.41	22.60	23.78	24.96	26.15	27.33	28.52	29.70	30.88	32.07	33.25	34.44	35.62	36.80	37.99	39.17	40.36	40.77
50 – 55%	16.72	17.90	19.08	20.27	21.45	22.64	23.82	25.00	26.19	27.37	28.56	29.74	30.92	32.11	33.29	34.48	35.66	36.84	38.03	39.21	39.63
45 – 50%	15.57	16.76	17.94	19.12	20.31	21.49	22.68	23.86	25.04	26.23	27.41	28.60	29.78	30.96	32.15	33.33	34.52	35.70	36.88	38.07	38.48
40 – 45%	14.43	15.61	16.80	17.98	19.16	20.35	21.53	22.72	23.90	25.08	26.27	27.45	28.64	29.82	31.00	32.19	33.37	34.56	35.74	36.92	37.34
35 – 40%	13.28	14.47	15.65	16.84	18.02	19.20	20.39	21.57	22.76	23.94	25.12	26.31	27.49	28.68	29.86	31.04	32.23	33.41	34.60	35.78	36.20
30 – 35%	12.14	13.32	14.51	15.69	16.88	18.06	19.24	20.43	21.61	22.80	23.98	25.16	26.35	27.53	28.72	29.90	31.08	32.27	33.45	34.64	35.05
25 – 30%	11.00	12.18	13.36	14.55	15.73	16.92	18.10	19.28	20.47	21.65	22.84	24.02	25.20	26.39	27.57	28.76	29.94	31.12	32.31	33.49	33.91
20 – 25%	9.85	11.04	12.22	13.40	14.59	15.77	16.96	18.14	19.32	20.51	21.69	22.88	24.06	25.24	26.43	27.61	28.80	29.98	31.16	32.35	32.76
15 – 20%	8.71	9.89	11.08	12.26	13.44	14.63	15.81	17.00	18.18	19.36	20.55	21.73	22.92	24.10	25.28	26.47	27.65	28.84	30.02	31.20	31.62
10 – 15%	7.56	8.75	9.93	11.12	12.30	13.48	14.67	15.85	17.04	18.22	19.40	20.59	21.77	22.96	24.14	25.32	26.51	27.69	28.88	30.06	30.48
5 – 10%	6.42	7.60	8.79	9.97	11.16	12.34	13.52	14.71	15.89	17.08	18.26	19.44	20.63	21.81	23.00	24.18	25.36	26.55	27.73	28.92	29.33
0 – 5%	5.28	6.46	7.64	8.83	10.01	11.20	12.38	13.56	14.75	15.93	17.12	18.30	19.48	20.67	21.85	23.04	24.22	25.40	26.59	27.77	28.19

Figure 5: The use of tables by the underconfident agent: the 3rd guess.

Ihre Schätzung war: 6

Leistungsintervall	Mögliche Zufallzahl:																				
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	0	1	2	3	4	5	6	7	8	9	10
95 – 100%	28.16	29.35	30.53	31.72	32.90	34.08	35.27	36.45	37.64	38.82	40.00	41.19	42.37	43.56	44.74	45.92	47.11	47.52	47.94	48.36	48.77
90 – 95%	27.02	28.20	29.39	30.57	31.76	32.94	34.12	35.31	36.49	37.68	38.86	40.04	41.23	42.41	43.60	44.78	45.96	46.38	46.80	47.21	47.63
85 – 90%	25.88	27.06	28.24	29.43	30.61	31.80	32.98	34.16	35.35	36.53	37.72	38.90	40.08	41.27	42.45	43.64	44.82	45.24	45.65	46.07	46.48
80 – 85%	24.73	25.92	27.10	28.28	29.47	30.65	31.84	33.02	34.20	35.39	36.57	37.76	38.94	40.12	41.31	42.49	43.68	44.09	44.51	44.92	45.34
75 – 80%	23.59	24.77	25.96	27.14	28.32	29.51	30.69	31.88	33.06	34.24	35.43	36.61	37.80	38.98	40.16	41.35	42.53	42.95	43.36	43.78	44.20
70 – 75%	22.44	23.63	24.81	26.00	27.18	28.36	29.55	30.73	31.92	33.10	34.28	35.47	36.65	37.84	39.02	40.20	41.39	41.80	42.22	42.64	43.05
65 – 70%	21.30	22.48	23.67	24.85	26.04	27.22	28.40	29.59	30.77	31.96	33.14	34.32	35.51	36.69	37.88	39.06	40.24	40.66	41.08	41.49	41.91
60 – 65%	20.16	21.34	22.52	23.71	24.89	26.08	27.26	28.44	29.63	30.81	32.00	33.18	34.36	35.55	36.73	37.92	39.10	39.52	39.93	40.35	40.76
55 – 60%	19.01	20.20	21.38	22.56	23.75	24.93	26.12	27.30	28.48	29.67	30.85	32.04	33.22	34.40	35.59	36.77	37.96	38.37	38.79	39.20	39.62
50 – 55%	17.87	19.05	20.24	21.42	22.60	23.79	24.97	26.16	27.34	28.52	29.71	30.89	32.08	33.26	34.44	35.63	36.81	37.23	37.64	38.06	38.48
45 – 50%	16.72	17.91	19.09	20.28	21.46	22.64	23.83	25.01	26.20	27.38	28.56	29.75	30.93	32.12	33.30	34.48	35.67	36.08	36.50	36.92	37.33
40 – 45%	15.58	16.76	17.95	19.13	20.32	21.50	22.68	23.87	25.05	26.24	27.42	28.60	29.79	30.97	32.16	33.34	34.52	34.94	35.36	35.77	36.19
35 – 40%	14.44	15.62	16.80	17.99	19.17	20.36	21.54	22.72	23.91	25.09	26.28	27.46	28.64	29.83	31.01	32.20	33.38	33.80	34.21	34.63	35.04
30 – 35%	13.29	14.48	15.66	16.84	18.03	19.21	20.40	21.58	22.76	23.95	25.13	26.32	27.50	28.68	29.87	31.05	32.24	32.65	33.07	33.48	33.90
25 – 30%	12.15	13.33	14.52	15.70	16.88	18.07	19.25	20.44	21.62	22.80	23.99	25.17	26.36	27.54	28.72	29.91	31.09	31.51	31.92	32.34	32.76
20 – 25%	11.00	12.19	13.37	14.56	15.74	16.92	18.11	19.29	20.48	21.66	22.84	24.03	25.21	26.40	27.58	28.76	29.95	30.36	30.78	31.20	31.61
15 – 20%	9.86	11.04	12.23	13.41	14.60	15.78	16.96	18.15	19.33	20.52	21.70	22.88	24.07	25.25	26.44	27.62	28.80	29.22	29.64	30.05	30.47
10 – 15%	8.72	9.90	11.08	12.27	13.45	14.64	15.82	17.00	18.19	19.37	20.56	21.74	22.92	24.11	25.29	26.48	27.66	28.08	28.49	28.91	29.32
5 – 10%	7.57	8.76	9.94	11.12	12.31	13.49	14.68	15.86	17.04	18.23	19.41	20.60	21.78	22.96	24.15	25.33	26.52	26.93	27.35	27.76	28.18
0 – 5%	6.43	7.61	8.80	9.98	11.16	12.35	13.53	14.72	15.90	17.08	18.27	19.45	20.64	21.82	23.00	24.19	25.37	25.79	26.20	26.62	27.04

