

Supplementary Information

DV	IV	Est. (SE)	t-value	Pr> t
β	Intercept	0.847 (0.006)	135.586	<0.001***
	Social Anxiety	-0.002 (0.006)	-0.387	0.699
	IQ	-0.008 (0.006)	-1.292	0.197
ϕ	Intercept	1.238 (0.018)	68.259	<0.001***
	Social Anxiety	-0.029 (0.018)	-1.608	0.108
	IQ	0.080 (0.018)	4.391	<0.001***
δ^+	Intercept	0.286 (0.009)	32.772	<0.001***
	Social Anxiety	0.040 (0.009)	4.566	<0.001***
	IQ	0.023 (0.009)	2.684	0.007**
δ^-	Intercept	0.136 (0.007)	19.419	<0.001***
	Social Anxiety	0.007 (0.007)	0.955	0.340
	IQ	-0.011 (0.007)	-1.520	0.1288

SI Table 1: Multivariate linear regressions of social anxiety (LSAS) and IQ (Ravens Matrices Scores) on fitted valenced EWA parameters ($N = 743$). Here β represents the inverse temperature, ϕ controls the learning rate, and δ , which dictates the rate of counterfactual updating, is split into δ^+ and δ^- , which control upwards- and downwards- counterfactual learning, respectively.

DV	IV	Est. (SE)	t-value	Pr> t
β	Intercept	1.205 (0.029)	40.875	<0.001***
	Anxious Depression	-0.026 (0.033)	-0.805	0.422
	Compulsive Behavior & Intrusive Thought	0.020 (0.030)	0.674	0.501
	Social Withdrawal	-0.016 (0.033)	-0.490	0.625
	IQ	0.106 (0.026)	4.007	<0.001***
ϕ	Intercept	0.847 (0.009)	90.391	<0.001***
	Anxious Depression	-0.011 (0.010)	-1.048	0.296
	Compulsive Behavior & Intrusive Thought	-0.002 (0.009)	-0.178	0.859
	Social Withdrawal	-0.008 (0.010)	-0.732	0.465
	IQ	-0.007 (0.008)	-0.865	0.388
δ^+	Intercept	0.256 (0.013)	19.009	<0.001***
	Anxious Depression	-0.007 (0.015)	-0.469	0.639
	Compulsive Behavior & Intrusive Thought	0.000 (0.014)	-0.023	0.982
	Social Withdrawal	0.049 (0.015)	3.232	0.001**
	IQ	0.008 (0.012)	0.640	0.523
δ^-	Intercept	0.155 (0.011)	13.719	<0.001***
	Anxious Depression	0.001 (0.013)	0.035	0.972
	Compulsive Behavior & Intrusive Thought	0.006 (0.011)	0.519	0.604
	Social Withdrawal	0.008 (0.013)	0.596	0.552
	IQ	-0.016 (0.010)	-1.588	0.113

SI Table 2: Multivariate linear regressions of psychiatric symptom dimensions (factors) and IQ (Ravens Matrices Scores) on fit valenced EWA parameters. Factors were ‘Anxious-Depression’, ‘Compulsive Behavior and Intrusive Thought’ and ‘Social Withdrawal’ (Experiment 2, $N = 331$). Here β represents the inverse temperature, ϕ controls the learning rate, and δ , which dictates the rate of counterfactual updating, is split into δ^+ and δ^- , which control upwards- and downwards- counterfactual learning, respectively.

DV	IV	Est. (SE)	t-value	Pr> t
β	Intercept	1.232 (0.023)	54.715	<0.001***
	Social Anxiety	-0.052 (0.023)	-2.322	0.021*
	IQ	-0.044 (0.025)	1.767	0.078
ϕ	Intercept	0.835 (0.009)	97.279	<0.001***
	Social Anxiety	0.008 (0.009)	0.949	0.343
	IQ	0.013 (0.009)	-1.333	0.183
δ	Intercept	0.215 (0.010)	21.813	<0.001***
	Social Anxiety	0.026 (0.010)	2.591	0.010*
	IQ	0.025 (0.011)	2.245	0.025*

SI Table 3: Multivariate linear regressions of social anxiety (LSAS) and IQ (Ravens Matrices Scores) on fitted EWA parameters (Experiment 1, $N = 412$). Here β represents the inverse temperature, ϕ controls the learning rate, and δ dictates the relative rate of counterfactual updating.

