

Supplementary Table S1. 123 cognitive terms from the Cognitive Atlas used in Neurosynth database.

Term list			
action	emotion regulation	judgment	reinforcement learning
adaptation	empathy	knowledge	response inhibition
addiction	encoding	language	response selection
anticipation	episodic memory	language comprehension	retention
anxiety	expectancy	learning	retrieval
arousal	expertise	listening	reward anticipation
association	extinction	localization	rhythm
attention	face recognition	loss	risk
autobiographical memory	facial expression	maintenance	rule
balance	familiarity	manipulation	salience
belief	fear	meaning	search
categorization	fixation	memory	selective attention
cognitive control	focus	memory retrieval	semantic memory
communication	gaze	mental imagery	sentence comprehension
competition	goal	monitoring	skill
concept	hyperactivity	mood	sleep
consciousness	imagery	morphology	social cognition
consolidation	impulsivity	motor control	spatial attention
context	induction	movement	speech perception
coordination	inference	multisensory	speech production
decision	inhibition	naming	strategy
decision making	insight	navigation	strength
detection	integration	object recognition	stress
discrimination	intelligence	pain	sustained attention
distraction	intention	perception	task difficulty
eating	interference	planning	thought
efficiency		priming	uncertainty
effort		psychosis	updating
emotion		reading	utility
		reasoning	valence
		recall	verbal fluency
		recognition	visual attention
		rehearsal	visual perception
			word recognition
			working memory

Supplementary Table S2. Linear mixed-effect model analysis of cortical thickness across menstrual cycle phases relative to the oral contraceptive period.

Term	Coefficient	Standard error	z	p-value	95% confidence interval
Intercept	2.631	0.028	94.033	< 0.001	[2.576, 2.686]
Phase [Follicular]	0.004	0.001	3.217	0.001	[0.001, 0.006]
Phase [Luteal]	0.014	0.001	12.838	< 0.001	[0.011, 0.016]
Phase [Ovulatory]	0.005	0.002	2.603	0.009	[0.001, 0.009]
Group variance	0.078	0.336			

Supplementary Table S3. Repeated measures ANOVA of inbound and outbound energy across 123 cognitive states by menstrual phase.

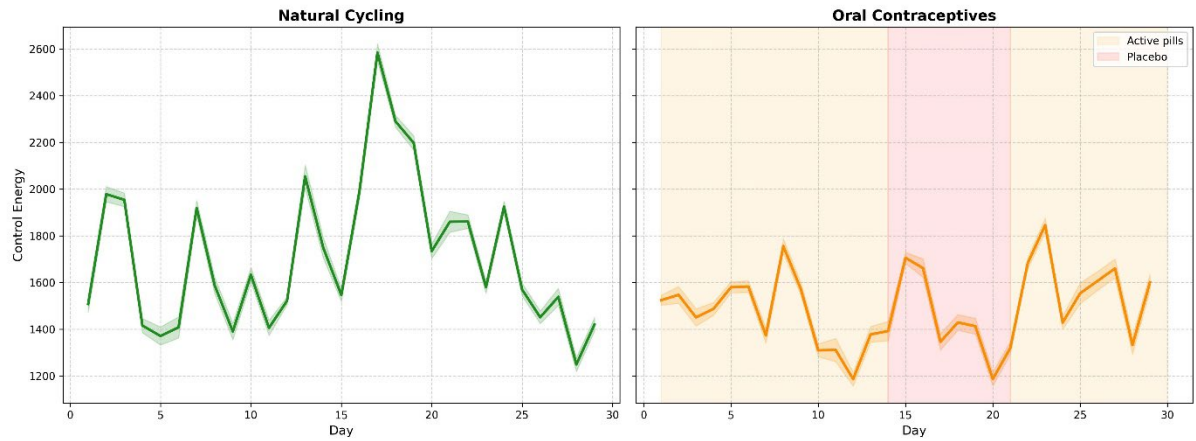
Cognitive state	F statistics (Inbound)	<i>p</i> -value (Inbound)	F statistics (Outbound)	<i>p</i> -value (Outbound)	FDR-adjusted <i>p</i> -value (Inbound)	FDR-adjusted <i>p</i> -value (Outbound)
action	3.233	0.049	2.416	0.102	0.320	0.761
adaptation	0.399	0.673	0.100	0.905	0.820	0.995
addiction	0.022	0.978	1.408	0.256	0.991	0.905
anticipation	1.312	0.280	0.324	0.725	0.536	0.995
anxiety	2.999	0.061	1.823	0.174	0.320	0.823
arousal	1.280	0.289	0.581	0.564	0.536	0.995
association	2.344	0.108	0.066	0.936	0.343	0.995
attention	1.252	0.297	2.194	0.124	0.536	0.761
autobiographical memory	3.980	0.026	0.220	0.803	0.320	0.995
balance	4.826	0.013	1.135	0.331	0.266	0.905
belief	0.339	0.715	0.205	0.816	0.845	0.995
categorization	0.231	0.795	0.118	0.889	0.881	0.995
cognitive control	0.952	0.394	0.484	0.619	0.629	0.995
communication	0.630	0.537	0.003	0.997	0.726	0.997
competition	1.551	0.224	1.153	0.325	0.466	0.905
concept	0.180	0.836	0.030	0.970	0.918	0.995
consciousness	0.881	0.422	0.107	0.899	0.659	0.995
consolidation	2.537	0.091	0.201	0.819	0.340	0.995
context	3.230	0.049	1.989	0.149	0.320	0.781
coordination	3.345	0.045	3.297	0.047	0.320	0.692
decision	1.060	0.356	0.810	0.452	0.599	0.995
decision making	1.384	0.262	1.588	0.216	0.511	0.905
detection	1.821	0.174	0.122	0.886	0.397	0.995
discrimination	2.307	0.112	0.404	0.670	0.343	0.995
distraction	1.263	0.293	0.264	0.769	0.536	0.995
eating	0.754	0.477	1.436	0.249	0.679	0.905
efficiency	4.057	0.024	1.154	0.325	0.320	0.905
effort	4.862	0.013	0.037	0.964	0.266	0.995
emotion	0.015	0.985	0.349	0.707	0.991	0.995
emotion regulation	0.108	0.898	0.019	0.981	0.947	0.995
empathy	1.133	0.332	0.072	0.931	0.575	0.995
encoding	1.985	0.150	3.045	0.058	0.364	0.692
episodic memory	2.035	0.143	0.152	0.860	0.364	0.995
expectancy	2.908	0.066	0.087	0.916	0.320	0.995
expertise	0.745	0.481	2.685	0.080	0.679	0.702
extinction	0.292	0.748	0.450	0.641	0.869	0.995
face recognition	2.714	0.078	4.843	0.013	0.320	0.692