Figure 6: The use of tables by the underconfident agent: the 4th guess.

Ihre Schätzung war: 0

Leistungsintervall	Mögliche Zufallzahl: −10	−9	−8	−7	−6	−5	−4	−3	−2	−1	0	1	2	3	4	5	6	7	8	9	10
95 – 100%	30.47	31.65	32.84	34.02	35.20	36.39	37.57	38.76	39.94	41.12	42.31	42.72	43.14	43.56	43.97	44.39	44.80	45.22	45.64	46.05	46.47
90 – 95%	29.32	30.51	31.69	32.88	34.06	35.24	36.43	37.61	38.80	39.98	41.16	41.58	42.00	42.41	42.83	43.24	43.66	44.08	44.49	44.91	45.32
85 – 90%	28.18	29.36	30.55	31.73	32.92	34.10	35.28	36.47	37.65	38.84	40.02	40.44	40.85	41.27	41.68	42.10	42.52	42.93	43.35	43.76	44.18
80 – 85%	27.04	28.22	29.40	30.59	31.77	32.96	34.14	35.32	36.51	37.69	38.88	39.29	39.71	40.12	40.54	40.96	41.37	41.79	42.20	42.62	43.04
75 – 80%	25.89	27.08	28.26	29.44	30.63	31.81	33.00	34.18	35.36	36.55	37.73	38.15	38.56	38.98	39.40	39.81	40.23	40.64	41.06	41.48	41.89
70 – 75%	24.75	25.93	27.12	28.30	29.48	30.67	31.85	33.04	34.22	35.40	36.59	37.00	37.42	37.84	38.25	38.67	39.08	39.50	39.92	40.33	40.75
65 – 70%	23.60	24.79	25.97	27.16	28.34	29.52	30.71	31.89	33.08	34.26	35.44	35.86	36.28	36.69	37.11	37.52	37.94	38.36	38.77	39.19	39.60
60 – 65%	22.46	23.64	24.83	26.01	27.20	28.38	29.56	30.75	31.93	33.12	34.30	34.72	35.13	35.55	35.96	36.38	36.80	37.21	37.63	38.04	38.46
55 – 60%	21.32	22.50	23.68	24.87	26.05	27.24	28.42	29.60	30.79	31.97	33.16	33.57	33.99	34.40	34.82	35.24	35.65	36.07	36.48	36.90	37.32
50 – 55%	20.17	21.36	22.54	23.72	24.91	26.09	27.28	28.46	29.64	30.83	32.01	32.43	32.84	33.26	33.68	34.09	34.51	34.92	35.34	35.76	36.17
45 – 50%	19.03	20.21	21.40	22.58	23.76	24.95	26.13	27.32	28.50	29.68	30.87	31.28	31.70	32.12	32.53	32.95	33.36	33.78	34.20	34.61	35.03
40 – 45%	17.88	19.07	20.25	21.44	22.62	23.80	24.99	26.17	27.36	28.54	29.72	30.14	30.56	30.97	31.39	31.80	32.22	32.64	33.05	33.47	33.88
35 – 40%	16.74	17.92	19.11	20.29	21.48	22.66	23.84	25.03	26.21	27.40	28.58	29.00	29.41	29.83	30.24	30.66	31.08	31.49	31.91	32.32	32.74
30 – 35%	15.60	16.78	17.96	19.15	20.33	21.52	22.70	23.88	25.07	26.25	27.44	27.85	28.27	28.68	29.10	29.52	29.93	30.35	30.76	31.18	31.60
25 – 30%	14.45	15.64	16.82	18.00	19.19	20.37	21.56	22.74	23.92	25.11	26.29	26.71	27.12	27.54	27.96	28.37	28.79	29.20	29.62	30.04	30.45
20 – 25%	13.31	14.49	15.68	16.86	18.04	19.23	20.41	21.60	22.78	23.96	25.15	25.56	25.98	26.40	26.81	27.23	27.64	28.06	28.48	28.89	29.31
15 – 20%	12.16	13.35	14.53	15.72	16.90	18.08	19.27	20.45	21.64	22.82	24.00	24.42	24.84	25.25	25.67	26.08	26.50	26.92	27.33	27.75	28.16
10 – 15%	11.02	12.20	13.39	14.57	15.76	16.94	18.12	19.31	20.49	21.68	22.86	23.28	23.69	24.11	24.52	24.94	25.36	25.77	26.19	26.60	27.02
5 – 10%	9.88	11.06	12.24	13.43	14.61	15.80	16.98	18.16	19.35	20.53	21.72	22.13	22.55	22.96	23.38	23.80	24.21	24.63	25.04	25.46	25.88
0 – 5%	8.73	9.92	11.10	12.28	13.47	14.65	15.84	17.02	18.20	19.39	20.57	20.99	21.40	21.82	22.24	22.65	23.07	23.48	23.90	24.32	24.73

Figure 7: The use of tables by the unbiased agent: the 2nd guess.

