Performance on Real Data: Benchmark Algorithms

The AV data results for the benchmark algorithms are shown in Figures S1 to S3. The results from MVAB, in Figure S1, show that MVAB can localize auditory activity (Figure S1 (a) left) and a visual activation (Figure S1 (c)). The time courses for these sources, Figure S1 (b) and (d) (shown by the crosshairs), do not contain useful information. The results from SL/dSPM in Figure S2 demonstrate that SL/dSPM is able to localize a source in the left auditory cortex (Figure S2 (a)) and a visual activation (Figure S2 (e)). The peaks for the auditory and visual sources, Figure S2 (b) and (f), are around 100ms and 150ms respectively. SL/dSPM also localizes a large source along the midline in the precuneous (Figure S2 (c)), but this source has the same time course at the auditory source, see Figure S2 (d). The results from MCE are presented in Figure S3; these results show that MCE is able to localize bilateral auditory activations (Figure S3 (a), (c)) and some visual activity (Figure S3 (e)). The time courses for the auditory and visual sources are shown in Figure S3 (b), (d), and (f). These time courses look most similar to those estimated with Champagne and are able to provide a clear distinction between the auditory activity at 100ms and the visual activity around 150ms. As seen in the AEF results, the MCE algorithm favors voxels on the edge of the voxel grid. Often, MCE does not accurately localize cortical areas, but the activations seem to be over reasonable locations given the task.

The face processing results for the benchmark algorithms can be found in Figures S4 to S6. The results from MVAB are shown in Figure S4. MVAB fails to localize any activity of interest, rather it localizes one source close to the center of the head (Figure S4(a)) and does not estimate a meaningful time course (Figure S4 (b)). SL/dSPM was more successful on this data set (Figure S5). A visual source is localized (Figure S5 (a)) in addition to bilateral sources near to fusiform gyrus (Figure S5 (c) and (e)). The time course for the visual source (Figure S5 (b)) shows a peak at 100ms. The time courses for the sources in fusiform gyrus (Figure S5 (d),(f)) show peaks at 170ms, but the source on the left has a larger peak at 100ms. These time courses do not help to separate activity in the visual sources and fusiform gyrus as clearly as the time courses obtained from Champagne. SL/dSPM also localizes activity near the center of the head, which is not functionally relevant, as seen in Figure S5 (c) and (e). MCE is able to localize a visual source (Figure S6 (a)) with a time course (Figure S6 (b)) that has a peak around 100ms. It is also able to localize bilateral sources near fusiform gyrus, as seen in Figure S6 (c) and (e). The time courses for these sources, shown in Figure S6 (d) and (f), have peaks around 170ms, but the left fusiform source does not have its maximum at 170ms. Since these benchmark algorithms do not account for the pre-stimulus period in their generative models, we did not run the contrast data set.

The results shown in Figure S7 display the benchmark algorithm results on the EEG face data. MVAB (Figure S7 (a)) and SL/dSPM (Figure S7 (b)) are able to localize sources at the occipital pole, an early visual processing area. They are not able to localize distinct sources on the ventral surface, unlike the results from Champagne. They also find sources in other areas of the brain that are not functionally relevant. MCE is able to localize a visual source and a source on the left ventral surface of the occipital lobe, seen in Figure S7 (c). With the exception of these two sources, all the remaining voxels are pruned to zero with MCE. The time courses reflect the voxel time courses at each of the sources localized for the three benchmark algorithms (the time courses were the similar, if not the same, across all areas of the brain).

Figure S1: Results on audio-visual data for MVAB. MVAB localizes auditory activity on the left (a) and one source in a visual area (c). The time courses in (b) and (d) correspond to the crosshair locations in (a) and (c), respectively.

Figure S2: Results on audio-visual data for SL/dSPM. SL/dSPM localizes a source in left auditory cortex (a) and a source in visual cortex (e). SL/dSPM also localizes a source in the center of head that does not have functional significance (c). The time courses in (b), (d), and (f) correspond to the crosshair locations in (a), (c). and (e), respectively.