DV	IV	Est. (SE)	t-value	P> t
β	Intercept	1.135 (0.035)	32.737	<0.001***
	Social Anxiety	-0.001 (0.034)	-0.023	0.981
	IQ	0.107 (0.031)	3.521	<0.001***
ϕ	Intercept	0.835 (0.010)	86.498	<0.001***
	Social Anxiety	-0.016 (0.010)	-1.677	0.095
	IQ	-0.009 (0.008)	-1.053	0.293
δ	Intercept	0.214 (0.014)	15.811	<0.001***
	Social Anxiety	0.034 (0.013)	2.507	0.013*
	IQ	0.002 (0.012)	0.169	0.866

SI Table 4: Multivariate linear regressions of social anxiety (LSAS) and IQ (Ravens Matrices Scores) on fitted EWA parameters (Experiment 2, $N = 331$). Here β represents the inverse temperature, ϕ controls the learning rate, and δ dictates the relative rate of counterfactual updating.

DV	IV	Est. (SE)	t-value	Pr> t
β	Intercept	1.276 (0.023)	56.305	<0.001***
	Social Anxiety	-0.048 (0.023)	-2.131	0.034*
	IQ	0.039 (0.025)	1.565	0.118
ϕ	Intercept	0.847 (0.009)	99.154	<0.001***
	Social Anxiety	0.006 (0.009)	0.700	0.484
	IQ	-0.010 (0.010)	-1.072	0.285
δ^+	Intercept	0.302 (0.012)	26.205	<0.001***
	Social Anxiety	0.031 (0.011)	2.663	0.008**
	IQ	0.041 (0.013)	3.201	0.015
δ^-	Intercept	0.118 (0.009)	13.256	<0.001***
	Social Anxiety	0.009 (0.009)	1.046	0.298
	IQ	-0.002 (0.009)	-0.164	0.870

SI Table 5: Multivariate linear regressions of social anxiety (LSAS) and IQ (Ravens Matrices Scores) on fitted valenced EWA parameters (Experiment 1, $N = 412$). Here β represents the inverse temperature, ϕ controls the learning rate, and δ dictates the relative rate of counterfactual updating.

DV	IV	Est. (SE)	t-value	Pr> t
β	Intercept	1.276 (0.030)	40.239	<0.001***
	Social Anxiety	-0.015 (0.030)	-0.509	0.611
	IQ	0.106 (0.026)	4.014	<0.001***
ϕ	Intercept	0.844 (0.009)	88.849	<0.001***
	Social Anxiety	-0.013 (0.009)	-1.374	0.170
	IQ	-0.007 (0.006)	-0.830	0.407
δ^+	Intercept	0.264 (0.014)	19.357	<0.001***
	Social Anxiety	0.047 (0.014)	3.442	<0.001***
	IQ	0.007 (0.012)	0.614	0.539
δ^-	Intercept	0.156 (0.011)	13.661	<0.001***
	Social Anxiety	0.007 (0.011)	0.658	0.298
	IQ	-0.016 (0.010)	-1.604	0.110

SI Table 6: Multivariate linear regressions of social anxiety (LSAS) and IQ (Ravens Matrices Scores) on fitted valenced EWA parameters (Experiment 2, $N = 331$).

