

Supplementary Material

Supplementary Table 1

	Mean valence ratings (\pm SEM) (scale -3 to 3)	Mean arousal ratings (\pm SEM) (scale 0 – 6)
Triumph	2.17 (\pm 0.12)	4.96 (\pm 0.11)
Amusement	1.15 (\pm 0.19)	3.82 (\pm 0.11)
Fear	-1.38 (\pm 0.30)	3.93 (\pm 0.25)
Disgust	-2.12 (\pm 0.05)	3.08 (\pm 0.06)
Rotated sounds	0.08 (\pm 0.10)	2.52 (\pm 0.09)

Supplementary Table 2

A.

Location	BA	Cluster size	MNI coordinates			Z score
			x	y	z	
<i>Regions demonstrating modulation of perceptual responses by emotion category</i>						
<i>Temporal regions</i>						
Mid L STG (PAC)	41	2984	-46	-18	4	7.63
Mid R STG (PAC)	41	3925	44	-18	8	6.87
Mid L ITS	37	42	-54	-58	-8	3.44
Posterior L MTG	39	15	-42	-70	14	3.36
Posterior R ITS	37/39	83	46	-70	8	3.98
Mid R fusiform gyrus	37	59	38	-50	-10	4.30
<i>Frontal regions</i>						
L precentral gyrus	6	522	-52	-6	52	6.28
R precentral gyrus	6	18	36	-14	50	3.27
R precentral gyrus	6	198	54	-2	44	3.89
L posterior IFG/precentral sulcus	44/6	84	-50	-2	22	4.03
L IFG	45	42	-48	24	2	3.60
Mesial L SFG (pre-SMA)	6	313	-4	0	64	4.43
Mesial R SFG (pre-SMA)	6		8	14	64	3.65
L SFS	6/8	33	-20	12	54	3.39
R SFS	6/8	119	22	16	46	4.34
R frontal pole	10	32	20	50	12	3.27
<i>Parietal and occipital regions</i>						
L precuneus	31	542	-22	-62	24	4.06
R posterior cingulate gyrus	30		4	-52	18	3.90
Posterior L collateral sulcus	18/19	148	-20	-82	-4	4.21
Posterior R collateral sulcus	18/19	49	18	-78	-8	4.13
<i>Limbic and paralimbic regions</i>						
L hippocampus		106	-26	-22	-20	4.69
R hippocampus		52	28	-26	-16	3.34
R parahippocampal gyrus		15	20	-24	-22	3.24
R amygdala		20	22	-8	-20	3.78
Posterior L cingulate gyrus		17	-8	-38	30	3.36
Posterior R cingulate gyrus		15	18	-54	12	3.09
Anterior L cingulate gyrus		12	-18	24	34	3.67
<i>Other regions</i>						
L caudate nucleus		19	-22	18	18	3.40
L cerebellar hemisphere		30	-22	-74	-36	3.18

B.

Location	BA	Cluster size	MNI coordinates			Z score
			x	y	z	
<i>Regions demonstrating significant activation during voluntary facial movement (smiling)</i>						
<i>Frontal regions</i>						
L anterior insula		45607	-40	10	2	6.44
R anterior insula			38	10	4	6.40
R central sulcus	4		64	-16	38	5.13
L central sulcus	4		-58	-14	48	5.07
R precentral gyrus	6		60	-6	42	5.41
R precentral gyrus	6		46	-6	40	5.33
L precentral gyrus	6		-56	-10	44	5.10
Mesial L SFG (SMA)	6		-6	-4	58	5.17
Mesial R SFG (pre-SMA)	6		10	2	70	5.19
Mesial L SFG (pre-SMA)	6		-10	-2	66	5.00
R IFG	45		36	20	6	5.65
R IFG	44		56	12	12	5.43
R IFG	44		48	12	14	5.16
R MFG	46/10	1684	30	44	20	5.40
<i>Limbic regions</i>						
L amygdale		958	-20	-8	-26	6.28
<i>Occipital regions</i>						
R lingual gyrus	19	13	22	-54	-2	2.30
<i>Other regions</i>						
R thalamus		110	10	-14	6	3.57
L thalamus		102	-10	-14	8	2.98

