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Intensive reasoning training alters patterns of brain connectivity at rest

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Patterns of correlated activity among brain regions reflect functionally relevant networks that are widely assumed to be stable over time. We hypothesized that if these correlations reflect the prior history of co-activation of brain regions, then a marked shift in cognition could alter the strength of coupling between these regions. We sought to test whether intensive reasoning training in humans would result in tighter coupling among regions in the lateral fronto-parietal network, as measured with resting-state fMRI (rs-fMRI). Rather than designing an artificial training program, we studied individuals who were preparing for a standardized test that places heavy demands on relational reasoning, the Law School Admissions Test (LSAT). LSAT questions require test-takers to group or sequence items according to a set of complex rules. We recruited young adults who were enrolled in an LSAT course that offers 70 hours of reasoning instruction (n=25), and age- and IQ-matched controls intending to take the LSAT in the future (n=24). Rs-fMRI data were collected for all subjects during two scanning sessions separated by 90 days. An analysis of pairwise correlations between brain regions implicated in reasoning showed that fronto-parietal connections were strengthened, along with parietal-striatal connections. These findings provide strong evidence for neural plasticity at the level of large-scale networks supporting high-level cognition.