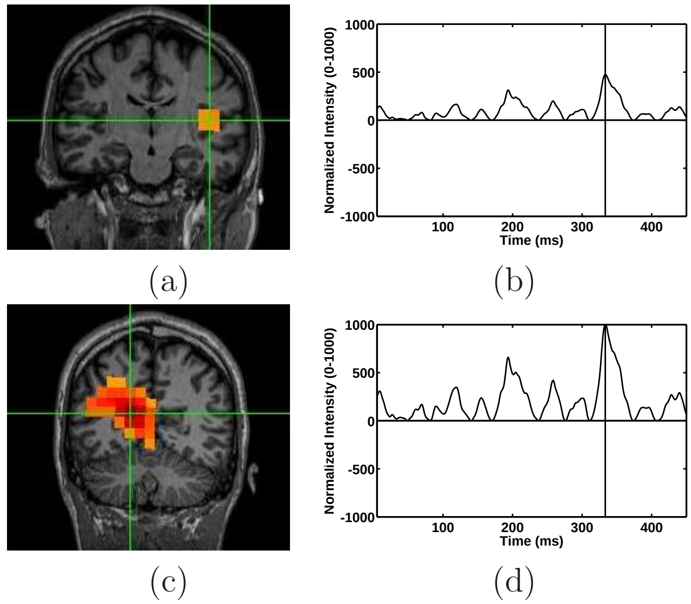
Figure S3: Results on audio-visual data for MCE. MCE localizes bilateral activity over auditory cortex (a) and a source over visual cortex (b,c). MCE favors the voxels on the edge of the voxel grid and does not successfully localize cortical areas, but does show activity above functionally significant areas.

Figure S4: Results on MEG face processing data for MVAB. MVAB localizes only one source near the center of the head, localization seen (a) and time course seen in (b).

Figure S5: Results on MEG face processing data for SL/dSPM. SL/dSPM is able to localize one source in a lateral visual area in middle occipital cortex (a), with the time course shown in (b). It is also able to localize bilateral activation in (or near) the fusiform gyrus (c,e), with time courses in (d,f).

Figure S6: Results on MEG face processing data for MCE. MCE is able to localize a visual source (a) and bilateral activity in the fusiform gyrus, (c) and (e). The time courses for these sources are shown in (b), (d) and (f).

Figure S7: Results on EEG face processing data for benchmark algorithms. MVAB (a) is able to localize visual areas in the occipital pole. SL/dSPM (b) is also able to localize occipital (visual) sources, particularly on the occipital pole. MCE (c) is able to localize two sources, one in left occipital cortex and one on the ventral surface of the brain. The time courses reflect the voxel time courses at each of the sources localized for the three benchmark algorithms (the time courses were the similar, if not the same, across all areas of the brain). For each algorithm, the occipital lobe is shown on left and the ventral surface of brain shown on the right, with right hemisphere on the right.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500
0
-500
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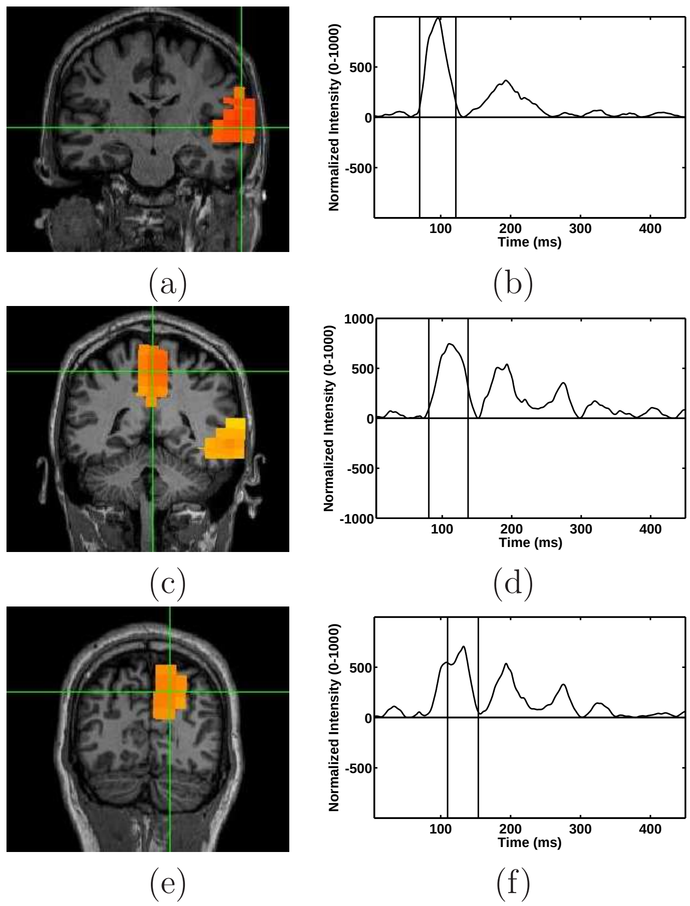
100
200
300
400
(a)
(b)
(c)
(d)