Supplementary Table 3

Location	BA	Cluster	MNI coordinates			Z score
			x	y	z	
<i>Regions showing combined auditory-perceptual and motor effects</i>						
<i>Frontal regions</i>						
L precentral gyrus	6	522	-52	-6	52	6.28
L precentral gyrus/central sulcus	6/4		-40	-14	32	4.30
R precentral gyrus	6	198	54	-2	44	3.89
R precentral gyrus/central sulcus	6/4		48	-12	42	3.22
R central sulcus	4		50	-12	50	2.86
Mesial L SFG (pre-SMA)	6	313	-4	0	64	4.43
Mesial SFG (pre-SMA)	6		0	8	66	4.01
Mesial R SFG (pre-SMA)	6		8	14	64	3.65
L posterior IFG/precentral sulcus	44/6	75	-50	-2	22	4.03
Posterior R SFS	8	30	24	18	54	3.75
Posterior R SFS	6/8		26	14	62	2.83
Anterior L insula		96	-46	6	-4	4.69
Anterior R insula		628	46	8	-6	6.01
Anterior R IFG	45		44	24	4	5.25
R frontal operculum	6/44		52	4	6	4.27
Anterior R IFG	45/47	13	42	30	4	4.33
<i>Temporal and occipital regions</i>						
Anterior R STS	22/21	27	50	8	-18	3.55
Posterior L MTG	39	13	-42	-70	14	3.36
Posterior R ITS	37/39	82	46	-70	8	3.98
Posterior L ITG	37	21	-44	-60	-12	3.18
Posterior L ITG	37		-50	-52	-12	3.04
Mid R fusiform gyrus	37	42	38	-50	-10	4.30
Posterior R collateral sulcus	18/19	36	18	-78	-8	4.13

Supplementary Table 4

Location	BA	MNI coordinates			Z score
		x	y	z	
<i>Positive correlation with emotional valence</i>					
<i>Frontal regions</i>					
L precentral gyrus*	6	-52	-6	50	4.26
L precentral gyrus*	6	-54	-6	46	4.19
L central sulcus*	4	-40	-18	34	3.11
L central sulcus*	4/3	-44	-20	36	3.10
L central sulcus*	6/4	-46	-16	40	3.10
R precentral gyrus*	6	54	-2	42	3.92
R precentral gyrus*	6	54	0	50	3.10
R precentral gyrus*	6	50	-2	52	2.98
R precentral gyrus/central sulcus*	6/4	46	-12	36	2.30
L posterior IFG/precentral sulcus*	44/6	-52	-2	26	2.67
L posterior IFG/precentral sulcus	44/6	-46	0	26	2.27
Dorsomedial L SFG (pre-SMA)*	6	-4	0	64	2.52
Posterior R SFS	6/8	24	16	54	2.18
<i>Temporal and occipital regions</i>					
Anterior R STS*	22/21	50	10	-18	2.44
Posterior R ITS*	37/39	42	-66	10	2.59
Posterior L ITG*	37	-46	-58	-10	2.78
Mid L ITG	37	-50	-52	-12	2.27
Posterior R collateral sulcus	19	22	-80	-12	2.59
Posterior R collateral sulcus	19/18	18	-80	-4	2.12
Mid R fusiform gyrus*	37	40	-50	-10	3.58
<i>Positive correlation with emotional arousal</i>					
<i>Frontal regions</i>					
L precentral gyrus*	6	-52	-4	48	4.47
L central sulcus*	4	-42	-16	34	3.04
L central sulcus*	4/3	-42	-20	36	3.01
L central sulcus*	4	-48	-16	48	2.62
L precentral gyrus*	6	-42	-8	58	2.45
R precentral gyrus*	6	54	-2	42	3.14
R precentral gyrus*	6	54	0	50	3.10
R precentral gyrus*	6	50	-2	52	2.84
R precentral gyrus/central sulcus*	6/4	46	-12	36	2.57
L posterior IFG/precentral sulcus*	44/6	-50	-2	22	2.35
L precentral sulcus/precentral	6	-56	-6	26	2.23
Dorsomedial L SFG (pre-SMA)*	6	-4	0	64	3.34
Dorsomedial L SFG (pre-SMA)	6	-2	10	66	2.98
L anterior insula		-46	8	-8	2.82
R anterior insula		42	10	-10	2.22
<i>Temporal regions</i>					
Anterior R STS*	22/21	54	8	-16	2.31
Posterior R ITS*	37/39	44	-70	10	2.59
Posterior L ITG*	37	-42	-60	-12	2.30
Mid R fusiform gyrus*	37	40	-50	-10	2.87

Supplementary Table 5

	Mean EMG amplitude (\pm SEM) (microvolts)	
	Lower face (zygomaticus major)	Upper face (corrugator supercilii)
Motor	4.69 (\pm 1.32)	-0.32 (\pm 0.14)
Triumph	0.17 (\pm 0.10)	0.11 (\pm 0.11)
Amusement	0.11 (\pm 0.05)	0.28 (\pm 0.21)
Fear	0.03 (\pm 0.05)	0.02 (\pm 0.14)
Disgust	-0.05 (\pm 0.03)	0.22 (\pm 0.21)
Rotated sounds	0.19 (\pm 0.16)	0.23 (\pm 0.19)
Null (resting)	-0.12 (\pm 0.13)	-0.26 (\pm 0.07)

Table legends

Supplementary Table 1

Mean valence and arousal ratings (\pm standard error of the mean, SEM) for stimuli from each category of emotional vocalization and for the spectrally rotated baseline stimuli. Rating scales are described in the Methods section.

