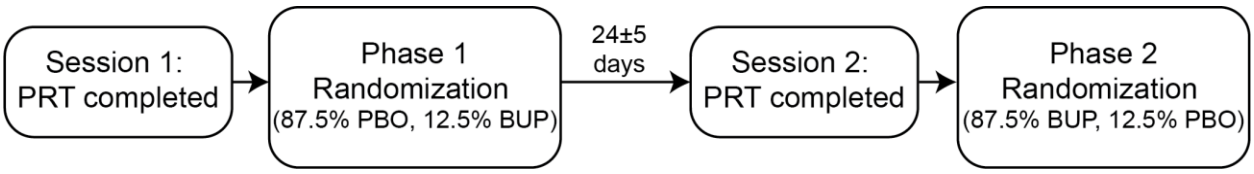
Supplemental Material for

Computational analyses of reward-based decision-making in depressed adults

Exclusion Criteria

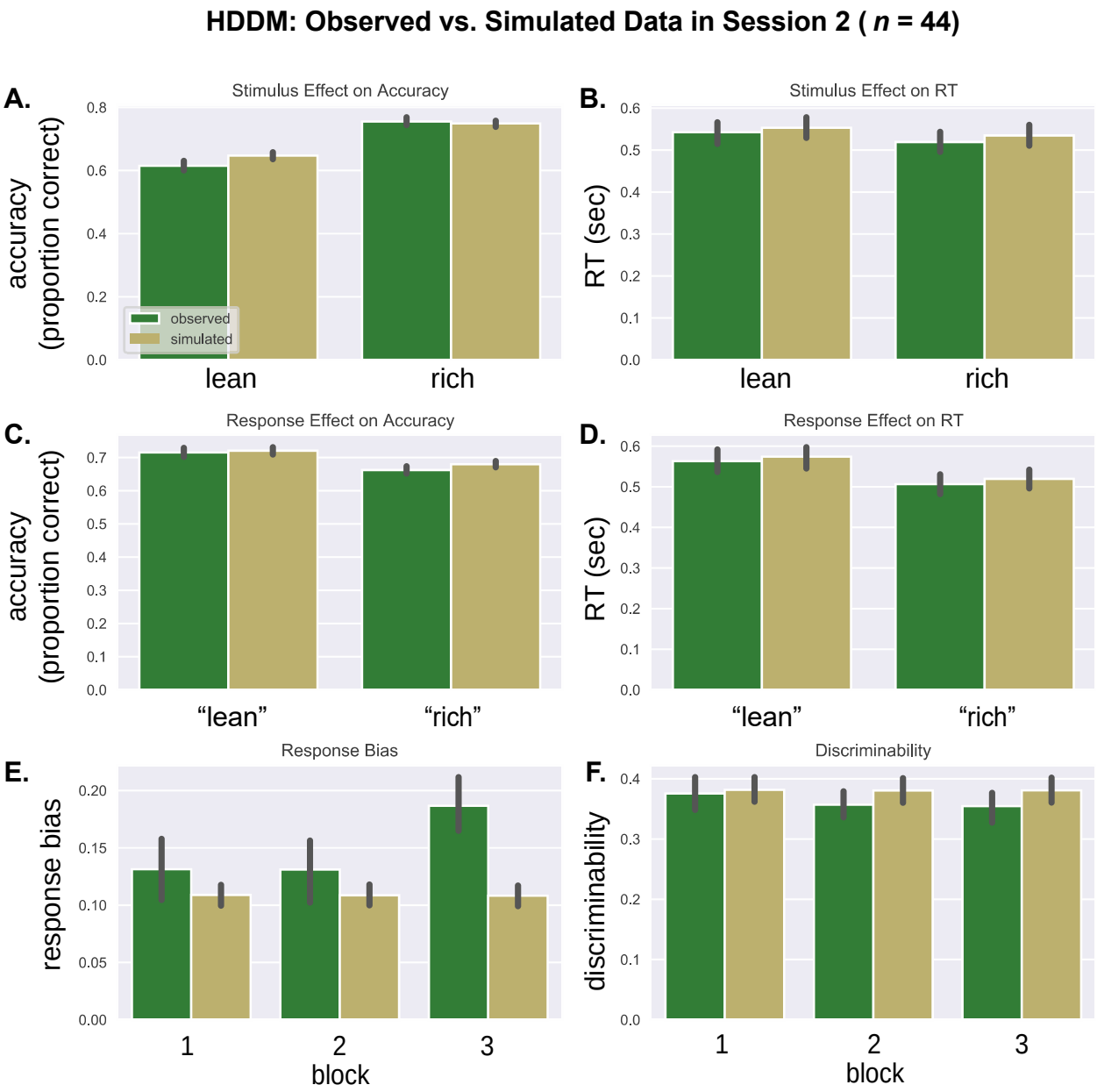
The exclusion criteria were as follows: (a) pregnancy or childbearing potential without a medically accepted contraceptive; (b) serious suicide or homicide risk; (c) unstable medical illness; (d) any of the following DSM-IV diagnoses—organic mental disorders, substance use disorders within the last year, psychotic disorders, bipolar disorder, acute bereavement, severe borderline or antisocial disorder, eating disorder, current primary diagnosis of panic disorder, social anxiety disorder, posttraumatic stress disorder, generalized anxiety disorder, or obsessive compulsive disorder, mood congruent or incongruent psychotic features; (e) history of abuse of stimulants or opiates; (f) current use of antipsychotics, anticonvulsants, stimulants, antidepressants, or augmenting agents [e.g., St. John's Wort]; (g) use of any investigational psychotropic drug in the last year; (h) non-response to two or more antidepressant trials of adequate dose and duration, per the ATHQ, over the last five years; (i) history of inadequate response to or poor tolerability of bupropion; (j) concomitant psychotherapy for depression; (k) current or prior treatment with vagal nerve stimulation, electroconvulsive therapy, or transcranial magnetic stimulation; or (l) red/green colorblindness (due to a task used in the PET/MRI scan).