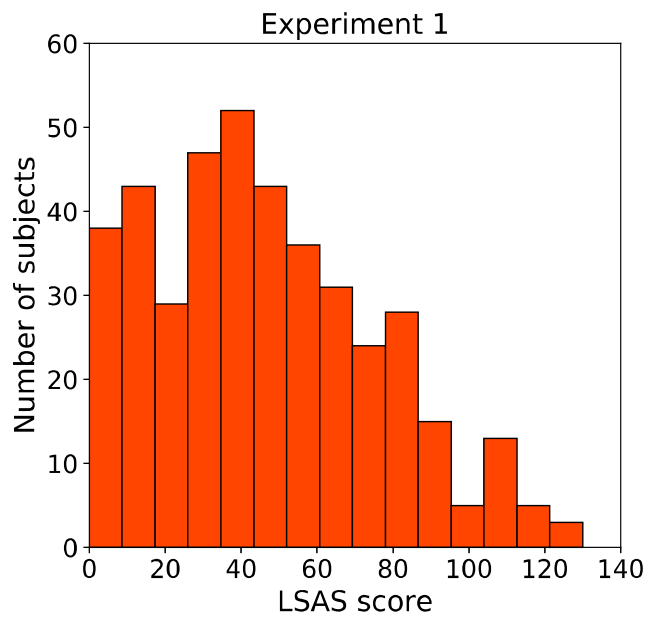
Model	Parameter	Experiment 1		Experiment 2	
		μ	(σ)	μ	(σ)
EWA	β	1.2	(0.46)	1.1	(0.63)
	ϕ	0.84	(0.17)	0.84	(0.17)
	δ	0.22	(0.20)	0.21	(0.24)
	$V^1(1)$	0.013	(0.0093)	-0.053	(0.019)
	$V^2(1)$	-0.34	(0.019)	-0.26	(0.0078)
	$V^3(1)$	-0.11	(0.029)	-0.17	(0.0078)
	$V^4(1)$	0.078	(0.015)	0.09	(0.043)
	$V^5(1)$	0.13	(0.012)	0.15	(0.014)
Valenced EWA	β	1.3	(0.46)	1.2	(0.55)
	ϕ	0.85	(0.17)	0.85	(0.17)
	δ^+	0.31	(0.24)	0.26	(0.25)
	δ^-	0.12	(0.18)	0.16	(0.21)
	$V^1(1)$	0.015	(0.0093)	-0.044	(0.014)
	$V^2(1)$	-0.34	(0.020)	-0.27	(0.013)
	$V^3(1)$	-0.11	(0.024)	-0.17	(0.012)
	$V^4(1)$	0.083	(0.014)	0.11	(0.017)
$V^5(1)$	0.13	(0.011)	0.16	(0.014)	

SI Table 7: Parameter fit values for the standard (top) and valenced (bottom) versions of the EWA model estimated separately for each experiment. Here β represents the inverse temperature, ϕ controls the learning rate, and δ , which dictates the rate of counterfactual updating, is split into δ^+ and δ^- , which control upwards- and downwards- counterfactual learning, respectively. The columns labeled μ and σ refer respectively to the mean and standard deviations (in parentheses) of the subject-level fit values for each experiment.

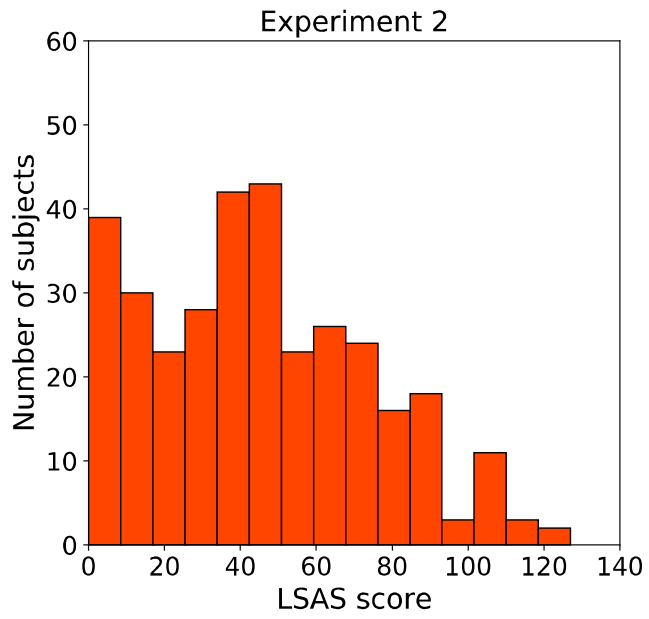
Empirical Distributions of Investment Strategies

	Investment				
	\$0	\$1	\$2	\$3	\$4
Nash Equilibrium	60%	0%	20%	0%	20%
Rapoport & Amaldoss (2000)	55%	3%	6%	14%	22%
Zhu et al., (2012)	49%	3%	10%	10%	28%
Experiments 1 & 2	41%	6%	9%	13%	31%

SI Table 8: Comparison of Nash equilibrium predictions and empirical distributions from Rapoport & Amaldoss (2000), Zhu et al., (2012), and Experiments 1 & 2.

