

Figure S1. Patient flow chart

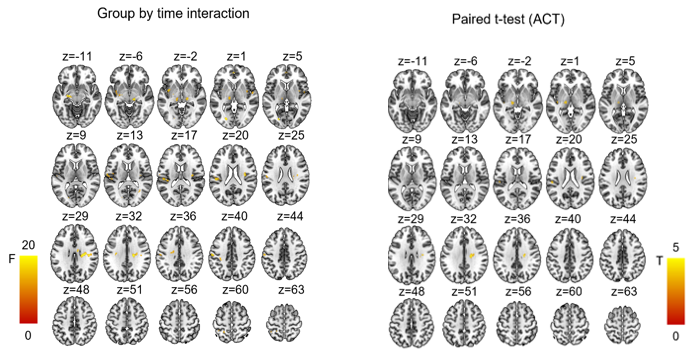


Figure S2. Results of negative statement/neutral person (NS/NP) condition during the TAF induction task (uncorrected p < 0.001)

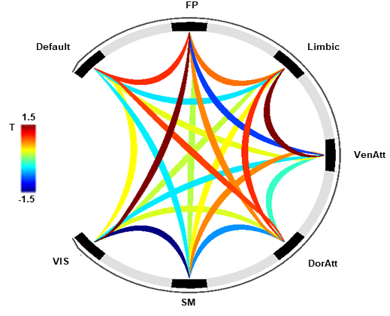


Figure S3. Changes of connectivity among large-scale networks between pre- and post-treatment using paired t-test within the ACT group (unthresholded results). VIS: Visual network, SM: Somatomotor network, DorAtt: Dorsal attention network, VenAtt: Ventral attention network, FP: Frontoparietal control network.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table S1. Change in symptom and process measures between pre- and post-treatment (mean±S.D.) | | | | | | | | | | | | |
|  |  | ACT (N=21) | |  | WLC (N=21) | |  | Paired-t test | |  | Independent t-test | |
|  | Prea | Postb |  | Prec | Postd |  | *t*a-b | *t*c-d |  | *t*a-c | *t*b-d |
| Symptom measure | |  |  |  |  |  |  |  |  |  |  |  |
|  | Y-BOCS | 22.5±7.0 | 18.4±7.7 |  | 23.5±6.8 | 23.8±7.1 |  | 3.9\*\*\* | -0.2 |  | -0.5 | ­2.4\* |
|  | OCI-R | 25.7±12.1 | 20.5±11.3 |  | 26.7±12.7 | 27.0±13.6 |  | 3.7\*\* | -0.3 |  | -0.3 | -1.7 |
|  | BDI | 13.3±7.5 | 10.1±7.8 |  | 16.6±10.3 | 15.0±10.4 |  | 1.8 | 1.6 |  | -1.2 | -1.7 |
| Process measure | |  |  |  |  |  |  |  |  |  |  |  |
|  | AAQ-II | 34.3±9.8 | 30.5±12.5 |  | 33.1±10.0 | 35.0±9.7 |  | 2.0 | -1.4 |  | 0.4 | -1.3 |
|  | AAQ-OC | 59.6±17.0 | 43.6±19.9 |  | 53.0±17.3 | 62.1±11.4 |  | 4.0\*\*\* | ­2.3\* |  | 1.3 | ­3.7\*\*\* |
|  | CFQ | 34.9±9.3 | 28.7±10.7 |  | 30.7±11.4 | 33.1±10.0 |  | 3.5\*\* | -1.7 |  | 1.3 | -1.4 |
|  | TAFS | 27.4±17.2 | 19.2±14.1 |  | 25.4±20.0 | 25.5±19.6 |  | 2.4\* | -0.1 |  | 0.4 | -1.2 |
| \*p < .05, \*\* p < .005, \*\*\* p < .001 | | | | | | | | | | | | |
| ACT, acceptance-commitment therapy; WLC, wait-list control; Y-BOCS, Yale-Brown Obsessive-Compulsive Scale; OCI-R, Obsessive-Compulsive Inventory-Revised; BDI, Beck Depression Inventory; AAQ-II, -OC, Acceptance and Action Questionnaire-II, - for Obsessions and Compulsions; CFQ, Cognitive Fusion Questionnaire; TAFS, Thought-Action Fusion Scale | | | | | | | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Table S2. Regions of interest across different analytic methods (group by time interactiona) | | | | | | |
| Analytic method | Brain region | Cluster size | MNI coordinates | | | Peak F |
| x | y | z |
| TAF-induced BOLD signal changes | Insula, left | 98 | -44 | -4 | 14 | 35.11 |
| Insula, right | 21 | 36 | -16 | 20 | 24.5 |
| Superior temporal gyrus, left | 87 | -60 | -14 | 12 | 25.35 |
| Superior temporal gyrus, right | 19 | 58 | -2 | -2 | 26.29 |
| Middle cingulate cortex, right | 19 | 8 | -8 | 26 | 22.37 |
| Inferior frontal gyrus, right | 16 | 52 | 16 | 26 | 19.38 |
| Hippocampus, left | 15 | -24 | -14 | -10 | 21.3 |
| PPI (seed: left insula) | Inferior frontal gyrus, left | 104 | -40 | 16 | 28 | 16.95 |
| Inferior frontal gyrus, right | 100 | 34 | 16 | 28 | 26.15 |