Figure S1



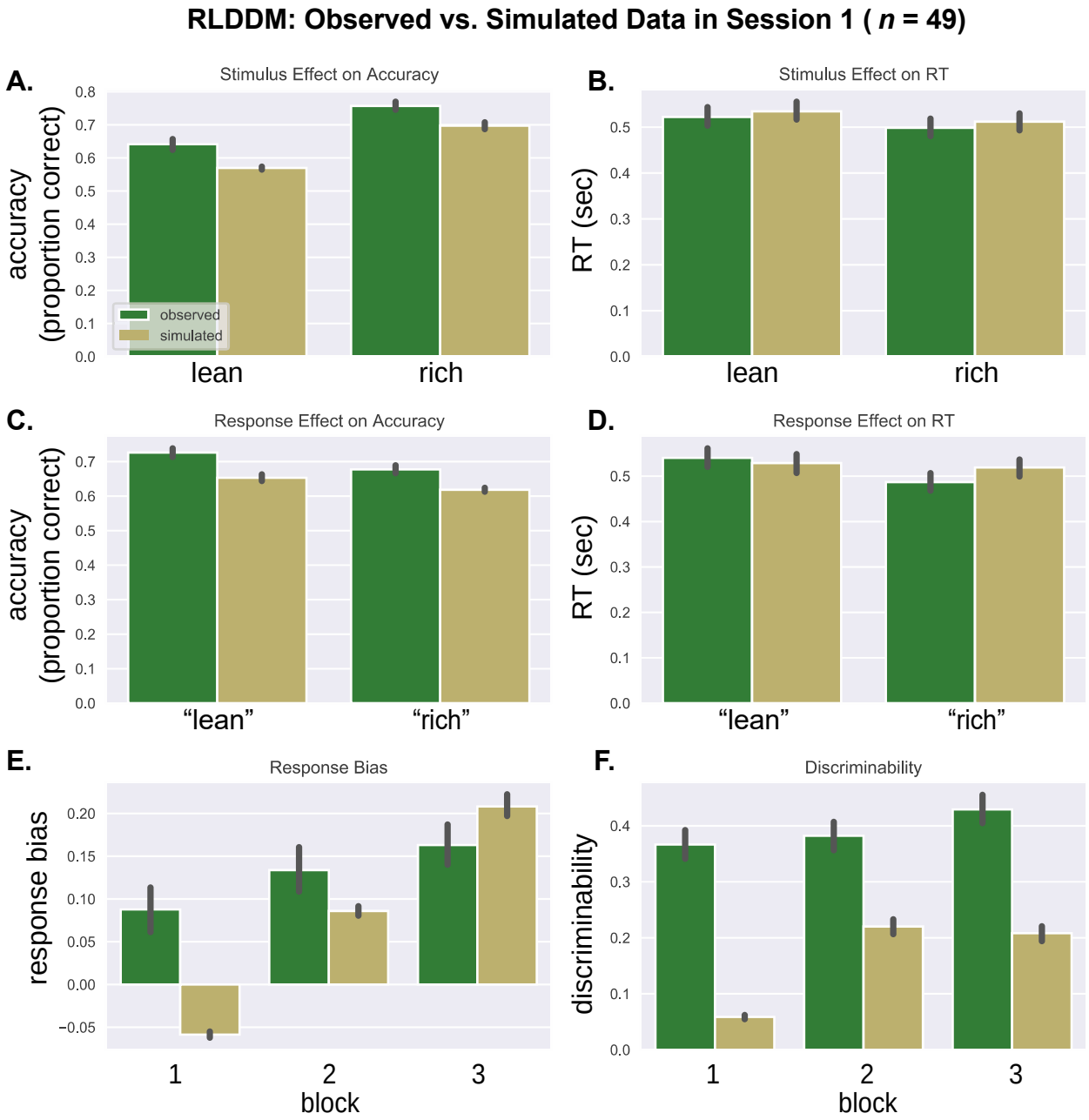
Note. Simplified protocol summary. PRT data were acquired immediately prior to Phase 1 randomization to placebo (PBO) or bupropion, and again immediately before Phase 2 re-randomization. All participants were diagnosed with Major Depressive Disorder, and Phase 1 randomization was disproportionately to the placebo condition given the goal to identify predictors of placebo response.

