

Supplementary Material

“Conceptual representations in the default, control and attention networks are task-dependent and cross-modal”

(Kuhnke, Kiefer & Hartwigsen 2023 *Brain & Language*)

Supplementary Materials and Methods

Table S1. Psycholinguistic measures for the four word categories (means; SD in parentheses).

	low sound	high sound	p	low action	high action	p
Sound rating	1.33 (0.29)	4.92 (0.62)	<10 ⁻¹¹³	2.92 (1.67)	3.34 (2.03)	0.12
Action rating	3.19 (1.64)	3.4 (1.64)	0.37	1.73 (0.49)	4.86 (0.45)	<10 ⁻¹⁰³
Visual rating	4.21 (0.54)	4.07 (0.81)	0.15	4.16 (0.82)	4.13 (0.52)	0.77
Familiarity rating	5.52 (0.39)	5.47 (0.41)	0.41	5.45 (0.42)	5.55 (0.37)	0.08
Letters	6.23 (1.61)	6.36 (2.0)	0.61	6.27 (1.98)	6.32 (1.63)	0.84
Syllables	2.21 (0.77)	2.29 (0.71)	0.44	2.22 (0.71)	2.28 (0.76)	0.56
Lemma freq.	5.33 (6.33)	5.56 (10.35)	0.85	4.74 (6.34)	6.14 (10.3)	0.26
Bigram freq.	254220.81 (136859.15)	231922.15 (122883.01)	0.24	254413.24 (139511.49)	231729.73 (119826.78)	0.23
Trigram freq.	145830.18 (85313.42)	132754.69 (76696.95)	0.27	146068.82 (84690.3)	132516.05 (77342.95)	0.25
Orthographic neighbors	7.41 (6.7)	6.09 (5.86)	0.15	7.05 (6.83)	6.44 (5.77)	0.5

Ratings were obtained from a total of 163 subjects who did not participate in the fMRI experiment. All other psycholinguistic measures were extracted from the *dlxDB* database (Heister et al., 2011; <http://dlxdb.de/>). Lemma, bigram and trigram frequencies and number of orthographic neighbors are given per one million words. Freq = frequency.