| Middle frontal gyrus, right | 108 | 54 | 22 | 32 | 27.12 |
| ICA of resting state fMRI data | Posterior cingulate gyrus, left | 198 | -4 | -66 | 14 | 19.75 |
| Posterior cingulate gyrus, right | 213 | 8 | -56 | 12 | 18.35 |
| Precuneus, bilateral | 33 | -2 | -66 | 16 | 17.94 |
| Lingual gyrus, left | 27 | -6 | -52 | 2 | 20.73 |
| a pre- and post-treatment x ACT and WLC | | | | | | |
| P < 0.05, FDR corrected for multiple comparisons and minimum cluster size of 10 | | | | | | |
| ACT, acceptance commitment therapy; WLC, waiting list controls; MNI, Montreal Neurological Institute; TAF, thought-action fusion; BOLD, blood oxygen level dependent; PPI, psycho-physiological interaction; ICA, independent component analysis | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Table S3. Regions of interest across different analytic methods within the ACT group (post- minus pre-treatment) | | | | | | |
| Analytic method | Brain region | Cluster size | MNI coordinates | | | Peak T |
| x | y | z |
| TAF-induced BOLD signal changes | Insula, left | 150 | -46 | -4 | 14 | 5.28 |
| Insula, right | 106 | 36 | -16 | 20 | 8.18 |
| Superior temporal gyrus, left | 39 | -64 | -24 | 12 | 4.90 |
| Superior temporal gyrus, right | 32 | 58 | -4 | -2 | 6.14 |
| PPI (seed: left insula) | Inferior frontal gyrus, left | 100 | -40 | 16 | 24 | 4.37 |
| ICA of resting state fMRI data | Posterior cingulate gyrus, left | 184 | -6 | -58 | 4 | 6.55 |
| Posterior cingulate gyrus, right | 56 | 4 | -62 | 14 | 5.00 |
| Precuneus, bilateral | 40 | -4 | -68 | 16 | 4.86 |
| Lingual gyrus, left | 140 | -2 | -60 | 4 | 5.11 |
| Middle temporal gyrus, left | 56 | -56 | -8 | -8 | 5.10 |
| Middle temporal gyrus, right | 75 | 64 | -6 | -8 | 6.90 |
| ACT, acceptance commitment therapy; MNI, Montreal Neurological Institute; TAF, thought-action fusion; BOLD, blood oxygen level-dependent; PPI, psycho-physiological interaction; ICA, independent component analysis | | | | | | |
| P < 0.05, FDR corrected for multiple comparisons and minimum cluster size of 10 | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Table S4. Selected regions of interest across different analytic methods within the ACT groupa | | | | | | |
| Analytic method | Brain region | Cluster size | MNI coordinates | | | Peak T |
| x | y | z |
| TAF-induced BOLD signal changes | Insula, left | 150 | -46 | -4 | 14 | 5.28 |
| Insula, right | 106 | 36 | -16 | 20 | 8.18 |
| Superior temporal gyrus, left | 39 | -64 | -24 | 12 | 4.90 |
| Superior temporal gyrus, right | 32 | 56 | 4 | 2 | 6.14 |
| PPI  (seed: left insula) | Inferior frontal gyrus, left | 100 | -40 | 16 | 24 | 4.37 |
| ICA of resting state fMRI data | Posterior cingulate gyrus, left | 184 | -6 | -58 | 4 | 6.55 |
| Posterior cingulate gyrus, right | 56 | 4 | -62 | 14 | 5.00 |
| Precuneus, bilateral | 40 | -4 | -68 | 16 | 4.86 |
| Lingual gyrus, left | 140 | -2 | -60 | 4 | 5.11 |