Figure S2



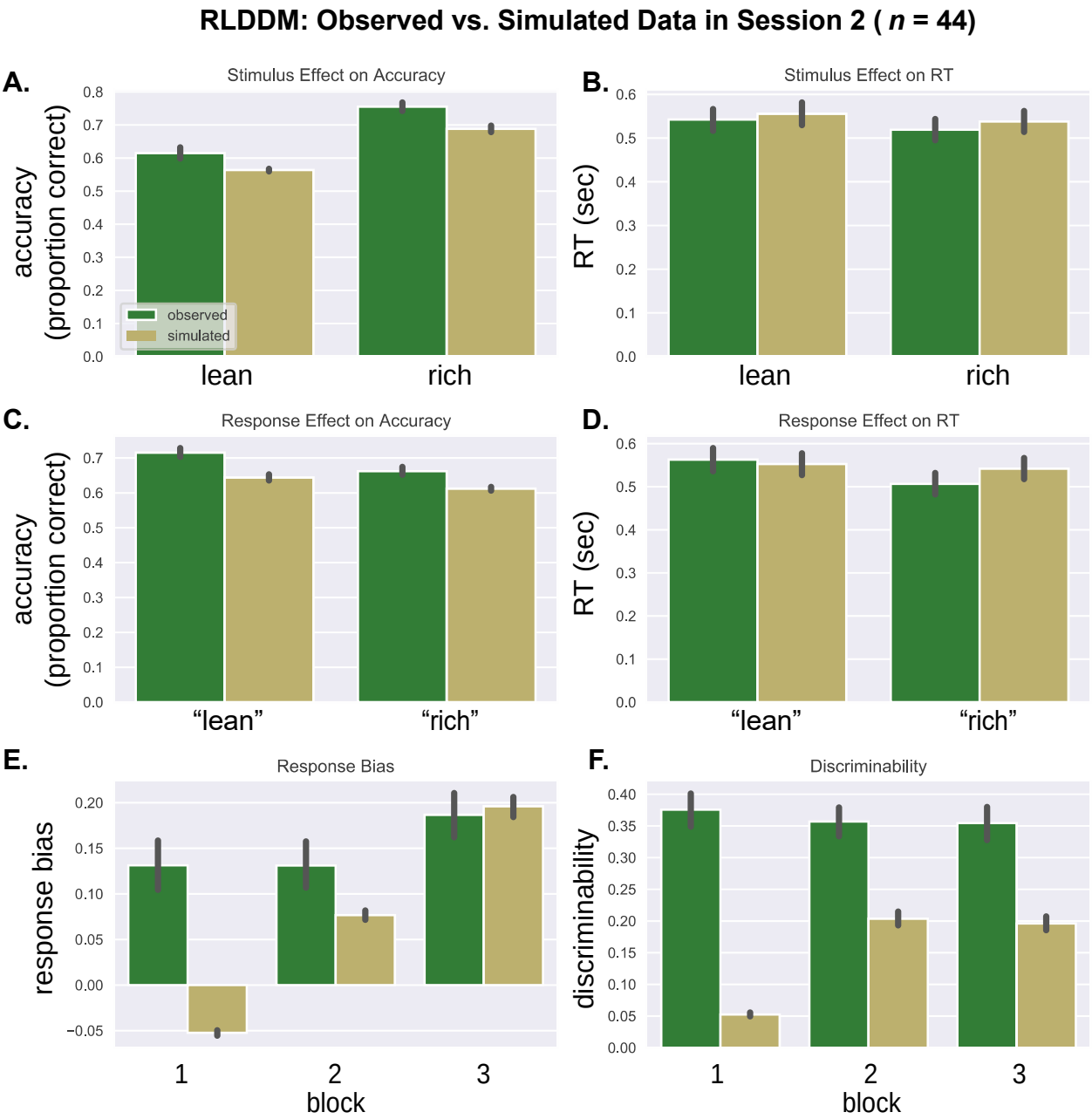
Note. Observed data from Session 2 vs. data from 500 simulations, generated using the HDDM. Results are shown for (A) the stimulus effect (rich/lean) on accuracy, (B) the stimulus effect on RT, (C) the response effect ("rich"/ "lean") on accuracy, (D) the response effect on RT, (E) response bias, and (F) discriminability.

