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INDEPENDENT COMPONENT ANALYSIS OF EEG DATA.

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Because of the spread of electromagnetic signals through CSF and skull through volume conduction, EEG data recorded at different points on the scalp tend to be correlated. Bell and Sejnowski (1995) have recently presented an artificial neural network algorithm that identifies and separates statistically independent signals from a number of channels composed of linear mixtures of an equal number of sources. Here we present a first application of this Independent Component Analysis (ICA) algorithm to human EEG data. Conceptually, ICA filtering separates the problem of source identification in EEG data from the related problem of physical source localization. Three subjects performed a continuous auditory detection task in two half hour sessions. ICA filters trained on 14-channel EEG data collected during these sessions identified 14 statistically independent source channels which could then be further processed using event-related potential (ERP), event-related spectral perturbation (ERSP), and other signal processing techniques. One ICA source channel contained most eye movement activity, and another two collected line noise and muscle activity, while others were free of these artifacts. Changes in spectral power in several ICA channels covaried with changes in performance. If ICA sources can be shown to have distinct and consistent relationships to behavior or other physiological signals, ICA filtering may reveal meaningful aspects of event-related brain dynamics associated with sensory and cognitive processing but hidden within correlated EEG responses at individual scalp sites.