Figure S1


(a)
(b)
Normalized Intensity (0-1000)
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(c)
(d)
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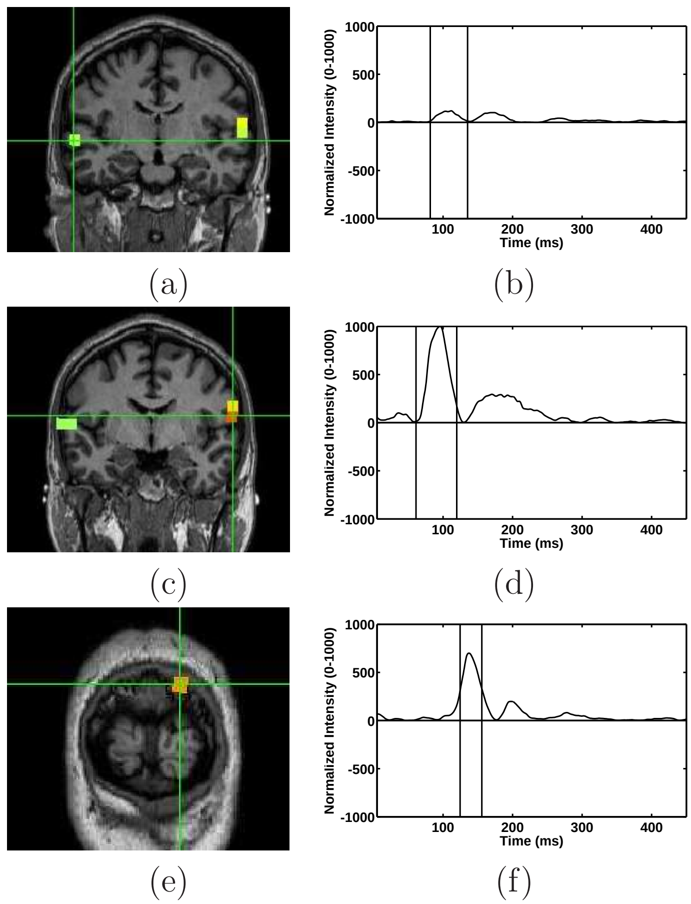
-1000
(e)
(f)