Figure S3



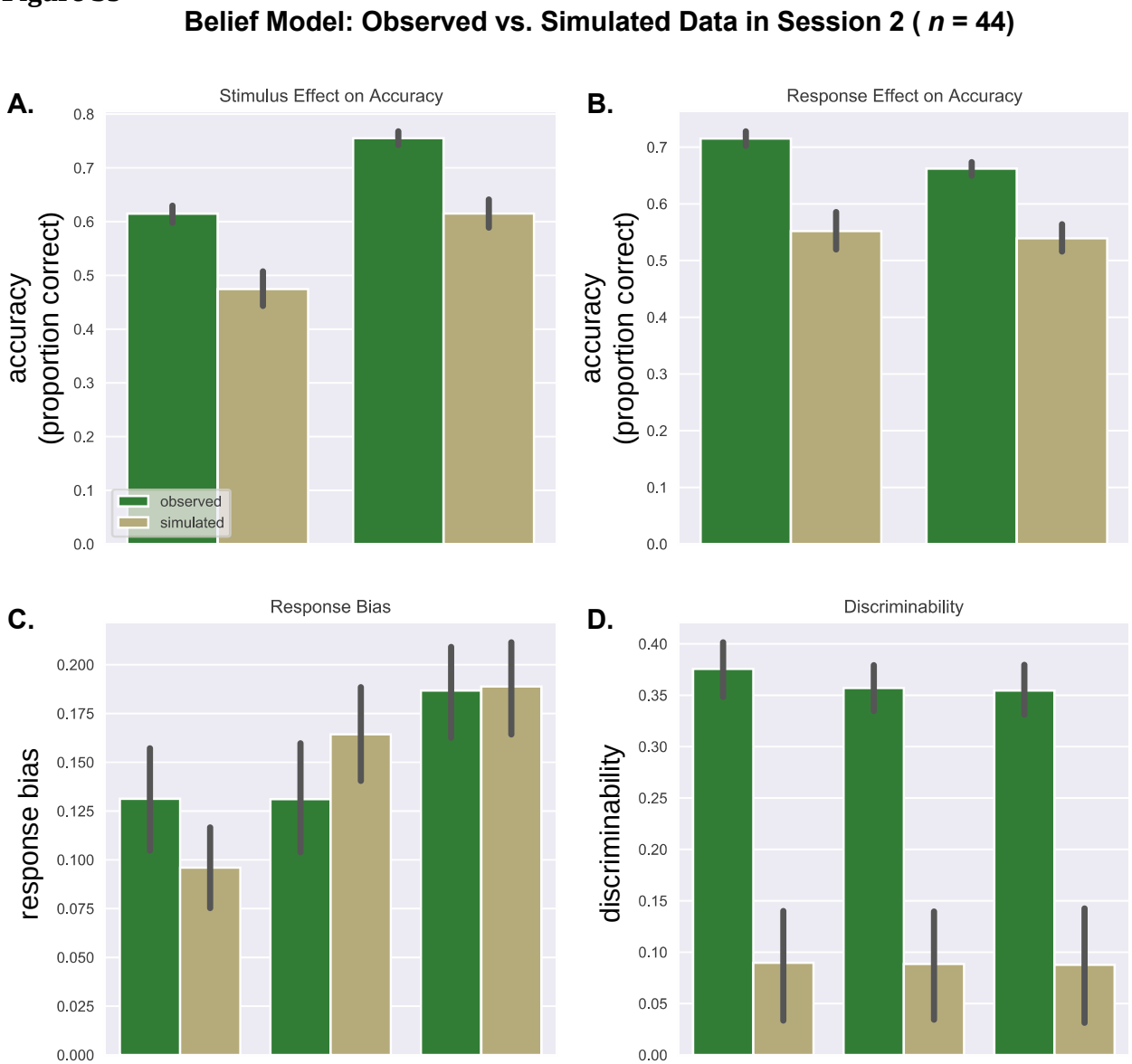
Note. Observed data from Session 1 vs. data from 50 simulations, generated using the RLDDM. Results are shown for (A) the stimulus effect (rich/lean) on accuracy, (B) the stimulus effect on RT, (C) the response effect ("rich"/ "lean") on accuracy, (D) the response effect on RT, (E) response bias, and (F) discriminability.