Supplementary Results

Whole-brain results for task-irrelevant features

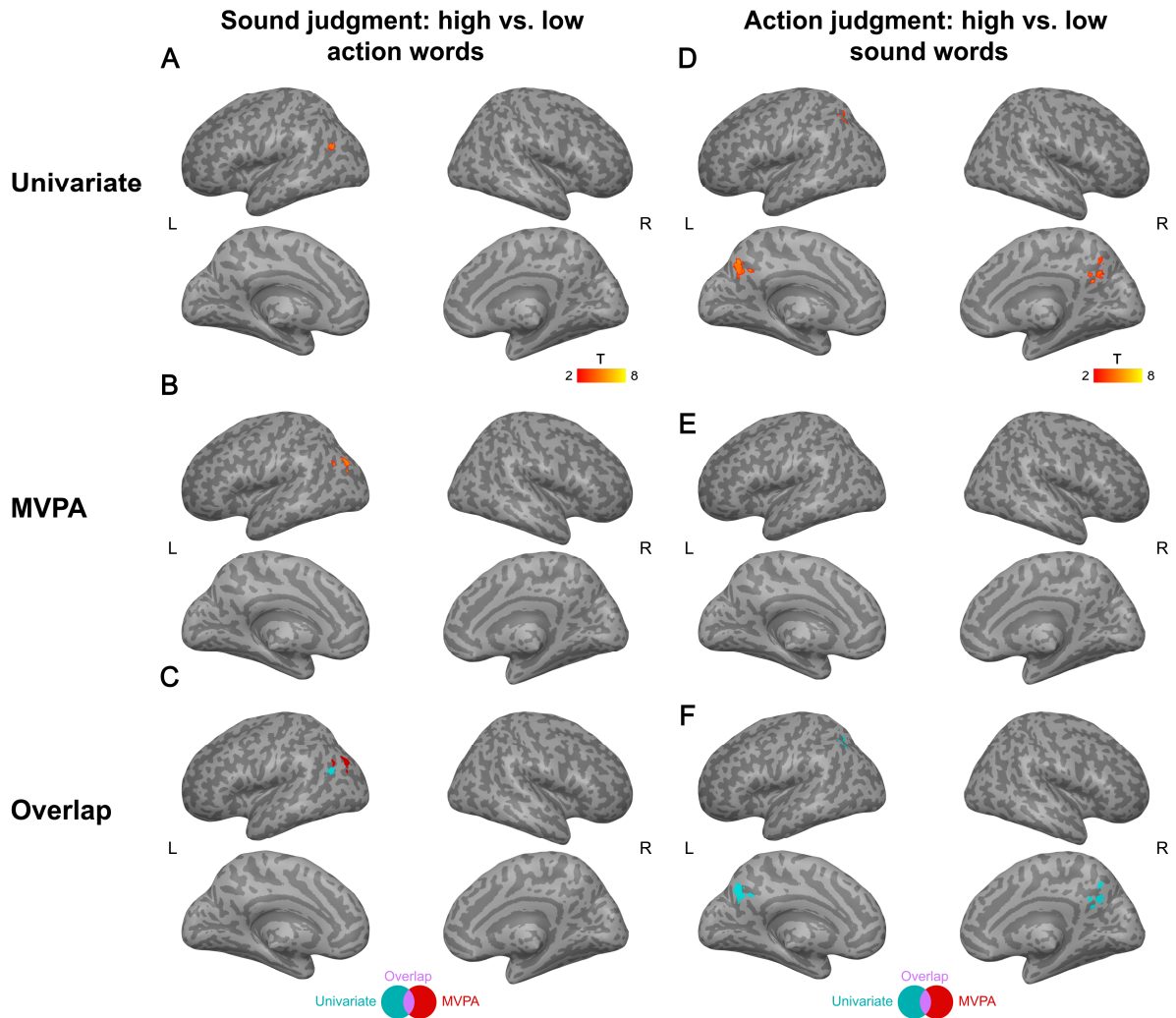


Figure S1. Comparison of results for whole-brain univariate analysis vs. searchlight MVPA on task-irrelevant conceptual feature retrieval. Both univariate and MVPA subject-specific maps were smoothed with a 5-mm FWHM Gaussian kernel. All group-level maps were thresholded at a voxel-wise $p < 0.001$ and a cluster-wise $p < 0.05$ FWE-corrected (using non-parametric permutation tests).

Supplementary MVPA decoding analyses using 17-network parcellation

In addition to our main MVPA decoding analysis using the 7-network parcellation by Yeo et al. (2011), we also performed each decoding analysis using the more fine-grained 17-network parcellation.

MVPA decoding in large-scale functional networks

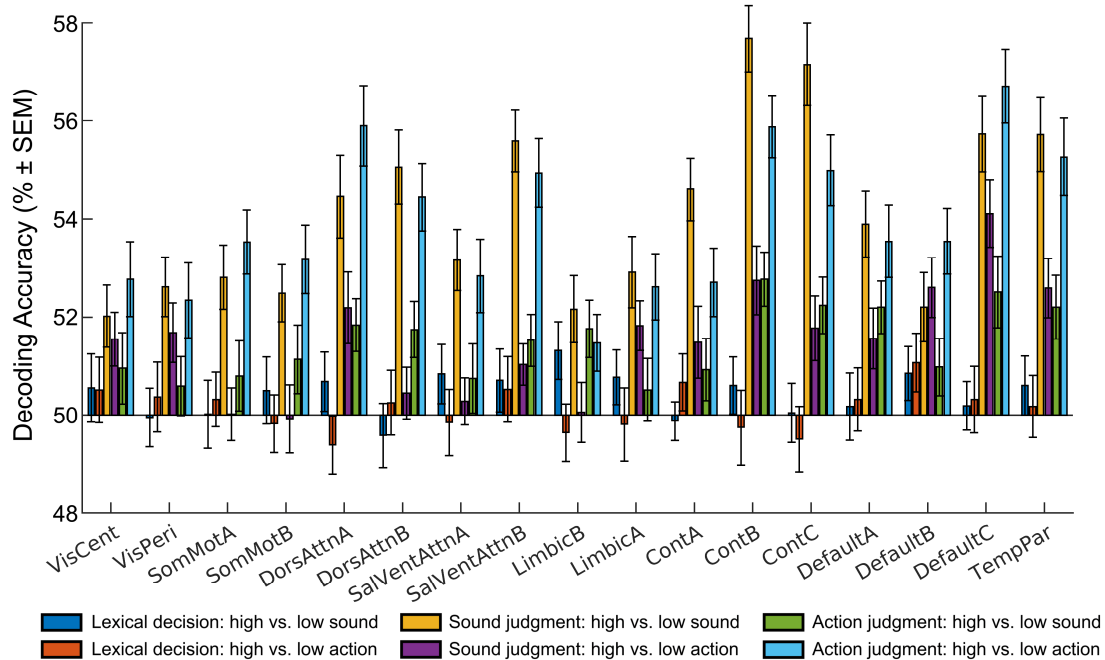


Figure S2. Results of ROI-based MVPA decoding analyses in the 17 resting-state networks by Yeo et al. (2011). A machine-learning classifier was trained on the activation patterns in a given network for 5 out of the 6 blocks, and tested on the remaining block (i.e., leave-one-block-out cross validation).