Ihre Schätzung war: −4

Leistungsintervall	Mögliche Zufallzahl: −10	−9	−8	−7	−6	−5	−4	−3	−2	−1	0	1	2	3	4	5	6	7	8	9	10
95 – 100%	32.00	33.19	34.37	35.56	36.74	37.92	39.11	39.52	39.94	40.36	40.77	41.19	41.60	42.02	42.44	42.85	43.27	43.68	44.10	44.52	44.93
90 – 95%	30.86	32.04	33.23	34.41	35.60	36.78	37.96	38.38	38.80	39.21	39.63	40.04	40.46	40.88	41.29	41.71	42.12	42.54	42.96	43.37	43.79
85 – 90%	29.72	30.90	32.08	33.27	34.45	35.64	36.82	37.24	37.65	38.07	38.48	38.90	39.32	39.73	40.15	40.56	40.98	41.40	41.81	42.23	42.64
80 – 85%	28.57	29.76	30.94	32.12	33.31	34.49	35.68	36.09	36.51	36.92	37.34	37.76	38.17	38.59	39.00	39.42	39.84	40.25	40.67	41.08	41.50
75 – 80%	27.43	28.61	29.80	30.98	32.16	33.35	34.53	34.95	35.36	35.78	36.20	36.61	37.03	37.44	37.86	38.28	38.69	39.11	39.52	39.94	40.36
70 – 75%	26.28	27.47	28.65	29.84	31.02	32.20	33.39	33.80	34.22	34.64	35.05	35.47	35.88	36.30	36.72	37.13	37.55	37.96	38.38	38.80	39.21
65 – 70%	25.14	26.32	27.51	28.69	29.88	31.06	32.24	32.66	33.08	33.49	33.91	34.32	34.74	35.16	35.57	35.99	36.40	36.82	37.24	37.65	38.07
60 – 65%	24.00	25.18	26.36	27.55	28.73	29.92	31.10	31.52	31.93	32.35	32.76	33.18	33.60	34.01	34.43	34.84	35.26	35.68	36.09	36.51	36.92
55 – 60%	22.85	24.04	25.22	26.40	27.59	28.77	29.96	30.37	30.79	31.20	31.62	32.04	32.45	32.87	33.28	33.70	34.12	34.53	34.95	35.36	35.78
50 – 55%	21.71	22.89	24.08	25.26	26.44	27.63	28.81	29.23	29.64	30.06	30.48	30.89	31.31	31.72	32.14	32.56	32.97	33.39	33.80	34.22	34.64
45 – 50%	20.56	21.75	22.93	24.12	25.30	26.48	27.67	28.08	28.50	28.92	29.33	29.75	30.16	30.58	31.00	31.41	31.83	32.24	32.66	33.08	33.49
40 – 45%	19.42	20.60	21.79	22.97	24.16	25.34	26.52	26.94	27.36	27.77	28.19	28.60	29.02	29.44	29.85	30.27	30.68	31.10	31.52	31.93	32.35
35 – 40%	18.28	19.46	20.64	21.83	23.01	24.20	25.38	25.80	26.21	26.63	27.04	27.46	27.88	28.29	28.71	29.12	29.54	29.96	30.37	30.79	31.20
30 – 35%	17.13	18.32	19.50	20.68	21.87	23.05	24.24	24.65	25.07	25.48	25.90	26.32	26.73	27.15	27.56	27.98	28.40	28.81	29.23	29.64	30.06
25 – 30%	15.99	17.17	18.36	19.54	20.72	21.91	23.09	23.51	23.92	24.34	24.76	25.17	25.59	26.00	26.42	26.84	27.25	27.67	28.08	28.50	28.92
20 – 25%	14.84	16.03	17.21	18.40	19.58	20.76	21.95	22.36	22.78	23.20	23.61	24.03	24.44	24.86	25.28	25.69	26.11	26.52	26.94	27.36	27.77
15 – 20%	13.70	14.88	16.07	17.25	18.44	19.62	20.80	21.22	21.64	22.05	22.47	22.88	23.30	23.72	24.13	24.55	24.96	25.38	25.80	26.21	26.63
10 – 15%	12.56	13.74	14.92	16.11	17.29	18.48	19.66	20.08	20.49	20.91	21.32	21.74	22.16	22.57	22.99	23.40	23.82	24.24	24.65	25.07	25.48
5 – 10%	11.41	12.60	13.78	14.96	16.15	17.33	18.52	18.93	19.35	19.76	20.18	20.60	21.01	21.43	21.84	22.26	22.68	23.09	23.51	23.92	24.34
0 – 5%	10.27	11.45	12.64	13.82	15.00	16.19	17.37	17.79	18.20	18.62	19.04	19.45	19.87	20.28	20.70	21.12	21.53	21.95	22.36	22.78	23.20

Figure 8: The use of tables by the unbiased agent: the 3rd and the 4th guess.

B Misguided Learning: Process

Misguided learning is characterized by the entire path of beliefs, with certain features distinguishing the learning processes of the overconfident from that of underconfident agents. The specific belief paths predicted by the model are depicted in red in Figure 4. The learning process of the overconfident agents is self-defeating: although the average estimated number is close to 0, the mean action predicted by the model in the 2^{nd}, 3^{rd} and 4^{th} guess is equal to -5.895, -7.333 and -7.802, respectively. By contrast, the learning process of underconfident agents is self-correcting: the agents overshoot initially, guessing 6.139 on average, but then they correct their estimates: the mean action predicted by the model is equal to 3.620 in the 3^{rd} and the 4^{th} guess. The mean predicted guess of unbiased agents is equal to the mean estimated number -0.358.

On the same graphs, we plotted the means of the agents' actual guesses in blue. As mentioned in the main text, the belief paths resemble the ones predicted by the model. We test it formally by comparing coefficients of a simple regression explaining the difference between a guess and the number with dummy variables, one for each guess in the multiple- and single-feedback rounds. The estimation results are presented in Table 9. In Table 10, we present p-values of tests performed separately for various pairs of coefficients. It shows that, for overconfident agents, the 3^{rd} guess in the multiple-feedback rounds is significantly lower than the 2^{nd} guess. With p-value of 0.019 we reject the null hypothesis that the coefficient of the 2^{nd} guess MF variable is smaller or equal to the coefficient of the 3^{rd} guess MF variable (H_0: $\beta^2_{MF} \leq \beta^3_{MF}$). Although we cannot reject the null hypothesis that the coefficient at the 3^{rd} guess in the multiple-feedback rounds is lower than the coefficient at the 4^{th} guess (p-value = 0.159), the strict inequality between the coefficients at the 2^{nd} and the 4^{th} guess is highly significant (p-value = 0.003). We conclude that the learning process of overconfident agents is self-defeating, as predicted by the model. Moreover, the results in Table 9 prove that the patterns evinced by the underconfident and unbiased agents in the multiple-feedback rounds coincide with the model's predictions.

Table 1: The learning process.