Figure S4



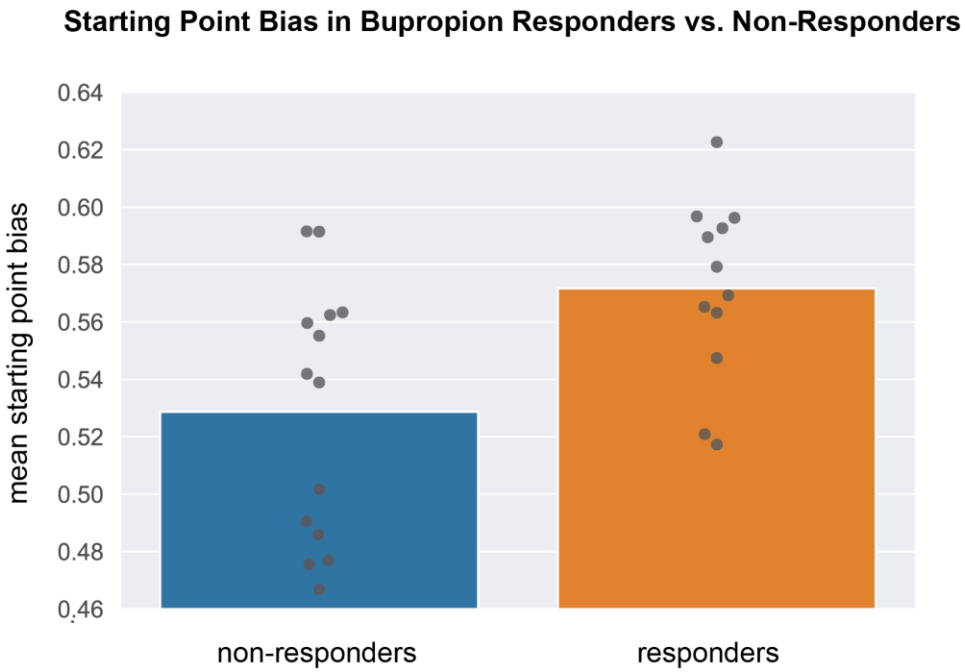
Note. Observed data from Session 2 vs. data from 50 simulations, generated using the RLDDM. Results are shown for (A) the stimulus effect (rich/lean) on accuracy, (B) the stimulus effect on RT, (C) the response effect ("rich"/ "lean") on accuracy, (D) the response effect on RT, (E) response bias, and (F) discriminability.

Figure S5



Note. Observed data from Session 2 vs. data from 500 simulations, generated using the belief model. Results are shown for (A) the stimulus effect (rich/lean) on accuracy, (B) the response effect ("rich"/ "lean") on accuracy, (C) response bias, and (D) discriminability.

Figure S6



Note. Mean starting point bias estimates for bupropion responders vs. non-responders, given non-response to placebo.

Table S1

Demographic Data

Session	*N*	Age	Number Females	Years of Education	Number White	Number Hispanic or Latino
1	49	29±10	25 (51%)	15±2	35 (71%)	8 (16%)
2	44	28±9	20 (45%)	15±2	34 (77%)	6 (14%)

Note. Mean±SD values are given for age and years of education. Session 1 data were collected at baseline, before randomization to placebo or bupropion; Session 2 data were collected approximately three weeks later (mean±S.D. = 24±5 days between sessions). Age data were missing for one participant in Sessions 1 and 2.

Table S2

Mean (SD) Response Bias, Discriminability, and Reward Totals by Session and Block

	Response bias	Discriminability	Reward total
	Session 1 (*n* = 49)		
Block 1	0.09 (0.18)	0.37 (0.19)	38.0 (2.39)
Block 2	0.14 (0.18)	0.38 (0.18)	38.6 (2.06)
Block 3	0.16 (0.16)	0.43 (0.19)	39.0 (1.95)
	Session 2 (*n* = 44)		
Block 1	0.13 (0.18)	0.37 (0.18)	38.4 (2.15)
Block 2	0.13 (0.19)	0.36 (0.15)	38.9 (2.15)
Block 3	0.19 (0.16)	0.35 (0.17)	38.6 (2.18)

