

Supplementary information S1 (box)

To visualize the main findings of previous functional neuroimaging studies on music-evoked emotions, and to provide coordinates for directed hypotheses of future studies, a meta-analysis was computed. The selection of studies was based on a search using *ISI Web of Knowledge* (Thomson Reuters, N.Y., USA) with keywords “music” AND “emotion” AND [“fMRI” OR “PET”] (May 2013), and two in-press studies from our group, which have since been published. Inclusion criteria were whole-brain analysis, provision of stereotaxic coordinates (MNI or Talairach space), use of a music stimulus, and at least one measure assessing the subjective feeling component evoked by that stimulus. None of the contrasts included music with lyrics, and none of the contrasts included a comparison of music against a non-stimulus rest condition. 21 studies [REFs. 1-21] with 319 participants, and 339 foci of 44 contrasts were included in the analysis. The analysis was computed using GingerALE.^{22,23} Detailed results of the analysis are provided in Table S1. The list of studies and contrasts included in the analysis is provided in Table S2.

Structure	mm ³	Studies	Coord. (x y z)
Cluster 1	3328	2,5-8,13,15,18,20,21	
r hippocampal formation (90% CA) ¹			22 -14 -14
r amygdala (60% LB) ¹			20 -7 -16
Cluster 2	2648	2,5,6,13,15,18-20	
l hippocampal formation (70% CA) ²			-24 -16 -14
l amygdala (70% SF) ²			-18 -8 -12
l hippocampal formation (60% FD) ²			-24 -26 -8
l hipp (70% SUB) ²			-16 -26 -8
Cluster 3	2352	6,7,14,17-20	
r nucleus accumbens			10 6 2
Cluster 4	1528	5-7,19-21	
r auditory cortex (TE 1.0 80%)			48 -18 8
Cluster 5	1176	5,10,14,19,21	
l caudate nucleus			-8 8 8
Cluster 6	1072	6,13,16,20,21	
l auditory cortex (TE 1.1 60%) ⁴			-38 -28 14
Cluster 7	464	2,9	
pre-SMA ³			2 16 48
frontomedian cortex (area 8) ³			8 20 46
rostral cingulate zone (area 32) ³			2 16 36
Sub-threshold clusters			
pre-genual cingulate cortex		12,20	-5 38 6
middle cingulate cortex (area p24)		7,9,16,19	-4 -12 38
medial orbitofrontal cortex		2,5	-2 38 -7
lateral orbitofrontal cortex		8,19	28 36 -6
l anterior insula		2,20	28 8 10
mediodorsal thalamus		2,20	2 -16 5
SPL (area 7)		1,9,19	20 -52 61

¹ The cluster including right CA and LB had two local max.

² The cluster including left CA, SF, FD, and SUB had four local max.

³ The cluster including pre-SMA, area 8 and area 32 had three local max.

⁴ The cluster in the left auditory cortex extended into the retroinsular cortex

Table S1. Results of meta-analysis. Structures observed in the analysis are listed in the outermost left column (with anatomical probabilities according to REF. 24 in parentheses). The middle-left column indicates the volume of clusters, the middle-right column lists studies contributing to the clusters (note that more than one contrast of a study can contribute to a single cluster). The outermost right column indicates coordinates of local maxima within clusters in Talairach space. Statistical significance threshold for Clusters 1 to 7 was $p < .01$ (FDR-corrected with a minimum cluster size of 200 cubic mm). Clusters significant at $p < .01$ (FDR-corrected) without cluster size threshold are listed in the lower panel to generate directed anatomical hypotheses for future studies. Note that, due

to the different experimental paradigms used in the included studies (and the associated risk for false negatives), limbic/paralimbic brain areas not indicated in this meta-analysis may nevertheless contribute to music-evoked emotions. Abbreviations: l: left; r: right; CA: cornu ammonis; FD: dentate gyrus of hippocampal formation; LB: laterobasal group of amygdala; SF: superficial group of amygdala; SMA: supplementary motor area; SPL: superior parietal lobule; SUB: subiculum of hippocampal formation; TE 1: primary auditory cortex.

Table S2: List of studies and contrasts included in the meta-analysis.

Study	Modality	Number of subjects	Number of foci	Contrast
Blood & Zatorre (1999) ¹	PET	10	3	Positive Correlations with dissonance
			5	Negative Correlations with dissonance
Blood & Zatorre (2001) ²	PET	10	9	Positive correlations with ratings of pleasantness
			6	Negative correlations with ratings of pleasantness
			8	Positive correlations with ratings of emotional intensity
			7	Negative correlations with ratings of emotional intensity
Menon & Levitin (2005) ³	fMRI	13	3	Unpleasant > pleasant
Khalfa et al. (2005) ⁴	fMRI	13	3	Minor vs. major
Baumgartner et al. (2006) ⁵	fMRI	9	27	Pictures with music > pictures without music
Koelsch et al. (2006) ⁶	fMRI	11	3	Pleasant > unpleasant
			3	Unpleasant > pleasant
Mitterschiffthaler et al. (2007) ⁷	fMRI	16	11	Happy > neutral
			7	Sad > neutral
Eldar et al. (2007) ⁸	fMRI	14	10	Negative combination effect
			11	Positive combination effect
Mizuno & Sugishita (2007) ⁹		18	8	Major – neutral
			5	Minor – neutral
			6	Major – minor
			3	Minor-major
Koelsch et al. (2008) ¹⁰	fMRI	11	4	Irregular > regular
Suzuki et al. (2008) ¹¹	PET	13	1	Consonance vs. dissonance
			3	Dissonance vs. consonance
			1	Minor vs. major
Green et al. (2008) ¹²	fMRI	21	4	Minor vs. major
Chapin et al. (2010) ¹³	fMRI	13	2	Emotional arousal
			9	Emotional arousal x experience
Salimpoor et al. (2011) ¹⁴	PET	10	7	Pleasure – neutral
	fMRI	10	2	Pleasure > neutral
Mueller et al. (2011) ¹⁵	fMRI	20	7	Pleasant > unpleasant
Caria et al. (2011) ¹⁶		14	20	Happy favorite music > happy standard
Brattico et al. (2011) ¹⁷	fMRI	15	6	Sad vs. happy
Trost et al. (2012) ¹⁸	fMRI	16	13	Positive correlations with arousal ratings
			3	Negative correlations with arousal ratings
			11	Positive correlations with valence ratings
			3	Negative correlations with valence ratings
Salimpoor et al. (2013) ¹⁹	fMRI	19	8	Music purchased vs. music not purchased
			39	Emotion-specific functional connectivity (increase in reward value)
Koelsch et al. (2013) ²⁰	fMRI	18	4	Joy > fear
			1	Fear > joy
			12	Interaction contrast of emotion (joy vs. fear) x time
			30	Emotion-specific functional connectivity (joy > fear)
Lehne et al. (in press) ²¹	fMRI	25	1	Positive correlation with tension
			2	Tension (versions with dynamics) > tension (versions without dynamics)
			8	Tension increase > tension decrease

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