Appendix A

Supplementary results

Table A1

Mean, SE (in parentheses) and range (in square brackets) of Δ for each channel cluster and method, together with the corresponding LCF improvement $\Delta^{\%}$. In addition, results of dependent t-tests comparing $SNR_{\zeta+LCF}$ and SNR_{ζ} are given with associated (uncorrected) p-values and corresponding False Discovery Rate q-values.

Cluster	None	ADJUST	FASTER	ICAW
	-0.35 (0.14)	0.33 (0.21)	0.61 (0.27)	0.17 (0.05)
	[-1.59, 0.67]	[-0.13, 2.90]	[-1.84, 2.44]	[-0.17, 0.61]
	-7.71%	7.97%	16.35%	4.13%
RC	$t(17) = 2.480$	$t(17) = 1.564$	$t(17) = 2.235$	$t(17) = 3.447$
	$SE = 0.14$	$SE = 0.21$	$SE = 0.27$	$SE = 0.05$
	$p = .024$	$p = .136$	$p = .039$	$p = .003$
	$q = .048$	$q = .193$	$q = .098$	$q = .008$
	-0.29 (0.13)	0.32 (0.13)	0.44 (0.21)	0.12 (0.06)
	[-1.20, 0.75]	[-0.03, 1.75]	[-1.69, 2.62]	[-0.50, 0.66]
	-7.34%	8.77%	13.57%	3.15%
R000	$t(17) = 2.179$	$t(17) = 2.433$	$t(17) = 2.027$	$t(17) = 1.839$
	$SE = 0.13$	$SE = 0.13$	$SE = 0.22$	$SE = 0.06$
	$p = .044$	$p = .026$	$p = .059$	$p = .083$
	$q = .062$	$q = .131$	$q = .117$	$q = .083$
	-0.16 (0.10)	0.12 (0.08)	0.40 (0.13)	0.11 (0.04)
	[-0.92, 0.72]	[-0.33, 1.19]	[-0.53, 1.71]	[-0.18, 0.53]
	-5.26%	3.90%	15.67%	3.74%
R045	$t(17) = 1.634$	$t(17) = 1.425$	$t(17) = 2.963$	$t(17) = 2.674$

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Cluster	**None**	**ADJUST**	**FASTER**	**ICAW**
	$SE = 0.10$	$SE = 0.08$	$SE = 0.13$	$SE = 0.04$
	$p = .121$	$p = .172$	$p = .009$	$p = .016$
	$q = .151$	$q = .193$	$q = .044$	$q = .023$
	0.05 (0.07)	0.13 (0.08)	0.03 (0.05)	0.06 (0.02)
	[-0.73, 0.63]	[-0.08, 1.31]	[-0.24, 0.59]	[-0.15, 0.18]
	2.13%	6.33%	1.28%	2.85%
R090	$t(17) = .668$	$t(17) = 1.660$	$t(17) = .586$	$t(17) = 3.346$
	$SE = 0.07$	$SE = 0.08$	$SE = 0.05$	$SE = 0.02$
	$p = .513$	$p = .115$	$p = .566$	$p = .004$
	$q = .513$	$q = .192$	$q = .566$	$q = .008$
	-0.62 (0.17)	0.40 (0.23)	0.35 (0.22)	0.26 (0.05)
	[-2.73, 0.75]	[-0.06, 4.00]	[-0.90, 2.36]	[-0.03, 0.85]
	-13.30%	9.63%	9.01%	6.20%
R135	$t(17) = 3.471$	$t(17) = 1.667$	$t(17) = 1.527$	$t(17) = 5.065$
	$SE = 0.18$	$SE = 0.24$	$SE = 0.23$	$SE = 0.05$
	$p = .003$	$p = .114$	$p = .145$	$p < .001$
	$q = .010$	$q = .192$	$q = .215$	$q < .001$
	-0.34 (0.09)	0.17 (0.08)	0.22 (0.19)	0.14 (0.05)
	[-1.19, 0.27]	[-0.04, 1.19]	[-0.82, 1.88]	[-0.15, 0.84]
	-8.60%	4.61%	6.08%	3.77%
R180	$t(17) = 3.735$	$t(17) = 2.091$	$t(17) = 1.084$	$t(17) = 2.487$
	$SE = 0.09$	$SE = 0.08$	$SE = 0.20$	$SE = 0.06$
	$p = .002$	$p = .052$	$p = .294$	$p = .024$
	$q = .008$	$q = .173$	$q = .326$	$q = .029$