Supplementary Table 2

A. Activation peaks in regions showing significant modulation of perceptual responses to affective vocalizations on the basis of emotional category. This table lists the most significant peak in each cluster for the *F*-contrast (effects of interest) from the within-subject repeated-measures ANOVA of perceptual responses to the four categories of emotional vocalization. Where a cluster extended across both hemispheres, the most significant peak in the opposite hemisphere is listed below the main peak. **B.** Activation peaks in regions showing significant activation during voluntary facial movement (smiling). The table lists the most significant peak in each cluster for the contrast of the motor condition versus baseline. Where a cluster extended across both hemispheres, the most significant peak in the opposite hemisphere is listed below the main peak.

Additional frontal peaks in the main cluster are listed in italics to demonstrate the location of activation within primary motor and premotor cortices, and in inferior frontal gyrus. For both contrasts, statistical thresholds were set at a voxel-level threshold of $P < 0.05$, FDR-corrected, and a cluster extent threshold of 10 voxels. Coordinates (in mm) giving peak location in MNI stereotactic space. Macroanatomical and Brodmann area (BA) localizations were determined from the stereotactic brain atlas of Talairach & Tournoux (1988) after mathematical conversion of voxel coordinates from MNI space.

Abbreviations: IFG = inferior frontal gyrus; ITS = inferior temporal sulcus; MFG = middle frontal gyrus; MTG = middle temporal gyrus; PAC = primary auditory cortex; pre-SMA = pre-supplementary motor cortex; SFG = superior frontal gyrus; SFS = superior frontal sulcus; SMA = supplementary motor area; STG = superior temporal gyrus.

Supplementary Table 3

Activation peaks in regions showing both auditory-perceptual effects during listening to emotional vocalizations and motor responses during facial movement. Activation peaks were obtained by inclusive masking of the ANOVA *F*-contrast with the contrast of the facial movement task versus baseline. Statistical thresholds for the main and masking contrasts were set at a voxel-level threshold of $P < 0.05$, FDR-corrected, and a cluster extent threshold of 10 voxels. Significant peaks > 8.0 mm apart in each cluster are listed,

with the most significant peak listed first. Coordinates (in mm) giving peak location in MNI stereotactic space. Macroanatomical and Brodmann area (BA) localizations were determined from the stereotactic brain atlas of Talairach & Tournoux (1988) after mathematical conversion of voxel coordinates from MNI space. The peaks used as the basis for spherical regions of interest to extract the hemodynamic responses shown in Figure 2 and Supplementary Figure 1 are indicated in bold. Abbreviations: IFG = inferior frontal gyrus; ITG = inferior temporal gyrus; ITS = inferior temporal sulcus; MTG = middle temporal gyrus; pre-SMA = pre-supplementary motor cortex; SFG = superior frontal gyrus; SFS = superior frontal sulcus; STS = superior temporal sulcus.

Supplementary Table 4

Regions demonstrating a significant positive correlation between auditory-perceptual responses to emotional vocalizations and valence and arousal properties of vocal stimuli. Statistical thresholds for these contrasts were set at a voxel-level threshold of $P < 0.05$, FDR-corrected across a search volume defined as the significantly-activated voxels identified in the inclusively-masked ANOVA F -contrast described above. Significant peaks > 4.0 mm apart in each cluster are listed, with the most significant peak listed first. Activation peaks in regions showing a significant positive correlation with both valence and arousal are marked with an asterisk. The method of statistical thresholding used in SPM2 (small volume correction) does not provide measurements of cluster size. The peaks used as the basis for spherical regions of interest to extract the hemodynamic responses shown in Figure 3 are indicated in bold. Abbreviations: IFG = inferior frontal gyrus; ITG = inferior temporal gyrus; ITS = inferior temporal sulcus; pre-SMA = pre-supplementary motor cortex; SFG = superior frontal gyrus; SFS = superior frontal sulcus; STS = superior temporal sulcus.

Supplementary Table 5

Mean EMG amplitude values (microvolt units) during each of the 7 experimental conditions over right-sided lower and upper facial muscles. EMG amplitude was measured as the average change in the root mean square of recorded responses in the 1000-1499 msec time window post stimulus onset, in comparison to pre-stimulus activity.

References

Talairach P, Tournoux J (1988) A stereotactic coplanar atlas of the human brain. Stuttgart: Thieme.