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## Presentation Abstract

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Title: Coherent spatio-temporal patterns during meditation

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Abstract: **Introduction:** We investigated spatial and temporal brain activity patterns during different phases of a meditation technique with a multi-session Independent Component Analysis (ICA). **Methods:** An experienced meditator (age 40/male) repeated the same four-stage meditation protocol during scans on five days. The stages were: (1) *breath-hold exercise*; (2) *concentration* on breathing; (3) *visual presentation*, he was shown the text of a verse (from his school) to meditate on; and (4) *aural presentation*, similar to (3) but the verse was presented as an audio recording by his instructor. The data were analyzed using a multi-session ICA algorithm (FSL; <http://www.fmrib.ox.ac.uk/fsl>). Multi-session ICA with temporal concatenation identified statistically independent spatial patterns that were common to all five scans. The ICA components were excluded if they were associated with either physiological noise or motion artifacts and if they were not consistently present in at least four of five sessions. **Results:** *Breath-hold exercise:* Components 1-3, consistently seen across all five sessions, show activity in areas of the brain stem, cerebellum and right superior posterior parietal area with a temporal pattern at the fundamental frequency of the breathing. *Concentration:* component 2 represented an increase in BOLD in the temporal tip and decrease in the right and left superior temporal lobe/insula area. Decrease in areas of mid and post cingulum were also seen. Component 3 is very similar to the resting state network previously reported in the literature. *Visual and aural presentations:* Similar areas showed consistent activity indicated by various independent components. The temporal areas of BA 21 and 22, middle and superior temporal gyrus were involved in five of the 10 components. Areas BA 45 and 46 and parietal area BA 39 were seen in

two other components. Possibly, the focus on remembered auditory stimulus might have emphasized these auditory circuits. Another component picked up activity in bilateral BA 11, bilateral BA 37 and bilateral BA 45 in the frontal lobes and also in BA 17-18 (visual areas).

**Discussion:** Coherent brain activity patterns were seen in auditory, visual and prefrontal areas in addition to the common neural circuits reported in resting state fMRI studies. As the meditator went into (subjectively reported) deeper states of meditation, increased complexity of brain activation patterns were seen that involved different brain circuitries.

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