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Cluster	None	ADJUST	FASTER	ICAW
	-0.20 (0.08)	0.25 (0.17)	0.27 (0.19)	0.13 (0.04)
	[-0.94, 0.31]	[-0.51, 2.62]	[-0.93, 1.63]	[-0.06, 0.67]
	-5.30%	6.94%	8.23%	3.71%
R225	$t(17) = 2.388$	$t(17) = 1.419$	$t(17) = 1.426$	$t(17) = 3.396$
	$SE = 0.08$	$SE = 0.17$	$SE = 0.19$	$SE = 0.04$
	$p = .029$	$p = .174$	$p = .172$	$p = .003$
	$q = .048$	$q = .193$	$q = .215$	$q = .008$
	-0.10 (0.09)	0.10 (0.08)	-0.19 (0.13)	0.10 (0.03)
	[-0.90, 0.46]	[-0.20, 1.09]	[-1.88, 0.66]	[-0.15, 0.34]
	-3.89%	3.82%	-7.02%	4.27%
R270	$t(17) = 1.110$	$t(17) = 1.152$	$t(17) = 1.483$	$t(17) = 2.975$
	$SE = 0.09$	$SE = 0.08$	$SE = 0.13$	$SE = 0.03$
	$p = .283$	$p = .265$	$p = .156$	$p = .008$
	$q = .314$	$q = .265$	$q = .215$	$q = .014$
	-0.24 (0.08)	0.23 (0.12)	0.35 (0.14)	0.08 (0.04)
	[-0.83, 0.34]	[-0.43, 1.60]	[-0.56, 1.88]	[-0.38, 0.34]
	-7.33%	7.30%	12.60%	2.42%
R315	$t(17) = 2.996$	$t(17) = 1.804$	$t(17) = 2.437$	$t(17) = 2.053$
	$SE = 0.08$	$SE = 0.13$	$SE = 0.15$	$SE = 0.04$
	$p = .008$	$p = .089$	$p = .026$	$p = .056$
	$q = .020$	$q = .192$	$q = .087$	$q = .062$
	-0.25 (0.04)	0.23 (0.05)	0.28 (0.06)	0.13 (0.02)
	[-2.73, 0.75]	[-0.51, 4.00]	[-1.88, 2.62]	[-0.50, 0.85]
	-7.06%	6.81%	8.86%	3.90%

All

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Cluster	**None**	**ADJUST**	**FASTER**	**ICAW**
	$t(161) = 6.428$	$t(161) = 4.700$	$t(161) = 4.383$	$t(161) = 8.474$
	$SE = 0.04$	$SE = 0.05$	$SE = 0.06$	$SE = 0.02$
	$p < .001$	$p < .001$	$p < .001$	$p < .001$
	$q < .001$	$q < .001$	$q < .001$	$q < .001$

Appendix B

LCF effects on the time-frequency domain

To assess the effects of LCF on analyses based on a time-frequency decomposition of the EEG signal we calculated power for 64 frequencies (logarithmically spaced between 2 and 100 Hz) using Morlet wavelets with 5 cycles (cf. Tallon-Baudry, Bertrand, Delpuech, & Pernier, 1997). We averaged log-transformed power across events and z-transformed the resulting values separately for each frequency on the basis of the respective mean and standard deviation in the 500 ms pre-stimulus baseline. We refer to this representations as event related spectrogram (ERS). Analogous to our ERP analyses, we computed difference ERSs to assess the performance of LCF.

The effects of LCF on the time-frequency decomposition of the EEG data seemed to be mainly localized to frequencies between 2 and 20 Hz (Figure C1). With FASTER, LCF had clear widespread effects up to 100 Hz, reflecting the retrieval of neural signal. Overall, the usage of any of these methods with or without LCF had no apparent disruptive effects on the spectrogram.

Appendix C

Results of a case with bad BSS solution

Artifact rejection tools based on BSS techniques are limited by the quality of the BSS solution. To the extent that the identified components cleanly separate signal and noise simply removing the noise components will be effective. To the extent that neural activity and noise are both present in individual components, LCF can improve the artifact rejection by limiting the amount of signal that is discarded along with the noise. Figure C2 illustrates a case where an unsatisfactory BSS allows LCF to considerably improve the solution based on FASTER alone — note the voltage range difference between Figure C2 and Figure 13.