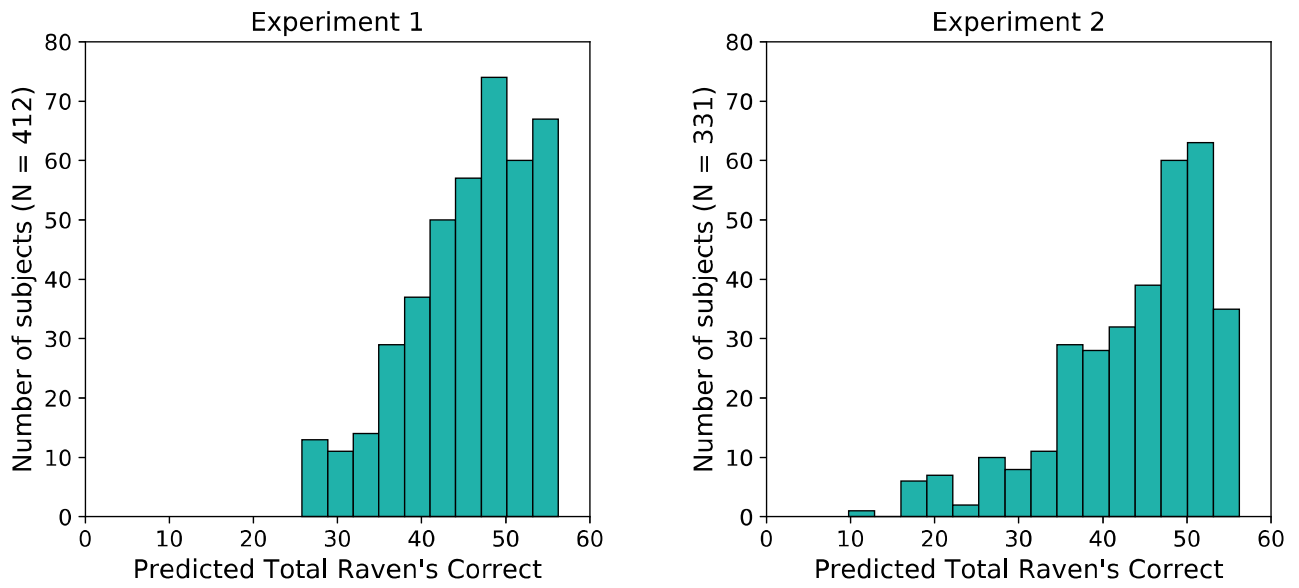


SI Figure 2: Distributions of subjects' scores on the Liebowitz Social Anxiety Scale (LSAS) for Experiment 1.