Cross-modal representations in large-scale functional networks

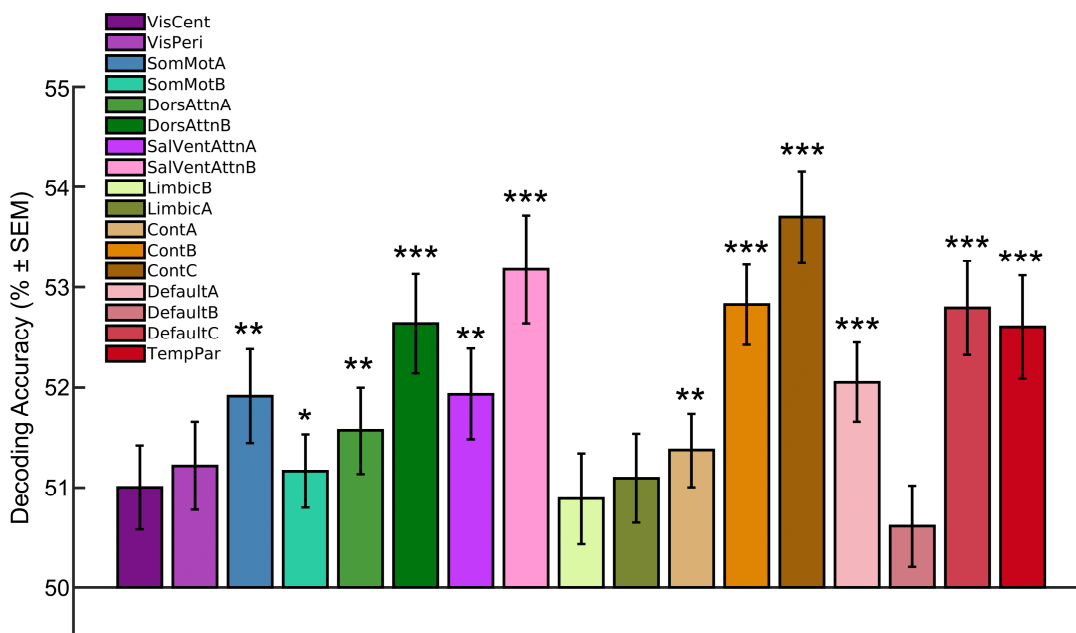


Figure S3. Cross-decoding of task-relevant conceptual features in the 17 resting-state networks by Yeo et al. (2011). The classifier was trained on activation patterns for task-relevant sound features (sound judgments: high vs. low sound words) and tested on task-relevant action features (action judgments: high vs. low action words), and vice versa. ***: $p < 0.001$; **: $p < 0.01$; *: $p < 0.05$ (Bonferroni-corrected for the number of networks).

Relationship between large-scale networks and the principal gradient of connectivity

As a supplementary analysis, we assessed the relationship between the 7 large-scale networks (Yeo et al., 2011) and the principal gradient of intrinsic connectivity (Gao et al., 2022; Margulies et al., 2016). The principal gradient captures the gradual change of intrinsic connectivity across the cortex (Wang et al., 2020). For each large-scale network, we extracted the mean gradient value across all voxels in the gradient map by Margulies et al. (2016) (available at <https://identifiers.org/neurovault.collection:1598>) that fell into the respective network ROI.

The results show that the principal gradient extends from modality-specific perceptual-motor systems (visual, somatomotor) on the lower end to the default mode network (DMN) at the upper end, as reported previously (Gao et al., 2022; Margulies et al., 2016; Wang et al., 2020). Dorsal and ventral attention networks, and the limbic and frontoparietal control systems are located at the middle of the gradient.

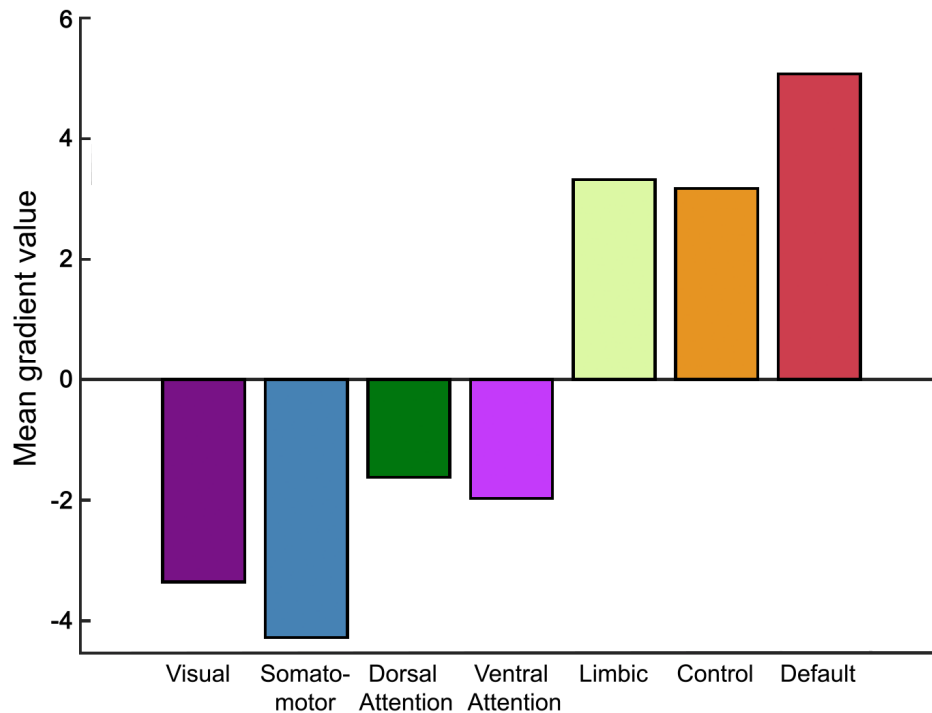


Figure S4. Gradient values of each large-scale functional network. The mean gradient value was extracted across all voxels in the gradient map by Margulies et al. (2016) that fell into each large-scale network of the 7-network parcellation by Yeo et al. (2011).

Coordinate Tables

The following tables report significant clusters and peak coordinates for the whole-brain univariate and MVPA searchlight analyses. All analyses were thresholded at a voxel-wise $p < 0.001$ and a cluster-wise $p < 0.05$ FWE-corrected using non-parametric permutation tests (5000 permutations). We report up to 3 peaks more than 8 mm apart in clusters larger than 100 mm³. Anatomical labels were determined using the SPM Anatomy toolbox (Version 2.2c; Eickhoff et al., 2005), the Harvard-Oxford atlas distributed with FSL (<http://www.fmrib.ox.ac.uk/fsl/>), and the human motor area template (<http://lrnlab.org/>; Mayka et al., 2006). Coordinates are in MNI space.