Table S3

Results of Regressing Response Bias and Discriminability on HDDM Parameters

Parameter	*B* [95% CI]	*SE*	β	*t*-value	*p*-value
Response Bias: Session 1					
Threshold (*a*)	0.01 [-0.14,0.16]	0.08	0.02	0.12	0.904
Non-decision time (*t*)	-0.16 [-0.73,0.41]	0.28	-0.07	-0.55	0.583
Drift rate (*v*)	-0.03 [-0.14,0.08]	0.05	-0.07	-0.49	0.626
Starting bias (*z*)	1.86 [1.17,2.56]	0.35	0.64	5.38	< 0.001
Discriminability: Session 1					
Threshold (*a*)	0.29 [0.23,0.35]	0.03	0.39	9.85	< 0.001
Non-decision time (*t*)	0.12 [-0.10,0.34]	0.11	0.04	1.07	0.289
Drift rate (*v*)	0.49 [0.45,0.53]	0.02	1.02	23.13	< 0.001
Starting bias (*z*)	-0.25 [-0.52,0.03]	0.14	-0.07	-1.80	0.078
Response Bias: Session 2					
Threshold (*a*)	0.01 [-0.17,0.19]	0.09	0.02	0.10	0.922
Non-decision time (*t*)	-0.25 [-0.76,0.26]	0.25	-0.13	-0.98	0.332
Drift rate (*v*)	-0.00 [-0.13,0.13]	0.06	-0.01	-0.05	0.962
Starting bias (*z*)	2.58 [1.50,3.66]	0.53	0.62	4.87	< 0.001
Discriminability: Session 2					
Threshold (*a*)	0.25 [0.18,0.32]	0.03	0.42	7.25	< 0.001
Non-decision time (*t*)	-0.05 [-0.24,0.14]	0.10	-0.02	-0.51	0.611
Drift rate (*v*)	0.49 [0.44,0.54]	0.02	1.17	20.16	< 0.001
Starting bias (*z*)	0.13 [-0.28,0.54]	0.20	0.03	0.64	0.523

Table S4

Retest Reliability of the HDDM and Belief Models

Parameter	Pearson *r*-value	*p*-value
	HDDM	
Threshold (*a*)	0.67	< 0.001
Non-decision time (*t*)	0.36	0.036
Drift rate (*v*)	0.63	< 0.001
Starting bias (*z*)	0.50	0.003
	Belief Model	
Reward sensitivity	0.06	0.727
Instruction sensitivity	0.33	0.054
Learning rate	0.25	0.148
Belief	0.27	0.123
Initial bias	-0.46	0.006

Note. These analyses were run on 34 participants with usable PRT data at Sessions 1 and 2, regardless of assignment to placebo or bupropion.

Table S5

Results of Regressing Response Bias and Discriminability on Belief Model Parameters

Parameter	*B* [95% CI]	*SE*	β	*t*-value	*p*-value
Response Bias: Session 1					
Reward sensitivity	0.15 [0.06,0.24]	0.04	0.53	3.30	0.002
Instruction sensitivity	-0.13 [-0.26,-0.00]	0.06	-0.28	-2.02	0.049
Learning rate	0.04 [0.02,0.06]	0.01	0.63	4.05	< 0.001
Belief	0.16 [0.03,0.29]	0.06	0.36	2.52	0.016
Initial bias	-0.25 [-0.86,0.36]	0.30	-0.10	-0.82	0.415
Discriminability: Session 1					
Reward sensitivity	-0.01 [-0.04,0.03]	0.02	-0.02	-0.35	0.729
Instruction sensitivity	0.38 [0.34,0.43]	0.02	0.66	16.28	< 0.001
Learning rate	-0.01 [-0.01,0.00]	0.00	-0.08	-1.83	0.075
Belief	0.26 [0.21,0.31]	0.02	0.46	10.91	< 0.001
Initial bias	-0.08 [-0.30,0.15]	0.11	-0.03	-0.68	0.499
Response Bias: Session 2					
Reward sensitivity	0.22 [0.13,0.31]	0.04	0.67	4.89	< 0.001
Instruction sensitivity	-0.00 [-0.12,0.11]	0.06	-0.01	-0.05	0.962
Learning rate	0.05 [0.03,0.07]	0.01	0.71	5.21	< 0.001
Belief	0.06 [-0.08,0.19]	0.07	0.10	0.82	0.420
Initial bias	-0.29 [-0.90,0.31]	0.30	-0.11	-0.99	0.329
Discriminability: Session 2					
Reward sensitivity	-0.04 [-0.09,0.00]	0.02	-0.12	-1.88	0.068
Instruction sensitivity	0.41 [0.35,0.47]	0.03	0.80	14.02	< 0.001
Learning rate	-0.01 [-0.02,-0.00]	0.00	-0.14	-2.13	0.040
Belief	0.20 [0.13,0.27]	0.03	0.32	5.67	< 0.001
Initial bias	0.25 [-0.06,0.57]	0.15	0.09	1.65	0.107