	Overconfident (1)	Unbiased Agents (2)	Underconfident (3)
Dependent variable: difference between a guess and the number. Independent variables: dummy variables for each guess in the MF and SF rounds.			
2^{nd} guess SF	-3.350***	0.333	3.494***
	(0.360)	(0.787)	(0.393)
3^{rd} guess SF	-2.958***	0.718	3.080***
	(0.379)	(0.780)	(0.381)
4^{th} guess SF	-2.992***	1.051	3.198***
	(0.361)	(0.829)	(0.387)
1^{st} guess MF	-0.283	0.872	0.464
	(0.388)	(1.004)	(0.373)
2^{nd} guess MF	-3.966***	0.385	3.257***
	(0.462)	(0.755)	(0.387)
3^{rd} guess MF	-4.527***	0.974	1.789***
	(0.527)	(0.860)	(0.350)
4^{th} guess MF	-4.802***	0.923	1.730***
	(0.565)	(0.811)	(0.359)
Const.	0.278	-0.513	-0.118
	(0.258)	(0.751)	(0.237)
N	1896	312	1896

Standard errors clustered at individual level. Their values in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2: The regression coefficients in the multiple- and single-feedback rounds.

(a) Overconfident Agents

	H_0: $\beta^2_{MF} \leq \beta^3_{MF}$	H_0: $\beta^3_{MF} \leq \beta^4_{MF}$	H_0: $\beta^2_{MF} \leq \beta^4_{MF}$
p-value	0.019^{**}	0.159	0.003^{***}
	H_0: $\beta^2_{SF} \leq \beta^3_{SF}$	H_0: $\beta^3_{SF} \leq \beta^4_{SF}$	H_0: $\beta^2_{SF} \leq \beta^4_{SF}$
p-value	0.953	0.431	0.958

(b) Unbiased Agents

	H_0: $\beta^2_{MF} = \beta^3_{MF}$	H_0: $\beta^3_{MF} = \beta^4_{MF}$	H_0: $\beta^2_{MF} = \beta^4_{MF}$
p-value	0.056^{*}	0.885	0.102
	H_0: $\beta^2_{SF} = \beta^3_{SF}$	H_0: $\beta^3_{SF} = \beta^4_{SF}$	H_0: $\beta^2_{SF} = \beta^4_{SF}$
p-value	0.251	0.307	0.226

(c) Underconfident Agents

	H_0: $\beta^2_{MF} \leq \beta^3_{MF}$	H_0: $\beta^3_{MF} = \beta^4_{MF}$
p-value	0.000^{***}	0.681
	H_0: $\beta^2_{SF} \leq \beta^3_{SF}$	H_0: $\beta^3_{SF} = \beta^4_{SF}$
p-value	0.008^{***}	0.394

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

C Revealed Beliefs

C.1 Deriving Beliefs from Guesses

The data from Confidence I and II tells us little about the changes in subjects' beliefs about their performance parameter *during* the learning exercise. To investigate this issue, we attempt to retrieve agents' beliefs from their guesses. The experimental design enables us to divulge the beliefs about one's relative performance with few additional assumptions. The loss-function specification implies that the myopically optimal action is to enter one's beliefs about the number in every guess. There is only one ability level that "rationalizes" the agent's optimal guess, given the feedback he obtained. Thus, to derive agents' beliefs from their actions, we need to assume that the participants chose optimally in every period and without errors.

Assumption R1. (Optimal Actions)

The agent chooses his action optimally and without mistakes in every period.

In every round we can derive beliefs about the relative performance parameter from the 2^{nd}, the 3^{rd} and the 4^{th} guess. In principle, we can use all 18 revealed beliefs to examine beliefs formation during the task. However, we decided to use only beliefs revealed from the second guess in each round. The reason is that the second guess is the same in multiple- and single-feedback rounds, so our measure is not influenced by errors made by the agents who confused the round type.

Assumption R2. (Updating at the beginning of the round)

The agents updates beliefs about his performance right before the second guess each round and keeps them unchanged till the beginning of the next round. In other words, the second guess in each round reveals the agent's beliefs in that round.

C.2 Beliefs in Rounds

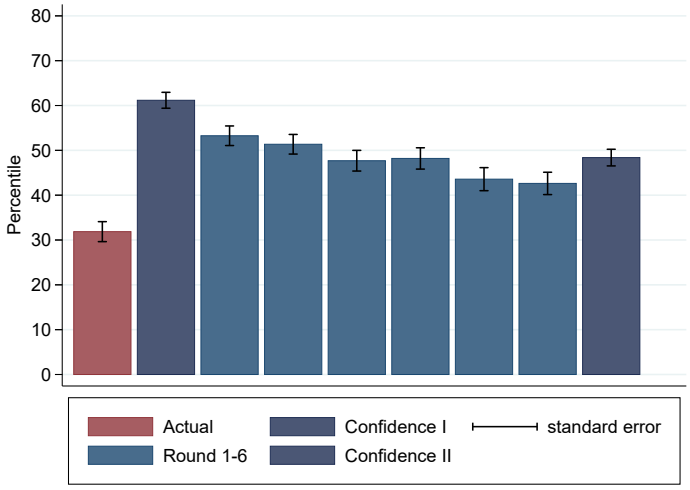
It is instructive to juxtapose the revealed beliefs with the beliefs elicited before and after the learning exercise. In Figure 11, we present the mean relative performance, beliefs elicited in Confidence I and Confidence II, and beliefs retrieved from the 2^{nd} guess in each round. However, we are aware that direct comparison is not appropriate. Firstly, between Confidence I and the 2^{nd} guess in Round 1, as well as the 2^{nd} guess in Round 6 and Confidence II, agents received feedback that was likely to change their beliefs. Secondly, the two elicitation methods are very different, and participants may not be invariant to the two procedures. Nevertheless, the beliefs derived from agents' guesses seem to be consistent with the beliefs elicited before and after the learning exercise. From the first to the last round, we observe a gradual change in beliefs in the direction of the true performance level for the overconfident and underconfident agents. The cumulative effect of updating over rounds, measured as the difference between beliefs revealed in the first and last round, is significant for the overconfident and underconfident, but not for the unbiased agents.