L	left	MFG	middle frontal gyrus
R	right	MTG	middle temporal gyrus
a (prefix)	anterior	OFC	orbitofrontal cortex
p (prefix)	posterior	PCC	posterior cingulate cortex
ACC	anterior cingulate cortex	PFC	prefrontal cortex
FG	fusiform gyrus	mPFC	medial PFC
IFG	inferior frontal gyrus	dmPFC	dorsomedial PFC
IFG op	IFG pars opercularis	vmPFC	ventromedial PFC
IFG orb	IFG pars orbitalis	PMC	premotor cortex
IFG tri	IFG pars triangularis	PMd	dorsal PMC
IPL	inferior parietal lobe	PMv	ventral PMC
IPS	intraparietal sulcus	PreCS	precentral sulcus
ITG	Inferior temporal gyrus	SMA	supplementary motor area
LTO	lateral temporal-occipital junction	SPL	superior parietal lobe
MCC	middle cingulate cortex	STG	superior temporal gyrus

Table S2. Univariate results for action feature retrieval (action judgments: high vs. low action words).

Region	Cluster size (mm ³)	x	y	z	T
L IPL/IPS	12406				
L IPS (hIP2)		-47	-44	48	8.03
L IPL		-47	-47	58	5.81
L IPL (PFm)		-44	-54	52	5.78
L pMTG/ITG	9750				
L pITG		-60	-42	-18	6.65
L pMTG		-50	-62	2	5.40
L pMTG		-57	-54	2	5.37
L aIFG / OFC	3531				
L OFC		-47	48	-2	5.31
L IFGorb		-42	46	-15	5.08
L OFC		-42	56	-10	5.07
R Cerebellum	3328				
R Cerebellum (Crus 2)		30	-80	-45	4.58
R Cerebellum (Crus 1)		40	-62	-40	4.47
R Cerebellum (Crus 2)		28	-82	-42	4.40
L aIFG / OFC	1766				
L IFG orb (Fo3)		-17	23	-20	5.51
L IFG orb (Fo3)		-22	26	-25	4.63
L OFC (Fo2)		-17	18	-18	4.62
L PCC / MCC	1547				
L PCC		-2	-34	30	5.21

L MCC		0	-30	32	5.06
L MCC		-2	-27	35	5.06
L Caudate	1234	-10	13	0	6.13

Table S3. MVPA results for action feature retrieval (action judgments: high vs. low action words).

Region	Cluster size (mm ³)	x	y	z	T
L IPL/IPS, SPL, pMTG/LTO	46641				
L IPS (hIP2)		-47	-44	48	6.26
L FG (FG4)		-42	-47	-18	6.12
L IPL (PGp)		-50	-67	30	6.10
L IFG, PMC, pre-SMA	18281				
L IFG tri		-44	43	2	5.74
L PMv		-50	6	40	5.70
L IFG tri (44)		-54	16	2	5.50
L dmPFC, ACC	8594				
L ACC		-2	48	12	5.57
L dmPFC (medial SFG)		-2	43	35	5.17
L ACC		-12	26	30	5.07
R aIFG	7047				
R IFG op (45)		58	18	15	5.59
R IFG tri		40	26	22	5.27
R IFG tri (45)		53	18	22	5.04
R Cerebellum	3094				
R Cerebellum (Crus I)		36	-64	-40	5.79
R Cerebellum (Crus I)		40	-70	-45	5.26
R Cerebellum (Crus II)		43	-72	-48	4.98
R MFG	2609				
R MFG		28	40	28	4.77
R MFG		33	40	25	4.72
R MFG		33	50	28	4.40
L PCC / Precuneus	1906				
L PCC		-2	-34	35	4.78
L Precuneus		-7	-54	45	4.44
L Precuneus		-4	-50	40	4.25
L Cerebellum	1844				
L Cerebellum (Crus II)		-40	-77	-50	4.56
L Cerebellum (lobule VIIIa)		-10	-74	-52	4.36
L Cerebellum (lobule VIIb)		-32	-67	-50	4.04
R Calcarine Gyrus	1813				
R Calcarine Gyrus		6	-57	15	4.99
R Calcarine Gyrus (hOc2)		16	-52	8	4.43
R Calcarine Gyrus (hOc2)		-2	-64	12	3.99
L/R Cerebellum	1547				
Cerebellar Vermis (lobule VIIIa)		0	-60	-30	5.33
Cerebellar Vermis (lobule VIIIa)		0	-67	-30	4.45
R Cerebellum (lobule VI)		8	-77	-28	3.93
R IPL/IPS, SPL, S1	1531				
R IPS (hIP3)		38	-54	52	5.02
R IPL (PGa)		50	-60	40	4.05
R SPL (7PC)		36	-47	58	3.86

R IPL	1453				
R IPL (PGp)		46	-67	30	4.41
R IPL (PGp)		48	-82	20	3.72
R IPL (PGp)		58	-67	32	3.71
R MFG	1344				
R MFG		30	16	42	5.44
R MFG		28	28	45	4.82
R MFG		33	20	48	4.01

Table S4. Overlap between univariate and MVPA results for action feature retrieval (action judgments: high vs. low action words).