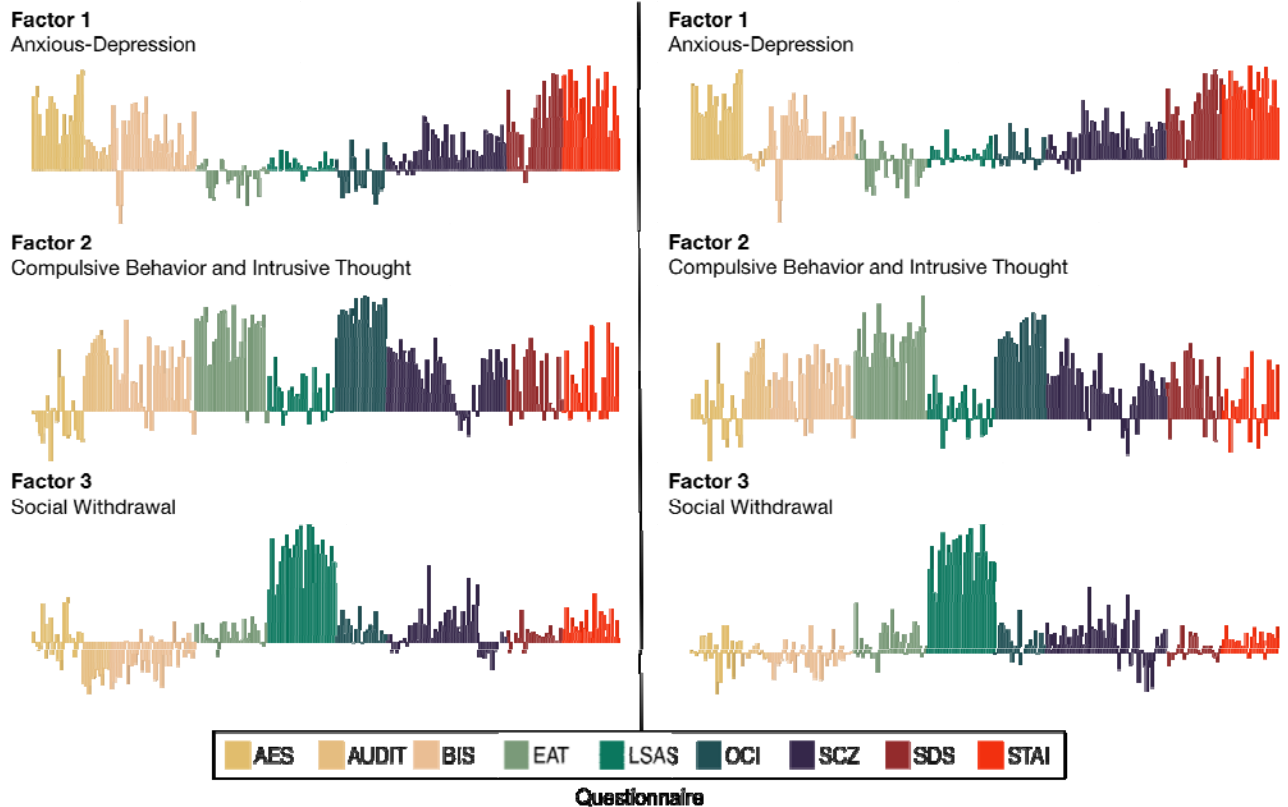


SI Figure 3: Distributions of subjects' scores on the Liebowitz Social Anxiety Scale (LSAS) for Experiment 2.

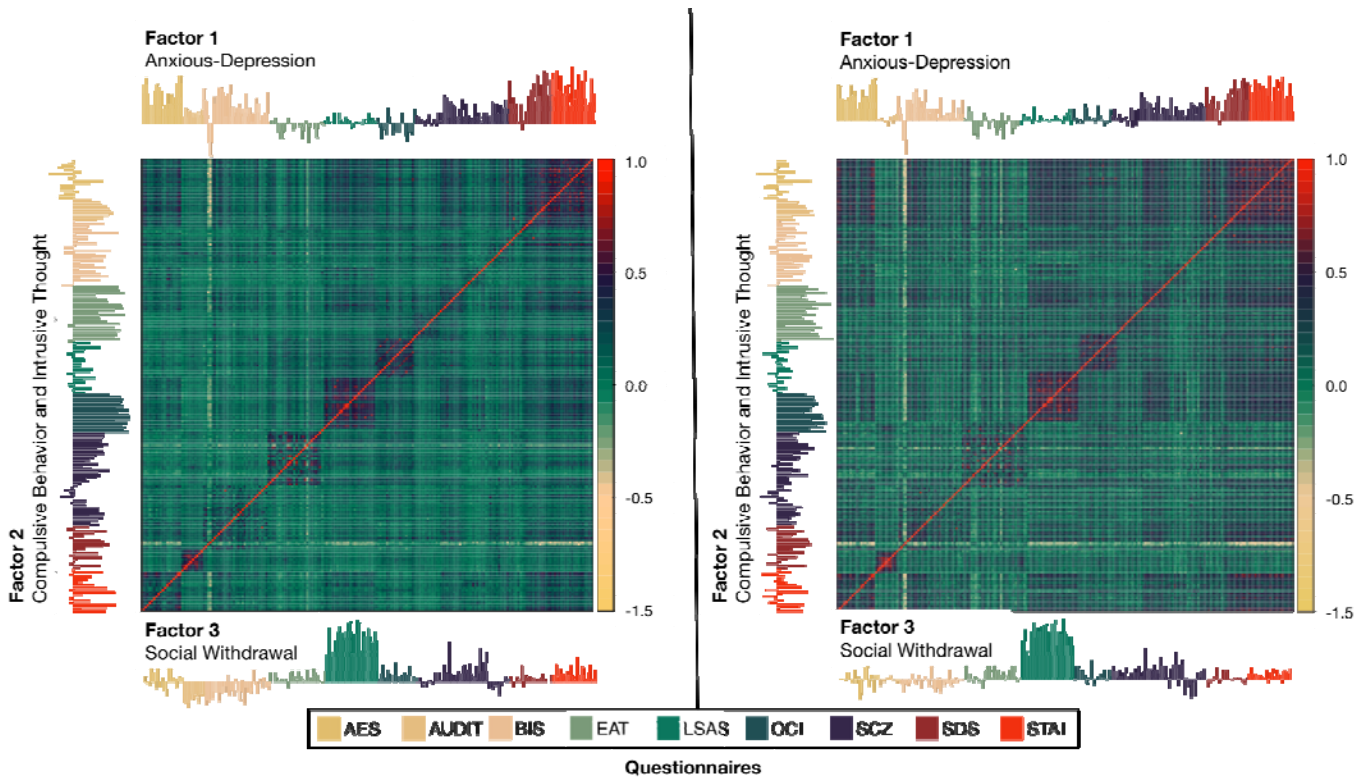
Abbreviated 9-item Raven's Standard Progressive Matrices (RSPM)