To describe the revealed beliefs, and at the same time complementing the data discussed so far, we present the distributions of beliefs in terms of agents' bias. In Figure 12, we present the distribution of bias based on the beliefs elicited in Confidence I and II in panels (a) and (h), and the bias based on the beliefs revealed in rounds 1 to 6 in panels (b) to (g). There is a notable heterogeneity among participants with respect to the magnitude of bias. The distribution changes visibly in each round, with more participants becoming unbiased towards the end of the experiment. Neither the distributions presented in panels (a) and (b), nor the distributions shown in (g) and (h), are alike.[1] As we have already mentioned, this might be due to differences in elicitation methods or feedback provided to agents. In particular, the first feedback, provided after the 1^{st} guess, is likely to have a large effect on agents' beliefs revealed in the first round.

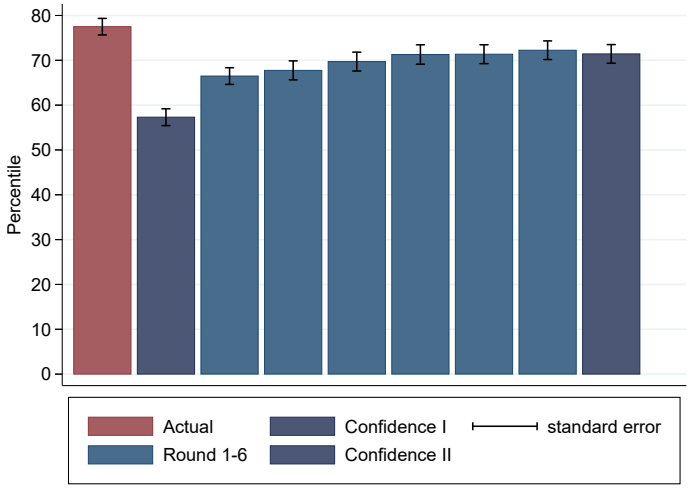
[1] Looking at the last two panels, one can notice that over 35% of all participants entered their choices in Round 6 as if they were unbiased, but only 25% indicated their actual performance as a switching probability in Confidence II. We conjecture that the difference is due to dissimilar elicitation methods or agents' (unwarranted) attempt to hedge, rather than participants "unlearning" their abilities at the end of the last round.

Figure 9: Mean actual performance, elicited and revealed beliefs.
(classification of types based on Confidence I)

(a) Overconfident Agents



(b) Underconfident Agents



(c) Unbiased Agents

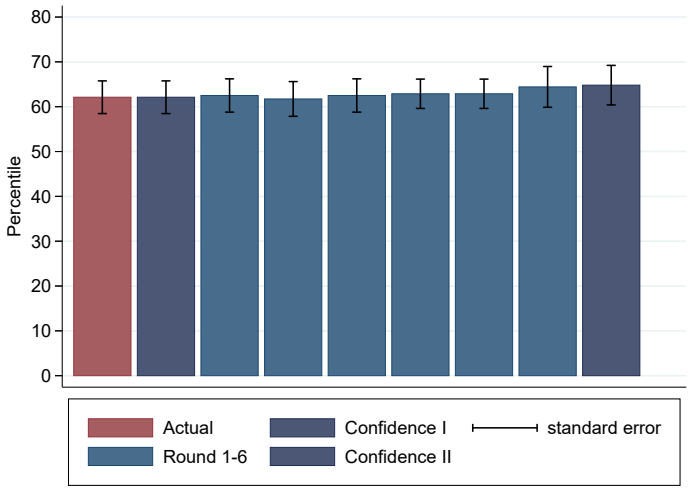
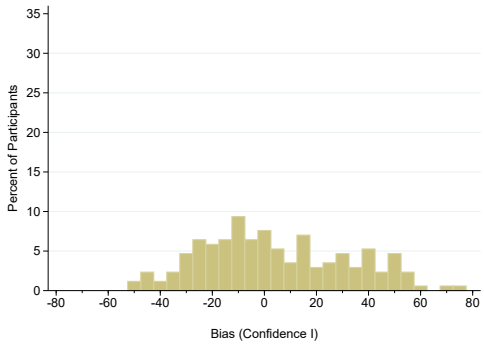
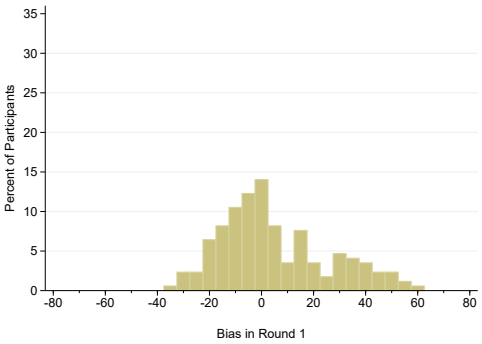


Figure 10: Distribution of participants' bias.

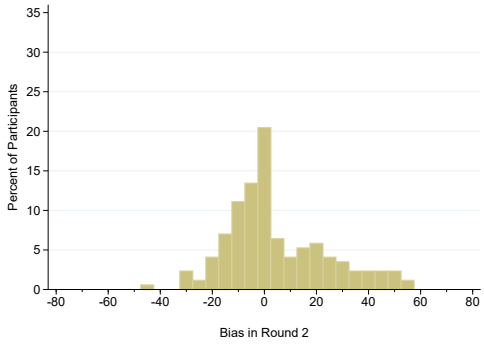
(a) Bias elicited in Confidence I.



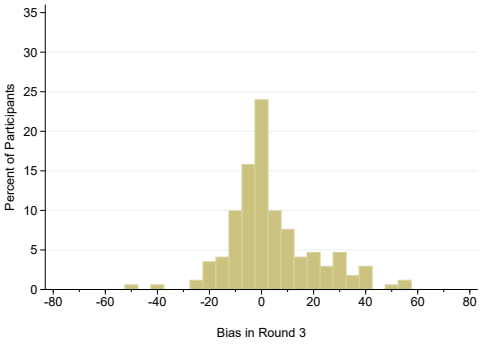
(b) Bias revealed in Round 1.



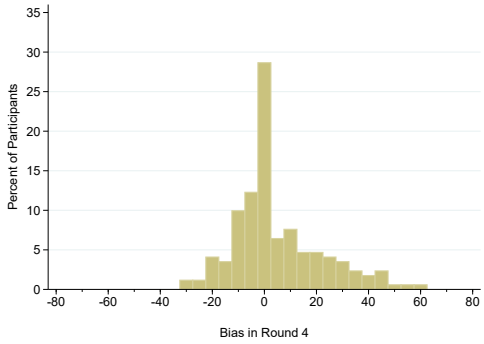
(c) Bias revealed in Round 2.