facial expression	0.734	0.486	1.474	0.241	0.679	0.905
familiarity	2.292	0.114	2.153	0.129	0.343	0.761
fear	0.835	0.441	1.224	0.304	0.661	0.905
fixation	0.750	0.478	1.710	0.193	0.679	0.866
focus	5.415	0.008	0.133	0.876	0.266	0.995
gaze	0.239	0.789	0.329	0.721	0.881	0.995
goal	1.271	0.291	1.976	0.151	0.536	0.781
hyperactivity	0.380	0.686	2.516	0.093	0.828	0.761
imagery	2.827	0.070	3.811	0.030	0.320	0.692
impulsivity	0.272	0.763	0.771	0.469	0.869	0.995
induction	2.733	0.077	0.591	0.558	0.320	0.995
inference	1.040	0.362	0.030	0.971	0.602	0.995
inhibition	4.504	0.017	0.665	0.519	0.289	0.995
insight	0.134	0.875	0.047	0.954	0.936	0.995
integration	0.009	0.991	0.179	0.837	0.991	0.995
intelligence	1.576	0.219	0.926	0.404	0.464	0.995
intention	2.966	0.062	0.226	0.799	0.320	0.995
interference	2.237	0.119	1.147	0.327	0.343	0.905
judgment	1.212	0.308	0.022	0.978	0.547	0.995
knowledge	3.072	0.057	0.337	0.716	0.320	0.995
language	2.414	0.102	0.084	0.919	0.343	0.995
language comprehension	5.434	0.008	0.069	0.933	0.266	0.995
learning	2.015	0.146	0.283	0.755	0.364	0.995
listening	0.091	0.914	0.199	0.820	0.952	0.995
localization	0.148	0.863	0.033	0.968	0.931	0.995
loss	0.675	0.515	0.346	0.709	0.703	0.995
maintenance	0.414	0.664	1.274	0.290	0.820	0.905
manipulation	3.089	0.056	1.236	0.301	0.320	0.905
meaning	3.173	0.052	0.824	0.446	0.320	0.995
memory	1.199	0.312	0.014	0.986	0.547	0.995
memory retrieval	2.358	0.107	0.050	0.952	0.343	0.995
mental imagery	0.504	0.607	0.954	0.393	0.778	0.995
monitoring	0.339	0.714	0.485	0.619	0.845	0.995
mood	1.494	0.236	1.969	0.152	0.476	0.781
morphology	0.410	0.666	1.339	0.273	0.820	0.905
motor control	1.766	0.183	2.171	0.127	0.403	0.761
movement	1.980	0.151	2.685	0.080	0.364	0.702
multisensory	3.112	0.055	0.201	0.819	0.320	0.995
naming	1.642	0.206	1.295	0.285	0.444	0.905
navigation	1.412	0.255	0.041	0.960	0.506	0.995
object recognition	2.181	0.126	3.739	0.032	0.343	0.692