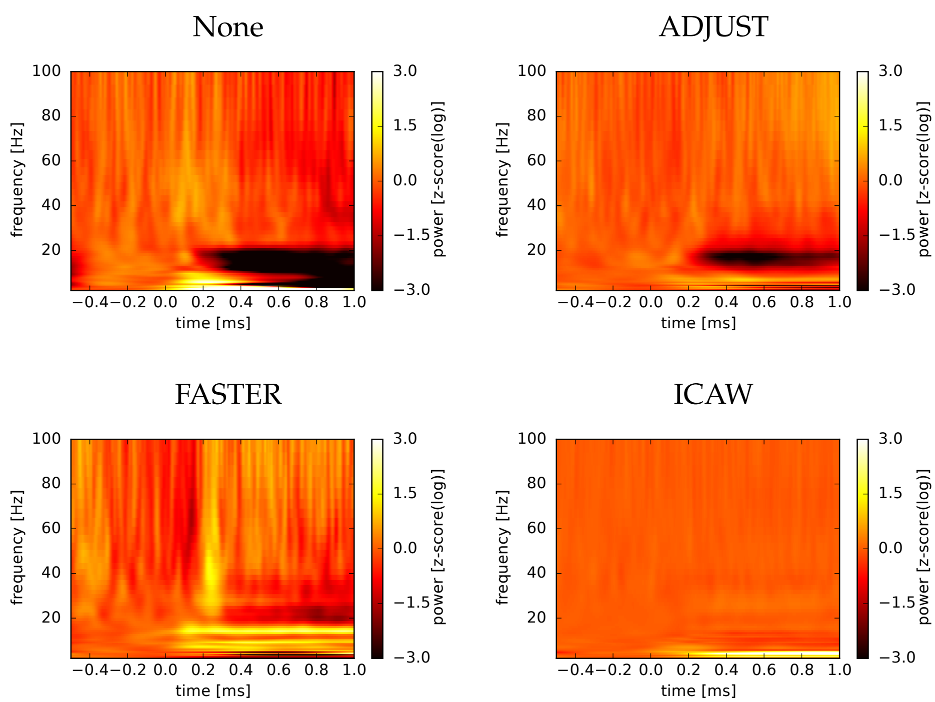

Figure C1. Difference between the ERSs for channel cluster R0 as defined in Figure 8. Mean across participants, for multiple artifact rejection methods. ERSs for methods without LCF are subtracted from ERSs for methods with LCF.

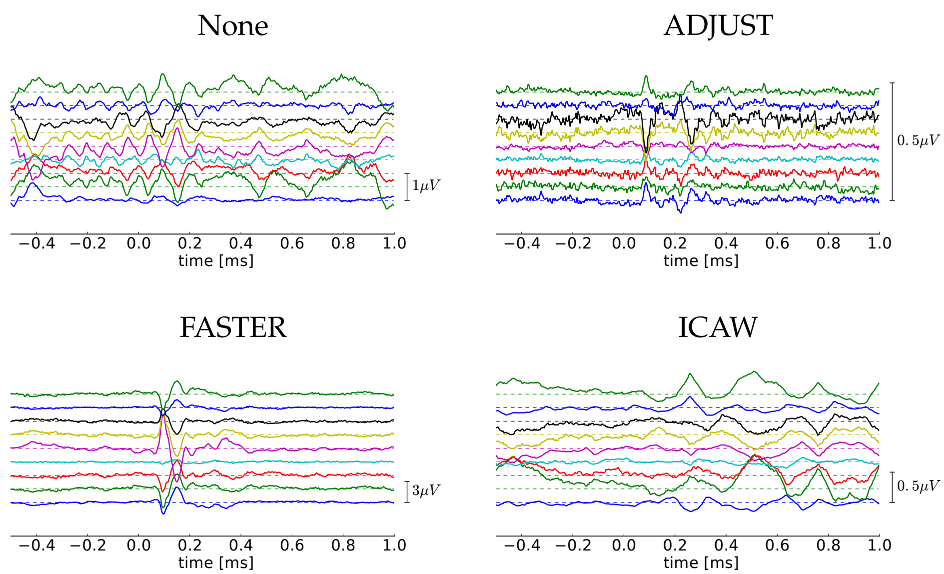

Figure C2. Difference between the ERPs from a subject with an unsatisfactory BSS solution. Lines correspond to the ERP difference of each brain region specified in Figure 8, so that the top line is RC and subsequent ones are R0, R45, R90, . . . , R315. Note that the scale of the y-axes differs between panels as indicated.