Figure S2


(a)
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Normalized Intensity (0-1000)
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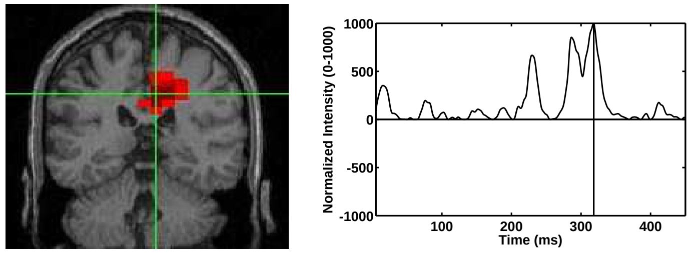
Figure S3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Normalized Intensity (0-1000)
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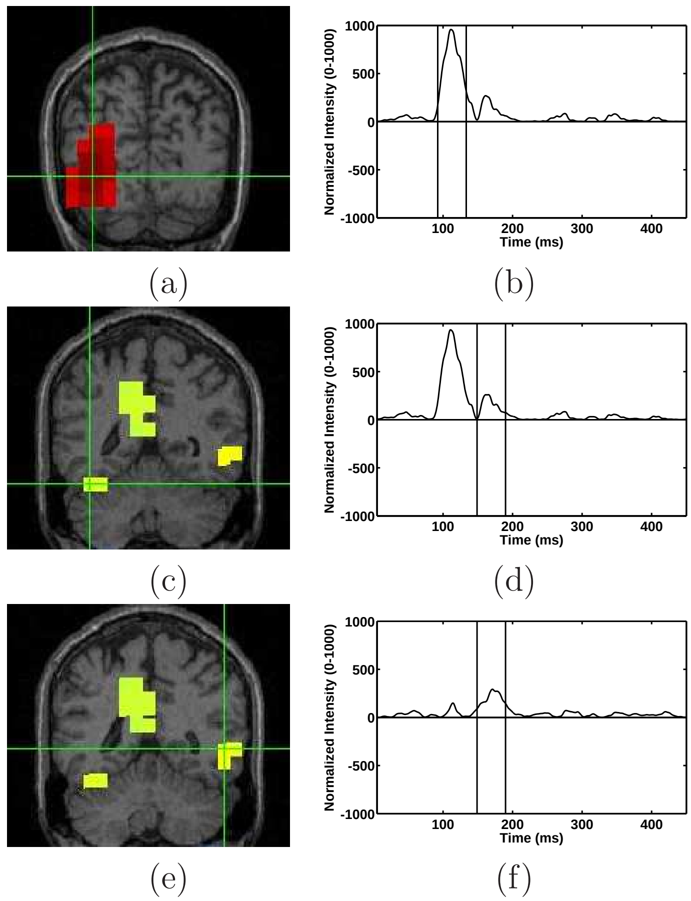
Time (ms)

(a) (b)

Figure S4


Normalized Intensity (0-1000)
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-500
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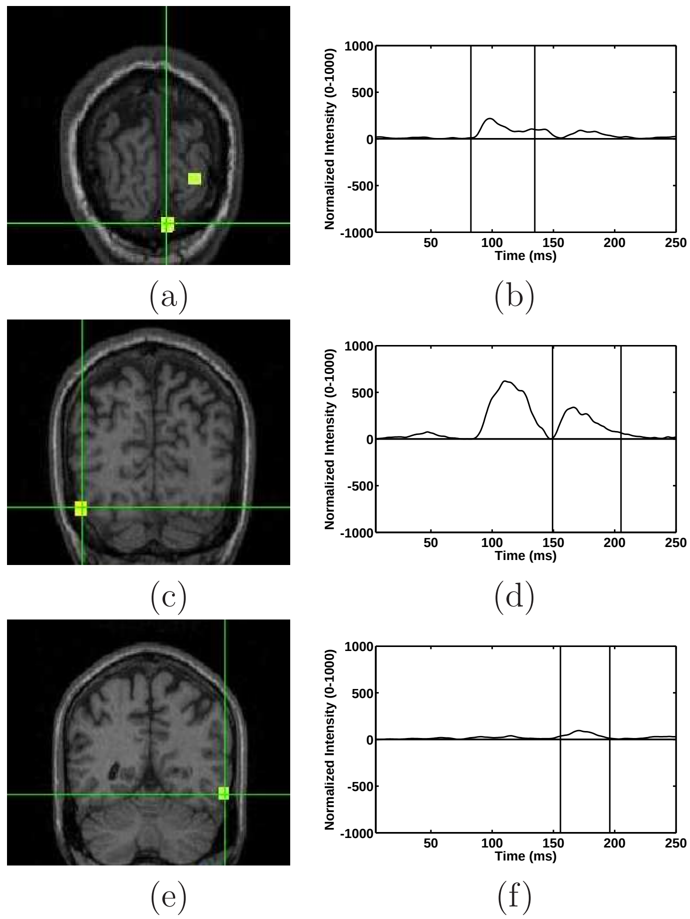
Time (ms)
(a)
(b)
(c)
(d)
(e)
(f)