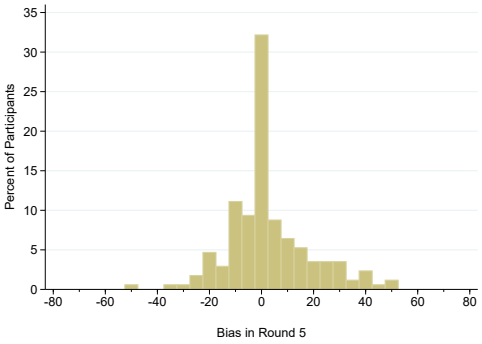
(d) Bias revealed in Round 3.



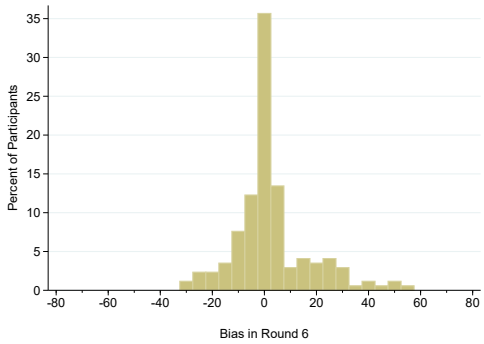
(e) Bias revealed in Round 4.



(f) Bias revealed in Round 5.



(g) Bias revealed in Round 6.



(h) Bias elicited in Confidence II.

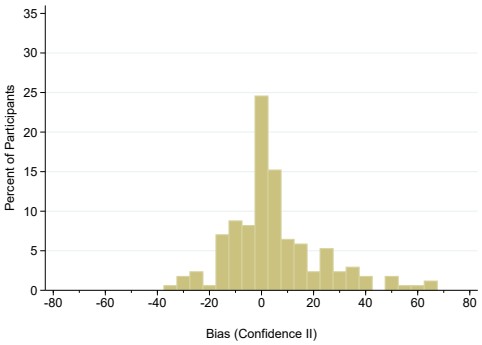


Table 3: The frequency of participants becoming unbiased during the experiment.

	Conf. I	R1	R2	R3	R4	R5	R6	**Conf. II**
Overconfident*	0	9	7	9	10	14	17	14
Unbiased	13	12	12	12	12	12	12	4
Underconfident	0	3	16	20	27	29	32	24
All subjects	13	24	35	41	49	55	61	42

* Classification based on Confidence I.

Table 11 presents the number of participants becoming unbiased during the course of the experiment based on beliefs elicited (Conf. I and Conf. II), and revealed (R1 to R6). The agents classified as underconfident in Confidence I are much more likely to become unbiased during the experiment than the overconfident agents. 32 participants out of 79 classified as underconfident entered their guesses in the sixth round as if they were unbiased, but only 17 out of 79 overconfident agents did so.[2] Almost all agents classified as unbiased in Confidence I entered their choices as if they were unbiased, but only one third of them indicated the switching point equal to their relative performance in Confidence II. We can only speculate whether the agents were driven by an impulse to hedge, or encountering no difficulties during the main task served as some kind of a signal.

C.3 Model Predictions Based on Revealed Beliefs

So far, we have tested the model's predictions, assuming that there is no change in agents' beliefs during the experiment. We relax this assumption here, allowing agents to update their beliefs at the beginning of each round. For each agent, we calculate the predicted actions based on his revealed beliefs.

Firstly, we reproduce Figure 4 by plotting the mean actual guess and mean guess predicted by the model, separately for the overconfident, underconfident and unbiased

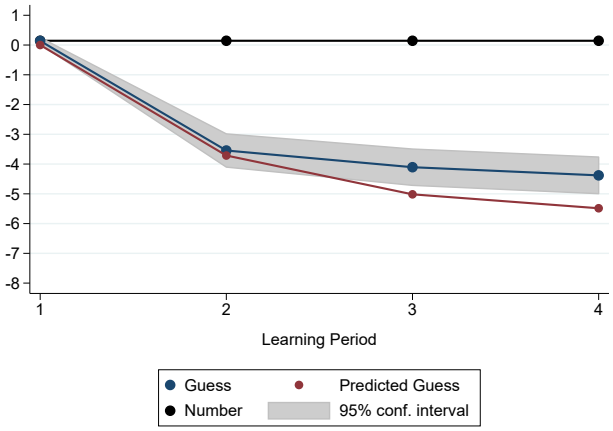
[2]Interestingly, this relation is reversed in the sample from the additional control condition – more overconfident than underconfident participants became unbiased during the task (see Götte and Kozakiewicz, 2018).

agents in Figure 5. The mean predicted guesses (in red) are much closer to the actual choices (in blue) on graphs presented in Figure 5. Agents' choices in the 3rd and 4th guess are almost the same as the model's predictions based on revealed beliefs. The better fit is reflected in the regression estimates in Table 12. The coefficients of the Model variable are higher than the respective coefficients in Table 6, and there is little difference between the early and late rounds. Overall, the model explains 73.5% variation in the data. Moreover, it does a much better job at explaining the choices of overconfident and underconfident agents, in comparison to the analysis based on elicited beliefs.

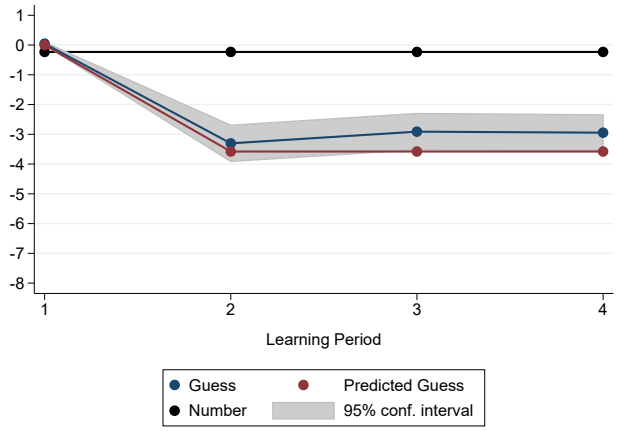
Secondly, we re-examine the impact of additional feedback, as well as agent's bias, on learning. Again, we look at the distance between the agent's guess and the number. This time, we classify participants as overconfident, underconfident or unbiased on the basis of their revealed beliefs. It is possible for an agent to change his type during the experiment. The results of the analysis are presented in Table 13 and Table 14 (note: the corresponding results, assuming no updating, can be found in Table 4 and Table 5).