Region	Cluster size (mm ³)	x	y	z	T
L IPL/IPS, SPL	7813				
L IPS (hIP2)		-47	-44	48	6.26
L IPL (PFm)		-42	-60	50	5.30
L IPL (PFt)		-60	-34	42	4.15
L pMTG	1828				
L pMTG		-50	-60	2	4.96
L pMTG		-60	-47	2	4.09
L pMTG		-64	-50	-5	4.02
R Cerebellum	1266				
R Cerebellum (Crus I)		38	-62	-40	4.47
R Cerebellum (Crus I)		38	-70	-42	4.27
R Cerebellum (Crus I)		46	-67	-40	3.99
L pITG / FG	1156				
L pITG		-57	-40	-15	4.95
L FG (FG4)		-50	-47	-18	3.85
L aIFG / OFC, MFG	500				
L OFC		-47	46	-2	4.09
L MFG		-44	50	2	3.79
L IFG tri		-44	46	5	3.58
L PCC	438				
L FG (FG4)	47	-50	-60	-12	3.77

Table S5. Univariate results for sound feature retrieval (sound judgments: high vs. low sound words).

Region	Cluster size (mm ³)	x	y	z	T
L IPL/IPS	9438				
L IPL (PGa)		-44	-62	50	5.96
L IPL (PGa)		-37	-72	50	5.23
L IPS (hIP2)		-50	-44	52	5.11
L aIFG	8250				
L IFG orb		-47	46	-8	5.68
L IFG orb		-37	36	-18	5.31
L IFG tri		-47	46	2	4.87
L dmPFC	7188				
L dmPFC (medial SFG)		-4	33	38	6.94
L dmPFC (medial SFG)		-12	48	38	5.53
L dmPFC (medial SFG)		-4	30	48	5.49
L MFG / PreCS	3078				
L MFG		-47	16	42	5.17
L MFG		-40	10	48	4.80
L PreCS		-47	20	30	4.54
L vmPFC	1297				
L vmPFC (Fo2)		-12	18	-18	5.92
L vmPFC (Fo3)		-14	23	-22	4.58
L vmPFC (Fo3)		-17	33	-22	4.57
L pMTG	1141				
L pMTG		-57	-42	-12	5.26

L pMTG		-62	-40	-2	4.15
L pMTG		-60	-44	-5	3.59
R Cerebellum	969				
R Cerebellum (Crus I)		40	-64	-42	4.29
R Cerebellum (Crus II)		40	-74	-45	4.06
R Cerebellum (Crus II)		36	-77	-45	4.01
L Insula	813				
L Insula		-30	23	-10	5.29
L Insula		-27	26	-5	4.35
L Insula		-30	18	5	4.08

Table S6. MVPA results for sound feature retrieval (sound judgments: high vs. low sound words).

Region	Cluster size (mm ³)	x	y	z	T
L/R mPFC / ACC, aIFG	83406				
L dmPFC (medial SFG)		-20	36	55	7.22
L dmPFC		-24	16	58	6.56
L dmPFC (medial SFG)		-12	46	40	6.27
L/R IPL/IPS, Precuneus / PCC	61391				
L IPS (hIP2)		-44	-50	45	8.34
L IPL (PFt)		-52	-37	42	7.33
L IPS (hIP3)		-30	-62	50	6.86
R IPL/IPS, SPL	10219				
R IPL (PF)		68	-24	38	6.36
R IPL (PFm)		48	-54	55	6.15
R IPL (PFm)		50	-44	38	5.88
L AAC (pSTG/MTG), FG	9031				
L MOG (hOc5)		-50	-67	-2	5.92
L FG (FG4)		-50	-54	-12	5.50
L FG (FG4)		-47	-50	-25	5.48
R aIFG, Insula	5797				
R IFG tri (45)		56	40	5	6.97
R Insula		33	28	0	5.33
R IFG tri (45)		48	38	15	5.08
R AAC (pSTG/MTG), IPL	2734				
R AAC (TE3)		58	-37	2	5.75
R AAC (TE3)		68	-27	2	5.59
R IPL (PF)		60	-40	15	3.68

Table S7. Overlap between univariate and MVPA results for sound feature retrieval (sound judgments: high vs. low sound words).

Region	Cluster size (mm ³)	x	y	z	T
L IPL/IPS	8172				
L IPL (PFm)		-42	-60	50	5.21
L IPS (hIP2)		-47	-44	50	5.01
L IPS (hIP3)		-34	-57	48	4.98
L dmPFC	5375				
L dmPFC (medial SFG)		-12	48	38	5.37
L dmPFC (medial SFG)		-2	36	35	5.23
L dmPFC (medial SFG)		-4	28	38	5.16
L aIFG	4609				
L IFG orb		-42	48	-10	4.60
L MFG		-44	50	8	4.59
L IFG orb		-42	53	-2	4.51
L MFG / PreCS	1844				
L MFG		-47	13	42	4.59
L MFG		-37	10	50	4.12
L PreCS		-50	18	32	4.09
L pMTG	859				
L pMTG		-60	-42	-12	4.68
L pMTG		-60	-44	-5	3.58

L Insula	578				
L Insula		-30	23	-8	4.36
L Insula		-32	20	-10	4.23
L dmPFC	125	-2	16	60	4.22
L IFG orb (Fo3)	109	-34	38	-18	3.67

Table S8. Univariate results for multimodal regions (conjunction of [action judgments: high vs. low action words] \cap [sound judgments: high vs. low sound words]).