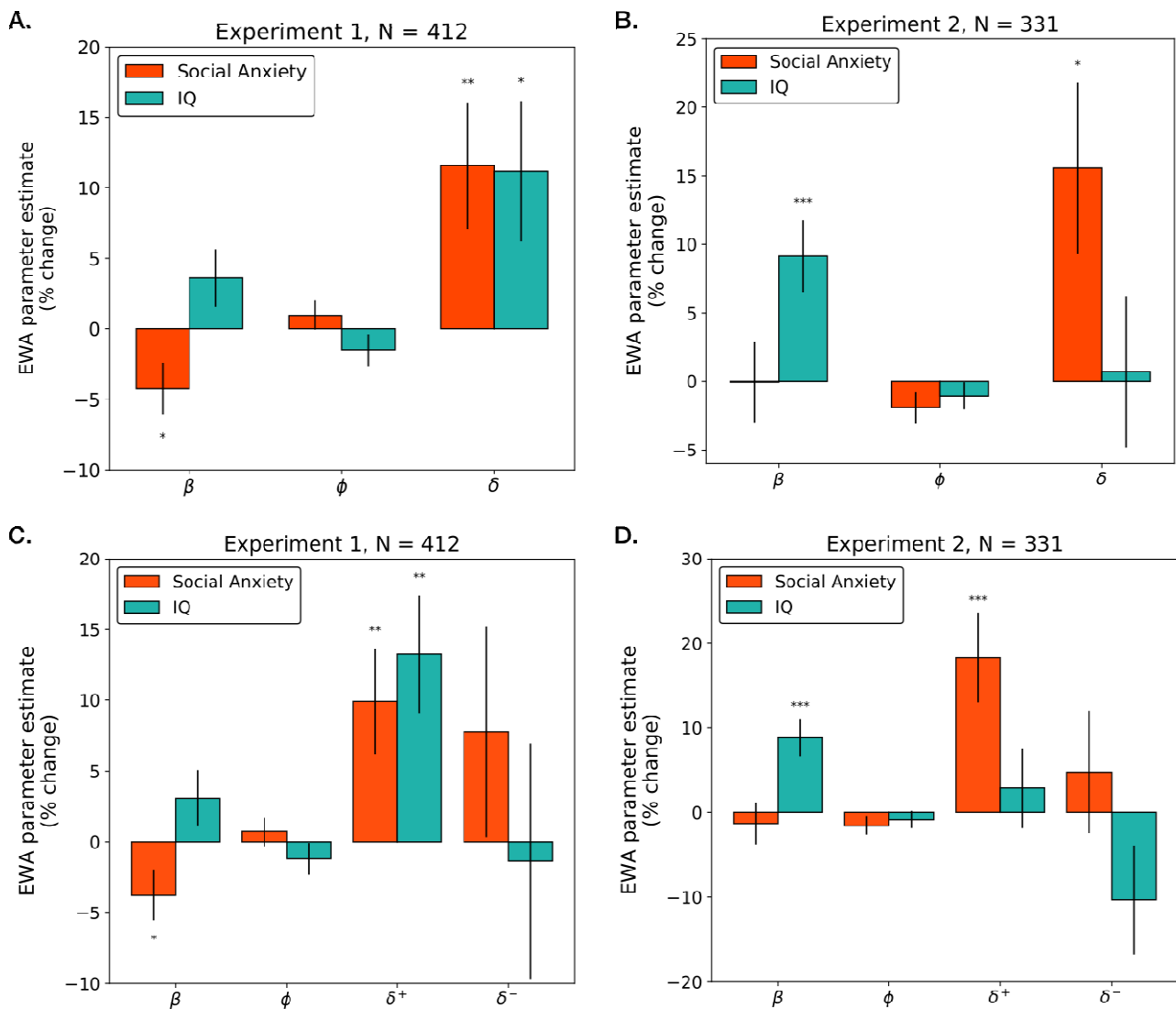
SI Figure 4: Projected IQ scores for Experiments 1 (left) and Experiment 2 (right) based on subjects' responses to the 9-item abbreviated version of the Raven's Standard Progressive Matrices (RSPM).