For the overconfident agents, we report a higher effect of the bias on the gap between beliefs and the true state. A 10% increase in overconfidence translates to 1.89 and 1.80 increase in the distance for the 3rd and the 4th guess (comparing to the 0.815 and 0.734 increase in the previous analysis). For the underconfident agents, we now observe a significant effect of the bias. As the agent's underconfidence increases by 10 percent points, the distance between the agent's beliefs and the true state increases by 2.31 in the 3rd and by 2.39 in the 4th guess. When we include the interaction term, the effect of the multiple-feedback rounds becomes insignificant (both in the 3rd and in the 4th guess). The sign of the coefficient of the interaction term is positive, unlike the sign of the coefficient of the variable denoting the underconfident agent's bias. As expected, the effect of bias works in the opposite direction in the multiple-feedback rounds, reducing the underconfident agents' mistake.

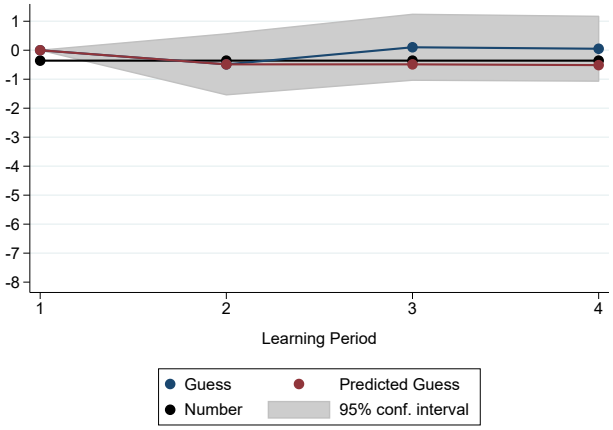
Figure 5. The estimated numbers, the participants' actual and predicted guesses.



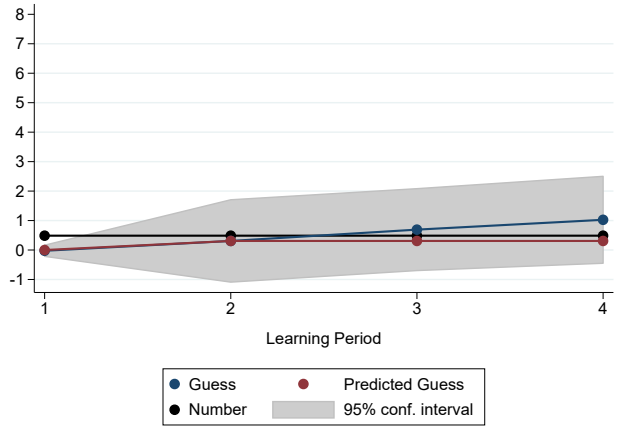
(a) Overconfident agents in MF Rounds.



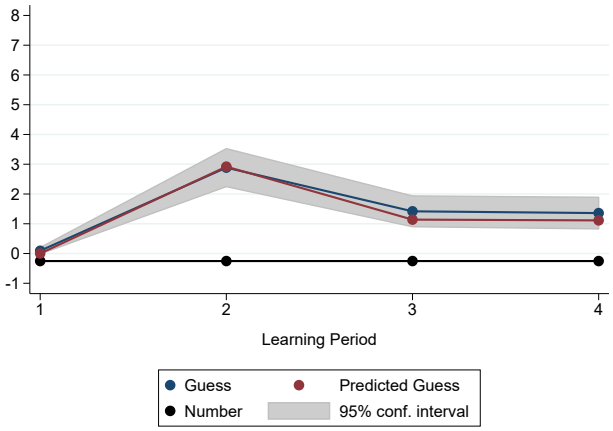
(b) Overconfident agents in SF Rounds.



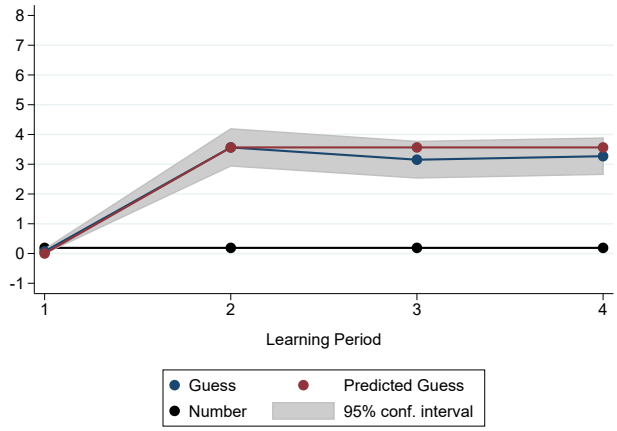
(c) Unbiased agents in MF Rounds.



(d) Unbiased agents in SF Rounds.



(e) Underconfident agents in MF Rounds.



(f) Underconfident agents in SF Rounds.

Table 4: How well the model predicts the 3rd and 4th guess.

	All Rounds	Early Rounds	Late Rounds
Model	0.831***	0.826***	0.838***
	(0.025)	(0.030)	(0.030)
Const.	0.242**	0.238*	0.247*
	(0.091)	(0.119)	(0.096)
R^2	0.735	0.742	0.728
N	2052	1026	1026

	All Rounds		Early Rounds		Late Rounds	
	SF	MF	SF	MF	SF	MF
Model	0.834***	0.832***	0.818***	0.835***	0.854***	0.827***
	(0.027)	(0.033)	(0.040)	(0.040)	(0.030)	(0.045)
Const.	0.181	0.305**	0.260	0.238	0.104	0.362**
	(0.126)	(0.110)	(0.189)	(0.188)	(0.151)	(0.117)
R^2	0.758	0.697	0.751	0.706	0.767	0.684
N	1026	1026	542	484	484	542

	Overconfident	Unbiased Agents	Underconfident
Model	0.753***	0.890***	0.860***
	(0.046)	(0.056)	(0.037)
Const.	-0.261	0.554	0.282
	(0.179)	(0.286)	(0.149)
R^2	0.534	0.743	0.744
N	948	156	948

Classification of types based on revealed beliefs.

Dependent variable: the participants' guesses (3rd and 4th).
Independent variable: guesses predicted by the model.

Standard errors clustered at individual level. Their values in parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: The effect of feedback on the difference between the number and a guess.