| a regions were significant both in paired t-test between pre- and post-treatment and in group-by-time interaction | | | | | | |
| P < 0.05, FDR corrected for multiple comparisons and minimum cluster size of 10 | | | | | | |
| ACT, acceptance commitment therapy; MNI, Montreal Neurological Institute; TAF, thought-action fusion; BOLD, blood oxygen level-dependent; PPI, psycho-physiological interaction; ICA, independent component analysis | | | | | | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table S5. Correlations between changes in brain activity or connectivity and psychological measures across the entire participants | | | | | | | | | | | | | | |
|  |  | YBOCS | | OCI-R | | | AAQ-II | | | AAQ-OC | CFQ | | TAFS | |
| **Brain activity during TAF** | | | | | | | | | | | | | | |
| Left insula | *r* | -0.30 | | -0.29 | | | -0.22 | | | -0.31 | -0.35 | | -0.35 | |
| *p-uncorr* | 0.077 | | 0.083 | | | 0.185 | | | 0.069 | **0.034** | | **0.037**a | |
| *p-FDR* | 0.231 | | 0.221 | | | 0.247 | | | 0.185 | 0.204 | | 0.185 | |
| Right insula | *r* | -0.29 | | -0.37 | | | -0.06 | | | -0.28 | -0.18 | | -0.33 | |
| *p-uncorr* | 0.085 | | **0.024** | | | 0.713 | | | 0.105 | 0.279 | | 0.051 | |
| *p-FDR* | 0.185 | | 0.288 | | | 0.713 | | | 0.193 | 0.335 | | 0.185 | |
| Left STG | *r* | -0.23 | | -0.24 | | | -0.08 | | | -0.12 | -0.23 | | -0.25 | |
| *p-uncorr* | 0.163 | | 0.158 | | | 0.641 | | | 0.503 | 0.164 | | 0.143 | |
| *p-FDR* | 0.261 | | 0.271 | | | 0.399 | | | 0.574 | 0.246 | | 0.231 | |
| Right STG | *r* | -0.23 | | -0.29 | | | -0.07 | | | -0.30 | -0.44 | | -0.28 | |
| *p-uncorr* | 0.178 | | 0.083 | | | 0.670 | | | 0.078 | **0.007** | | 0.094 | |
| *p-FDR* | 0.251 | | 0.199 | | | 0.699 | | | 0.185 | 0.168 | | 0.188 | |
| **Brain connectivity during TAF** | | | | | | | | | | | | | | |
| Left insula – left IFG interaction | *r* | -0.28 | | | -0.22 | | | -0.25 | -0.31 | | | -0.38 | | 0.00 |
| *p-uncorr* | 0.093 | | | 0.196 | | | 0.130 | 0.068 | | | **0.022** a | | 0.989 |
| *p-FDR* | 0.186 | | | 0.235 | | | 0.195 | 0.186 | | | 0.132 | | 0.989 |
| **Resting-state brain connectivity** | | | | | | | | | | | | | | |
| Left PCG | *r* | -0.17 | -0.16 | | | -0.09 | | | -0.44 | | | -0.25 | | -0.24 |
| *p-uncorr* | 0.295 | 0.319 | | | 0.572 | | | **0.005** | | | 0.113 | | 0.132 |
| *p-FDR* | 0.354 | 0.333 | | | 0.572 | | | **0.040** | | | 0.247 | | 0.243 |
| Right PCG | *r* | -0.25 | -0.20 | | | -0.19 | | | -0.47 | | | -0.32 | | -0.20 |
| *p-uncorr* | 0.112 | 0.217 | | | 0.238 | | | **0.002** | | | **0.040** | | 0.221 |
| *p-FDR* | 0.269 | 0.306 | | | 0.317 | | | **0.024** | | | 0.192 | | 0.312 |
| Bilateral precuneus | *r* | -0.26 | -0.16 | | | -0.22 | | | -0.33 | | | -0.25 | | -0.28 |
| *p-uncorr* | 0.105 | 0.307 | | | 0.170 | | | **0.038** a | | | 0.122 | | 0.086 |
| *p-FDR* | 0.280 | 0.351 | | | 0.272 | | | 0.192 | | | 0.225 | | 0.243 |
| Left lingual gyrus | *r* | -0.18 | -0.21 | | | -0.16 | | | -0.51 | | | -0.29 | | -0.26 |