SI Figure 5: Item loadings for (trans-diagnostic) psychiatric factors derived from data in Gillan et al., (2016), ($N=1413$) (left panel) and Experiment 2, ($N=331$) (right panel). Factor analysis on the correlation matrix of 209 questionnaire items suggested that 3-factor solution best explained these data. Factors were ‘Anxious-Depression’, ‘Compulsive Behavior and Intrusive Thought’ and ‘Social Withdrawal’. Item loadings for each factor are indicated by the height of the vertical bars for each respective item (bars extending downwards indicate negative loadings). For convenience, item bars are grouped by questionnaire along each factor’s horizontal axis. the color-code (bottom) specifies the questionnaire from which each item was drawn: AES (Apathy Evaluation Scale), AUDIT (Alcohol Use Disorders Identification Test), BIS (Barratt Impulsiveness Scale 11), EAT (Eating Attitudes Test), LSAS (Liebowitz Social Anxiety Scale), OCI (Obsessive-Compulsive Inventory-Revised [OCI-R]), SCZ ((Short Scales for Measuring Schizotypy), SDS (Zung Self-Rating Depression Scale), STAI (State Trait Anxiety Inventory). As implied by the shared resemblance of the left and right panels, the factor loadings derived from the two datasets were highly correlated: Factor 1: $R = .94$, $p < 1e-96$; Factor 2: $R = .91$, $p < 1e-79$; Factor 3: $R = .91$, $p < 1e-80$).



SI Figure 6: Correlation matrices of 209 questionnaire items based on data in Gillan et al., (2016), ($N = 1413$) (left) and Experiment 2, ($N = 331$) (right). Factor analysis indicated that these data were best explained by 3-factors: ‘Anxious-Depression’, ‘Compulsive Behavior and Intrusive Thought’ and ‘Social Withdrawal’. Items are grouped by questionnaire (indicated by the color-code) and the individual item loadings for each factor for are presented on the top, left and bottom sides of the correlation matrix.



SI Figure 7: Percent change in EWA parameters as a function of social anxiety (LSAS) and IQ (Abbreviated 9-item Raven’s Matrices) for subjects from Experiment 1 (A, C; N=412) and Experiment 2 (B, D; N = 331). The y-axes indicate the % change in the dependent variable (i.e., β , ρ) for each change of 1 standard deviation (SD) in the predictor (i.e., LSAS or IQ) and error bars indicate standard error. The upper and lower panels depict parameters estimated according to the standard EWA model (A. and B.) and the valenced EWA model (C. and D.) respectively.