Region	Cluster size (mm ³)	x	y	z	T
L IPL/IPS	4188				
L IPL (PFm)		-42	-60	50	5.30
L IPS (hIP2)		-50	-44	52	5.11
L IPS (hIP3)		-40	-62	42	4.16
L aIFG	2266				
L IFG orb		-47	48	-2	4.78
L IFG orb		-44	46	-15	4.77
L IFG orb		-37	46	-15	4.45
L pMTG/ITG	906				
L pITG		-57	-42	-15	4.87
L pMTG		-62	-44	-5	3.55
R Cerebellum	703				
R Cerebellum (Crus II)		36	-77	-45	4.01
R Cerebellum (Crus I)		40	-67	-42	3.91
L vmPFC	375				
L vmPFC (Fo2)		-14	20	-20	4.24
L vmPFC (Fo3)		-20	28	-20	3.88
L vmPFC (Fo3)		-17	26	-22	3.69

Table S9. MVPA results for multimodal regions (conjunction of [action judgments: high vs. low action words] \cap [sound judgments: high vs. low sound words]).

Region	Cluster size (mm ³)	x	y	z	T
L IPL/IPS, Precuneus	18422				
L IPS (hIP2)		-47	-44	48	6.17
L IPS (hIP1)		-42	-54	45	5.52
L Precuneus (7A)		-27	-70	42	4.70
L IFG	6469				
L IFG tri		-47	40	5	4.70
L IFG op (44)		-54	13	2	4.69
L IFG tri (45)		-50	43	2	4.68
L MFG / PreCS	5234				
L PreCS		-50	10	40	4.48
L PreCS		-44	3	38	4.11
L PreCS		-47	3	52	4.07
L dmPFC / ACC	2703				
L dmPFC (medial SFG)		-2	40	35	4.83
L ACC		-4	26	32	4.80
L ACC		-12	30	28	4.23
L pMTG/ITG, FG	2359				
L FG (FG4)		-42	-50	-25	4.65
L pMTG		-64	-52	-2	4.37
L FG (FG4)		-44	-47	-22	4.36
L PCC	891				
L PCC		-2	-34	35	4.50
L PCC		-2	-30	35	4.44
L PCC		-7	-44	38	3.35
L pITG	875	-57	-40	-15	4.95
L dmPFC / ACC	688				
L ACC		-4	48	12	4.42
L ACC		-2	46	10	4.30
L dmPFC (medial SFG)		-7	43	18	3.72

R IPL/IPS	609				
R IPS (hIP3)		40	-54	52	4.67
R IPL (PGa)		48	-57	45	3.46
R aIFG	531				
R IFG tri (45)		48	36	15	4.15
R IFG tri (45)		50	38	12	3.95
R IFG tri (45)		40	30	15	3.91
R MFG / SFG	469				
R MFG		28	20	45	3.97
R SFG		28	16	38	3.91
R MFG		28	26	45	3.84
L dmPFC (medial SFG)	266	-4	56	35	4.14
L Precuneus	156				
L Precuneus		-2	-50	40	3.79
L Precuneus		-7	-52	45	3.72
L mPFC (Fp1)	156	-7	63	22	3.69

Table S10. Overlap between univariate and MVPA results for multimodal regions (conjunction of [action judgments: high vs. low action words] \cap [sound judgments: high vs. low sound words]).

Region	Cluster size (mm ³)	x	y	z	T
L IPL/IPS	3453				
L IPL (PFm)		-42	-60	50	5.21
L IPS (hIP2)		-47	-44	50	5.01
L IPS (hIP1)		-44	-54	48	4.67
L pMTG	453	-57	-40	-12	4.66
L aIFG	344				
L IFG orb		-44	50	2	3.79
L IFG tri (45)		-50	46	0	3.72
L IFG tri		-44	46	5	3.58

Table S11. Cross-decoding between sound and action feature retrieval (training on [action judgments: high vs. low action words], and testing on [sound judgments: high vs. low sound words], and vice versa).

Region	Cluster size (mm ³)	x	y	z	T
L IPL/IPS, SPL/S1	11094				
L SPL (7A)		-34	-54	52	6.28
L S1 (area 2)		-42	-37	52	5.79
L IPL (PFm)		-47	-54	55	5.30
L Precuneus	4359				
L Precuneus (7P)		-10	-74	50	6.13
L Precuneus (7A)		-4	-70	30	4.43
L Precuneus		0	-60	38	4.03
L dmPFC	3641				
L dmPFC (medial SFG)		-4	33	32	5.17
L dmPFC (medial SFG)		0	33	42	4.63
L dmPFC (medial SFG)		-10	28	50	4.42
R IPL/IPS, SPL/S1	2766				
R S1 (area 2)		38	-40	55	5.76
R IPL (PFm)		50	-40	45	4.78
R IPL (PFt)		50	-32	38	4.32
L aSTG, IFG	1281				
L IFG (44)		-52	10	-2	4.87
L aSTG		-47	3	-2	3.83

Comparison of univariate analysis and MVPA decoding in anatomical ROIs

The following tables report the results of statistical analyses on the univariate activation magnitudes and MVPA decoding accuracies in anatomical regions-of-interest (ROIs) commonly implicated in conceptual-semantic processing. For statistical inference, we first conducted one-sample t-tests in each ROI. Second, we conducted paired t-tests comparing the activation magnitudes / decoding accuracies between experimental conditions. P-values were corrected for multiple comparisons using Bonferroni correction for the number of ROIs.

Table S12. One-sample t-tests on the univariate activation magnitudes (contrast values in arbitrary units) in each ROI against 0.