pain	2.077	0.138	0.254	0.777	0.361	0.995
perception	0.971	0.387	1.689	0.197	0.627	0.866
planning	2.543	0.091	3.082	0.056	0.340	0.692
priming	0.105	0.900	0.061	0.941	0.947	0.995
psychosis	0.250	0.780	0.023	0.978	0.880	0.995
reading	1.791	0.179	3.204	0.051	0.401	0.692
reasoning	1.821	0.174	0.113	0.893	0.397	0.995
recall	2.087	0.137	0.404	0.670	0.361	0.995
recognition	2.711	0.078	3.759	0.031	0.320	0.692
rehearsal	1.019	0.370	1.543	0.226	0.606	0.905
reinforcement learning	2.245	0.118	0.722	0.492	0.343	0.995
response inhibition	5.508	0.008	0.141	0.869	0.266	0.995
response selection	3.383	0.043	0.782	0.464	0.320	0.995
retention	0.546	0.583	0.265	0.768	0.771	0.995
retrieval	2.871	0.068	0.641	0.532	0.320	0.995
reward anticipation	0.871	0.426	0.898	0.415	0.659	0.995
rhythm	3.190	0.051	2.877	0.067	0.320	0.692
risk	0.447	0.642	0.531	0.592	0.815	0.995
rule	0.516	0.601	1.235	0.301	0.778	0.905
salience	0.279	0.758	0.360	0.700	0.869	0.995
search	0.800	0.456	0.453	0.639	0.668	0.995
selective attention	3.576	0.037	3.134	0.054	0.320	0.692
semantic memory	4.376	0.019	2.143	0.130	0.289	0.761
sentence comprehension	2.356	0.107	0.020	0.980	0.343	0.995
skill	2.465	0.097	2.164	0.127	0.343	0.761
sleep	2.200	0.123	0.108	0.898	0.343	0.995
social cognition	3.403	0.043	0.097	0.908	0.320	0.995
spatial attention	2.182	0.125	1.916	0.160	0.343	0.787
speech perception	0.162	0.851	0.255	0.776	0.926	0.995
speech production	1.077	0.350	0.196	0.822	0.597	0.995
strategy	0.520	0.599	0.095	0.909	0.778	0.995
strength	0.045	0.956	1.361	0.267	0.989	0.905
stress	0.021	0.979	0.799	0.456	0.991	0.995
sustained attention	0.857	0.432	0.206	0.815	0.659	0.995
task difficulty	0.274	0.762	0.703	0.501	0.869	0.995
thought	4.926	0.012	0.262	0.771	0.266	0.995
uncertainty	1.908	0.161	0.419	0.661	0.381	0.995
updating	2.999	0.061	0.745	0.481	0.320	0.995
utility	0.714	0.496	4.906	0.012	0.685	0.692
valence	1.535	0.227	0.756	0.476	0.466	0.995
verbal fluency	0.852	0.434	0.374	0.690	0.659	0.995

visual attention	2.601	0.086	0.873	0.425	0.340	0.995
visual perception	0.567	0.572	2.913	0.065	0.764	0.692
word recognition	0.402	0.671	1.177	0.318	0.820	0.905
working memory	0.805	0.454	0.914	0.409	0.668	0.995

Supplementary Figure S1. Comparison of control energy trajectories between natural and OC cycles. Left: The control energy trajectory during a complete 30-day natural menstrual cycle. Right: The control energy trajectory during the 30-day OC cycle. The shaded background indicates the 23-day active pill intake period and the 7-day placebo period. (Note: Trajectories represent the model derived from Group C/cortical thickness-weighted).



Supplementary Figure S2. Mean transition energy and subject-wise energy distribution across cognitive states. (A) Comparison of mean inbound and outbound transition energy for 123 meta-analytic cognitive states (between the follicular and luteal phases). (B) Heatmap of energy distribution across the 22 subjects (from the HHS dataset) and cognitive states.