| *p-uncorr* | 0.267 | 0.190 | | | 0.307 | | | **< 0.001** | | | 0.071 | | 0.111 |
| *p-FDR* | 0.337 | 0.285 | | | 0.335 | | | **< 0.001** | | | 0.243 | | 0.243 |
| For the YBOCS, OCI-R, AAQ-II and CFQ, *r* represents Pearson's correlation coefficients; for the AAQ-OC and TAFS, *r* does Spearman’s coefficients after removing an outlier in a given scale.  Bold-face p-values indicate significance level <.05  a Statistical significance disappeared after controlling the additional baseline scores. | | | | | | | | | | | | | | |
| Y-BOCS, Yale-Brown Obsessive-Compulsive Scale; OCI-R, Obsessive-Compulsive Inventory-Revised; AAQ-II, -OC, Acceptance and Action Questionnaire-II, -for Obsessions and Compulsions; CFQ, Cognitive Fusion Questionnaire; TAFS, Thought-Action Fusion Scale; STG, superior temporal gyrus; ; IFG, inferior frontal gyrus; PCG, posterior cingulate gyrus; FDR, false discovery rate | | | | | | | | | | | | | | |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table S6. Correlations between changes in brain activity or connectivity and psychological measures within the ACT group | | | | | | | | | |
|  |  | YBOCS | OCI-R | AAQ-II | AAQ-OC | CFQ | | TAFS | |
| **Brain activity during TAF** | | | | | | | | | |
| Left insula | *r* | 0.19 | -0.21 | -0.05 | 0.46 | 0.32 | | 0.25 | |
| *P* | 0.446 | 0.395 | 0.837 | 0.058 | 0.204 | | 0.339 | |
| Right insula | *r* | -0.03 | -0.16 | -0.03 | 0.01 | 0.16 | | 0.24 | |
| *p* | 0.914 | 0.535 | 0.914 | 0.980 | 0.527 | | 0.348 | |
| Left STG | *r* | -0.05 | -0.03 | 0.14 | 0.14 | 0.32 | | 0.01 | |
| *p* | 0.831 | 0.908 | 0.569 | 0.588 | 0.198 | | 0.979 | |
| Right STG | *r* | -0.15 | 0.07 | 0.17 | -0.13 | -0.03 | | 0.52 | |
| *p* | 0.549 | 0.795 | 0.495 | 0.607 | 0.900 | | 0.842 | |
| **Brain connectivity during TAF** | | | | | | | | | | |
| Left insula – left IFG interaction | *r* | -0.04 | 0.06 | 0.14 | 0.20 | | 0.01 | | 0.47 |
| *p* | 0.877 | 0.804 | 0.582 | 0.421 | | 0.976 | | 0.058 |
| **Resting-state brain connectivity** | | | | | | | | | | |
| Left PCG | *r* | 0.13 | -0.17 | 0.22 | -0.28 | | -0.02 | | 0.13 |
| *p* | 0.582 | 0.466 | 0.353 | 0.229 | | 0.939 | | 0.593 |
| Right PCG | *r* | 0.02 | -0.06 | 0.09 | -0.37 | | -0.24 | | 0.20 |
| *p* | 0.931 | 0.813 | 0.700 | 0.106 | | 0.319 | | 0.424 |
| Bilateral precuneus | *r* | 0.19 | -0.18 | -0.11 | 0.06 | | -0.07 | | 0.10 |
| *p* | 0.414 | 0.452 | 0.645 | 0.799 | | 0.773 | | 0.698 |
| Left lingual gyrus | *r* | 0.13 | -0.20 | 0.12 | -0.27 | | -0.12 | | 0.16 |
| *p* | 0.581 | 0.387 | 0.603 | 0.246 | | 0.610 | | 0.503 |
| *r* represents Pearson's correlation coefficients | | | | | | | | | |
| Y-BOCS, Yale-Brown Obsessive-Compulsive Scale; OCI-R, Obsessive-Compulsive Inventory-Revised; AAQ-II, -OC, Acceptance and Action Questionnaire-II, -for Obsessions and Compulsions; CFQ, Cognitive Fusion Questionnaire; TAFS, Thought-Action Fusion Scale; STG, superior temporal gyrus; IFG, inferior frontal gyrus; PCG, posterior cingulate gyrus | | | | | | | | | |