ROI	Analysis	Mean	SD	T	p (corr.)
L aIFG	Lexical decision: high vs. low sound	0.023	0.055	0.408	1.000
L aIFG	Lexical decision: high vs. low action	-0.026	0.046	-0.555	1.000
L aIFG	Sound judgment: high vs. low sound	0.247	0.069	3.572	0.003
L aIFG	Sound judgment: high vs. low action	-0.225	0.052	-4.307	1.000
L aIFG	Action judgment: high vs. low sound	-0.031	0.057	-0.553	1.000
L aIFG	Action judgment: high vs. low action	0.115	0.069	1.676	0.356
L MFG	Lexical decision: high vs. low sound	0.006	0.046	0.134	1.000
L MFG	Lexical decision: high vs. low action	0.009	0.041	0.225	1.000
L MFG	Sound judgment: high vs. low sound	0.150	0.062	2.402	0.074
L MFG	Sound judgment: high vs. low action	0.012	0.058	0.211	1.000
L MFG	Action judgment: high vs. low sound	0.079	0.044	1.788	0.285
L MFG	Action judgment: high vs. low action	0.091	0.052	1.766	0.299
L pMTG	Lexical decision: high vs. low sound	0.023	0.044	0.531	1.000
L pMTG	Lexical decision: high vs. low action	0.026	0.038	0.692	1.000
L pMTG	Sound judgment: high vs. low sound	0.057	0.051	1.106	0.964
L pMTG	Sound judgment: high vs. low action	-0.012	0.045	-0.256	1.000
L pMTG	Action judgment: high vs. low sound	0.110	0.042	2.617	0.044
L pMTG	Action judgment: high vs. low action	0.124	0.040	3.105	0.012
L pIPL	Lexical decision: high vs. low sound	0.035	0.044	0.785	1.000
L pIPL	Lexical decision: high vs. low action	0.037	0.039	0.958	1.000
L pIPL	Sound judgment: high vs. low sound	0.086	0.051	1.678	0.354
L pIPL	Sound judgment: high vs. low action	0.063	0.047	1.348	0.649
L pIPL	Action judgment: high vs. low sound	0.067	0.051	1.314	0.688
L pIPL	Action judgment: high vs. low action	0.197	0.046	4.271	<0.001
ATL	Lexical decision: high vs. low sound	0.041	0.048	0.846	1.000
ATL	Lexical decision: high vs. low action	0.035	0.032	1.090	0.989
ATL	Sound judgment: high vs. low sound	-0.084	0.060	-1.386	1.000
ATL	Sound judgment: high vs. low action	-0.008	0.045	-0.182	1.000
ATL	Action judgment: high vs. low sound	0.068	0.051	1.331	0.668
ATL	Action judgment: high vs. low action	-0.021	0.047	-0.438	1.000
PCC/Precuneus	Lexical decision: high vs. low sound	0.009	0.057	0.150	1.000
PCC/Precuneus	Lexical decision: high vs. low action	0.037	0.043	0.858	1.000
PCC/Precuneus	Sound judgment: high vs. low sound	-0.016	0.078	-0.212	1.000
PCC/Precuneus	Sound judgment: high vs. low action	0.076	0.057	1.325	0.676
PCC/Precuneus	Action judgment: high vs. low sound	0.123	0.054	2.289	0.097
PCC/Precuneus	Action judgment: high vs. low action	0.019	0.053	0.354	1.000
dmPFC	Lexical decision: high vs. low sound	0.003	0.038	0.086	1.000
dmPFC	Lexical decision: high vs. low action	0.014	0.032	0.436	1.000
dmPFC	Sound judgment: high vs. low sound	0.043	0.050	0.843	1.000
dmPFC	Sound judgment: high vs. low action	-0.021	0.044	-0.477	1.000
dmPFC	Action judgment: high vs. low sound	0.028	0.037	0.749	1.000
dmPFC	Action judgment: high vs. low action	0.034	0.035	0.961	1.000

Table S13. Paired t-tests comparing the univariate activation magnitudes between conditions within each ROI.

ROI	Comparison	Mean	SD	T	p (corr.)
L aIFG	Lexical decision vs. action judgment for high vs. low action	-0.141	0.520	-1.715	0.660
L aIFG	Lexical decision vs. action judgment for high vs. low sound	0.054	0.460	0.745	1.000