Figure S5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150
200
250
Time (ms)
(a)
(b)
(c)
(d)
(e)
(f)

Figure S6

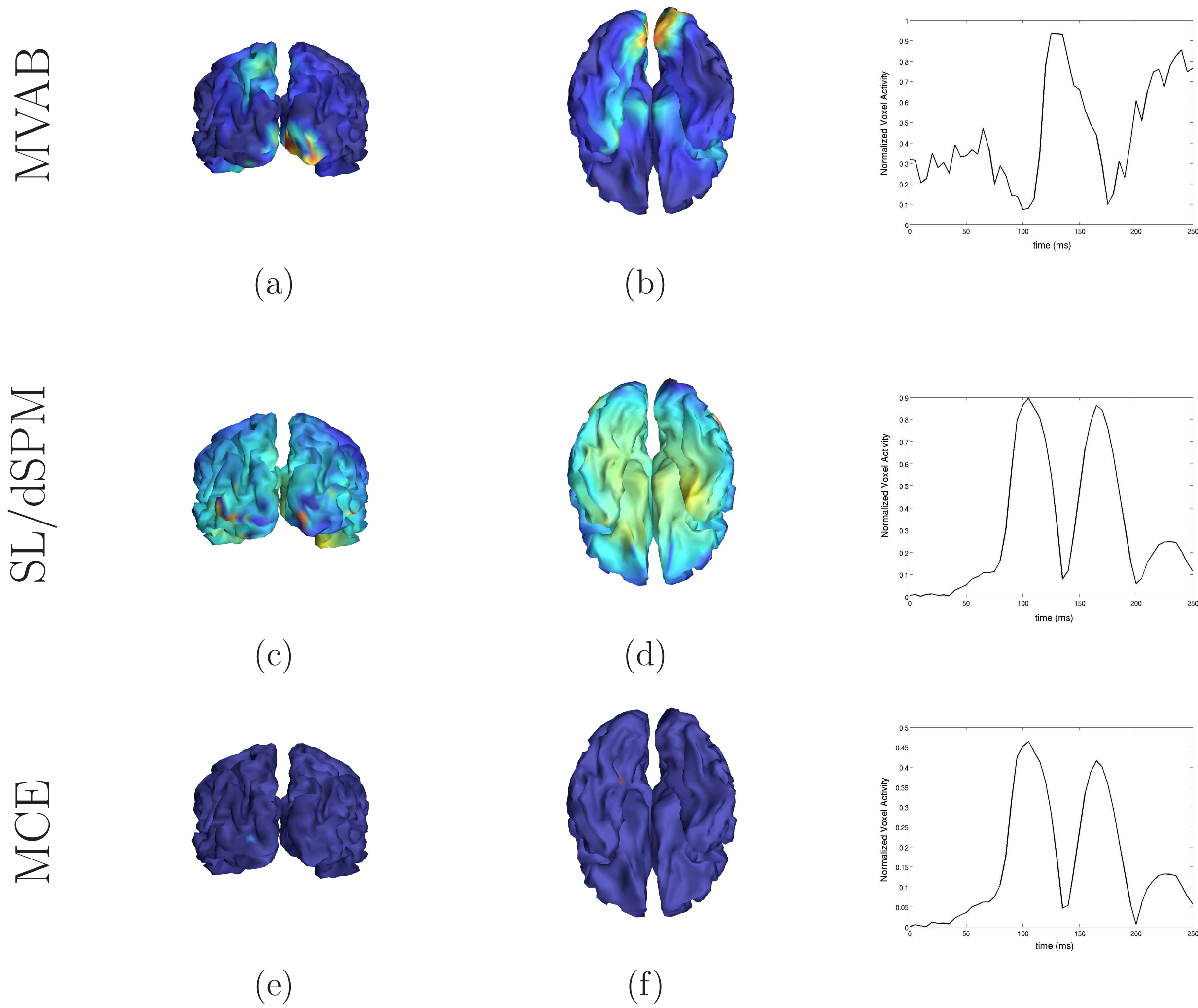

Figure S7