(allowing updating beliefs at the beginning of the round)

	Overconfident (1)	Unbiased Agents (2)	Underconfident (3)
Dependent variable: the difference between the number and the 4^{th} guess.			
MF Round	1.297***	-0.176	-2.052***
	(0.293)	(0.252)	(0.265)
Bias	0.180***	0	-0.239***
	(0.0130)	(.)	(0.0169)
Const.	0.645*	0.897***	1.916***
	(0.253)	(0.199)	(0.265)
Dependent variable: the difference between the number and the 3^{rd} guess.			
MF Round	1.146***	0.0423	-2.136***
	(0.240)	(0.218)	(0.254)
Bias	0.189***	0	-0.231***
	(0.0089)	(.)	(0.018)
Const.	0.547**	0.779***	2.016***
	(0.203)	(0.196)	(0.268)
Dependent variable: the difference between the number and the 2^{nd} guess.			
MF Round	0.0451	-0.163	-0.346
	(0.133)	(0.114)	(0.230)
Bias	0.210***	0	-0.302***
	(0.0052)	(.)	(0.0206)
Const.	0.493***	0.287	1.631***
	(0.126)	(0.151)	(0.289)
N	400	265	361

Bias and the classification of types are based on revealed beliefs.

Standard errors clustered at individual level. Their values in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: The effect of feedback on the difference between the number and a guess.

(allowing updating beliefs at the beginning of the round)

	Overconfident (1)	Unbiased Agents (2)	Underconfident (3)
Dependent variable: the difference between the number and the 4^{th} guess.			
MF Round	0.925**	-0.176	-0.706
	(0.342)	(0.252)	(0.446)
Bias	0.171***	0	-0.309***
	(0.014)	(.)	(0.032)
MF Round × Bias	0.0179	0	0.112**
	(0.020)	(.)	(0.037)
Const.	0.835***	0.897***	1.093**
	(0.243)	(0.199)	(0.377)
Dependent variable: the difference between the number and the 3^{rd} guess.			
MF Round	0.687*	0.0423	-0.652
	(0.333)	(0.218)	(0.442)
Bias	0.178***	0	-0.309***
	(0.011)	(.)	(0.031)
MF Round × Bias	0.0221	0	0.124***
	(0.019)	(.)	(0.036)
Const.	0.782***	0.779***	1.108**
	(0.225)	(0.196)	(0.358)
Dependent variable: the difference between the number and the 2^{nd} guess.			
MF Round	-0.142	-0.163	1.049*
	(0.182)	(0.114)	(0.422)
Bias	0.206***	0	-0.375***
	(0.007)	(.)	(0.023)
MF Round × Bias	0.00902	0	0.117**
	(0.009)	(.)	(0.035)
Const.	0.589***	0.287	0.777**
	(0.146)	(0.151)	(0.281)
N	400	265	361

Bias and the classification of types are based on revealed beliefs.

Standard errors clustered at individual level. Their values in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

D The Additional Control Condition

Table 7: The treatment effect on the distance between a guess and the number in the multiple-feedback rounds (controlling for the bias based on Confidence I).

	Overconfident (1)	Unbiased Agents (2)	Underconfident (3)
Dependent variable: the distance between the 4^{th} guess and the number.			
Treatment	0.893*	-0.125	-0.251
	(0.529)	(0.570)	(0.297)
Bias	0.055***	0.000	-0.059***
	(0.015)	(.)	(0.014)
Const.	2.764***	0.741	1.250***
	(0.441)	(0.492)	(0.297)
Dependent variable: the distance between the 3^{rd} guess and the number.			
Treatment	0.551	-0.074	-0.385
	(0.492)	(0.337)	(0.282)
Bias	0.070***	0.000	-0.059***
	(0.016)	(.)	(0.014)
Const.	2.612***	0.741***	1.360***
	(0.449)	(0.221)	(0.293)
Dependent variable: the distance between the 2^{nd} guess and the number.			
Treatment	0.596*	-1.020	-0.759*
	(0.351)	(0.750)	(0.392)
Bias	0.081***	0.000	-0.057***
	(0.012)	(.)	(0.017)
Const.	1.568***	1.148	3.225***
	(0.291)	(0.745)	(0.421)
N	456	66	456

Standard errors clustered at individual level. Their values in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 8: The treatment effect on the distance between a guess and the number in the single-feedback rounds.

	Overconfident (1)	Unbiased Agents (2)	Underconfident (3)
Dependent variable: the distance between the 4^{th} guess and the number.			
Treatment	0.617	0.393	-0.557
	(0.406)	(0.582)	(0.422)
Const.	3.429***	0.556*	4.050***
	(0.277)	(0.291)	(0.281)
Dependent variable: the distance between the 3^{rd} guess and the number.			
Treatment	0.569	-0.977	-0.559
	(0.408)	(0.882)	(0.419)
Const.	3.511***	1.593*	4.078***
	(0.272)	(0.861)	(0.279)
Dependent variable: the distance between the 2^{nd} guess and the number.			
Treatment	0.947**	-0.333	-0.601
	(0.428)	(0.350)	(0.418)
Const.	3.365***	0.667**	4.306***
	(0.294)	(0.291)	(0.274)
N	456	66	456

Standard errors clustered at individual level. Their values in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 9: The treatment effect on the distance between a guess and the number in the single-feedback rounds (controlling for the bias based on Confidence I).

	Overconfident	Unbiased Agents	Underconfident
	(1)	(2)	(3)
Dependent variable: the distance between the 4^{th} guess and the number.			
Treatment	0.320	0.393	-0.483
	(0.376)	(0.582)	(0.415)
Bias	0.065***	0.000	-0.046**
	(0.012)	(.)	(0.019)
Const.	1.826***	0.556*	3.042***
	(0.324)	(0.291)	(0.429)
Dependent variable: the distance between the 3^{rd} guess and the number.			
Treatment	0.259	-0.977	-0.475
	(0.377)	(0.882)	(0.410)
Bias	0.068***	0.000	-0.052***
	(0.013)	(.)	(0.019)
Const.	1.837***	1.593*	2.939***
	(0.321)	(0.861)	(0.436)
Dependent variable: the distance between the 2^{nd} guess and the number.			
Treatment	0.605	-0.333	-0.515
	(0.394)	(0.350)	(0.408)
Bias	0.075***	0.000	-0.054***
	(0.014)	(.)	(0.018)
Const.	1.521***	0.667**	3.123***
	(0.336)	(0.291)	(0.422)
N	456	66	456

Standard errors clustered at individual level. Their values in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$