L aIFG	Lexical decision vs. sound judgment for high vs. low action	0.200	0.399	3.166	0.021
L aIFG	Lexical decision vs. sound judgment for high vs. low sound	-0.225	0.496	-2.864	0.047
L aIFG	Lexical decision: sound vs. action	0.048	0.559	0.546	1.000
L aIFG	Sound judgment vs. action judgment for high vs. low action	-0.341	0.416	-5.181	<0.001
L aIFG	Sound judgment vs. action judgment for high vs. low sound	0.279	0.605	2.914	0.041
L aIFG	Sound judgment: sound vs. action	0.473	0.625	4.781	<0.001
L aIFG	Action judgment: sound vs. action	-0.147	0.552	-1.682	0.703
L MFG	Lexical decision vs. action judgment for high vs. low action	-0.082	0.412	-1.261	1.000
L MFG	Lexical decision vs. action judgment for high vs. low sound	-0.073	0.353	-1.301	1.000
L MFG	Lexical decision vs. sound judgment for high vs. low action	-0.003	0.451	-0.042	1.000
L MFG	Lexical decision vs. sound judgment for high vs. low sound	-0.143	0.463	-1.957	0.402
L MFG	Lexical decision: sound vs. action	-0.003	0.459	-0.042	1.000
L MFG	Sound judgment vs. action judgment for high vs. low action	-0.079	0.340	-1.471	1.000
L MFG	Sound judgment vs. action judgment for high vs. low sound	0.071	0.462	0.970	1.000
L MFG	Sound judgment: sound vs. action	0.137	0.584	1.489	1.000
L MFG	Action judgment: sound vs. action	-0.013	0.448	-0.177	1.000
L pMTG	Lexical decision vs. action judgment for high vs. low action	-0.098	0.361	-1.715	0.660
L pMTG	Lexical decision vs. action judgment for high vs. low sound	-0.086	0.267	-2.042	0.335
L pMTG	Lexical decision vs. sound judgment for high vs. low action	0.038	0.420	0.566	1.000
L pMTG	Lexical decision vs. sound judgment for high vs. low sound	-0.034	0.448	-0.475	1.000
L pMTG	Lexical decision: sound vs. action	-0.003	0.405	-0.044	1.000
L pMTG	Sound judgment vs. action judgment for high vs. low action	-0.135	0.322	-2.657	0.079
L pMTG	Sound judgment vs. action judgment for high vs. low sound	-0.053	0.434	-0.767	1.000
L pMTG	Sound judgment: sound vs. action	0.068	0.410	1.054	1.000
L pMTG	Action judgment: sound vs. action	-0.014	0.394	-0.232	1.000
L pIPL	Lexical decision vs. action judgment for high vs. low action	-0.160	0.389	-2.594	0.093
L pIPL	Lexical decision vs. action judgment for high vs. low sound	-0.033	0.388	-0.536	1.000
L pIPL	Lexical decision vs. sound judgment for high vs. low action	-0.026	0.415	-0.394	1.000
L pIPL	Lexical decision vs. sound judgment for high vs. low sound	-0.051	0.465	-0.694	1.000
L pIPL	Lexical decision: sound vs. action	-0.003	0.431	-0.041	1.000
L pIPL	Sound judgment vs. action judgment for high vs. low action	-0.134	0.364	-2.324	0.178
L pIPL	Sound judgment vs. action judgment for high vs. low sound	0.018	0.479	0.239	1.000
L pIPL	Sound judgment: sound vs. action	0.022	0.464	0.304	1.000
L pIPL	Action judgment: sound vs. action	-0.129	0.446	-1.836	0.518
ATL	Lexical decision vs. action judgment for high vs. low action	0.055	0.352	0.994	1.000
ATL	Lexical decision vs. action judgment for high vs. low sound	-0.027	0.348	-0.491	1.000
ATL	Lexical decision vs. sound judgment for high vs. low action	0.043	0.371	0.735	1.000
ATL	Lexical decision vs. sound judgment for high vs. low sound	0.125	0.488	1.614	0.802
ATL	Lexical decision: sound vs. action	0.006	0.400	0.095	1.000
ATL	Sound judgment vs. action judgment for high vs. low action	0.012	0.406	0.191	1.000
ATL	Sound judgment vs. action judgment for high vs. low sound	-0.152	0.432	-2.218	0.227
ATL	Sound judgment: sound vs. action	-0.076	0.482	-0.992	1.000
ATL	Action judgment: sound vs. action	0.088	0.419	1.335	1.000

PCC/Precuneus	Lexical decision vs. action judgment for high vs. low action	0.018	0.441	0.261	1.000
PCC/Precuneus	Lexical decision vs. action judgment for high vs. low sound	-0.115	0.418	-1.733	0.638
PCC/Precuneus	Lexical decision vs. sound judgment for high vs. low action	-0.039	0.492	-0.498	1.000
PCC/Precuneus	Lexical decision vs. sound judgment for high vs. low sound	0.025	0.657	0.240	1.000
PCC/Precuneus	Lexical decision: sound vs. action	-0.028	0.499	-0.360	1.000
PCC/Precuneus	Sound judgment vs. action judgment for high vs. low action	0.057	0.350	1.028	1.000
PCC/Precuneus	Sound judgment vs. action judgment for high vs. low sound	-0.139	0.593	-1.488	1.000
PCC/Precuneus	Sound judgment: sound vs. action	-0.092	0.619	-0.941	1.000
PCC/Precuneus	Action judgment: sound vs. action	0.104	0.496	1.330	1.000
dmPFC	Lexical decision vs. action judgment for high vs. low action	-0.020	0.302	-0.414	1.000
dmPFC	Lexical decision vs. action judgment for high vs. low sound	-0.024	0.294	-0.523	1.000
dmPFC	Lexical decision vs. sound judgment for high vs. low action	0.035	0.349	0.631	1.000
dmPFC	Lexical decision vs. sound judgment for high vs. low sound	-0.039	0.368	-0.674	1.000
dmPFC	Lexical decision: sound vs. action	-0.011	0.368	-0.184	1.000
dmPFC	Sound judgment vs. action judgment for high vs. low action	-0.055	0.257	-1.345	1.000
dmPFC	Sound judgment vs. action judgment for high vs. low sound	0.015	0.397	0.238	1.000
dmPFC	Sound judgment: sound vs. action	0.063	0.454	0.882	1.000
dmPFC	Action judgment: sound vs. action	-0.006	0.305	-0.128	1.000

Table S14. One-sample t-tests on the MVPA decoding accuracies in each ROI against chance level (50%).

ROI	Analysis	Mean	SD	T	p (corr.)
L aIFG	Lexical decision: high vs. low sound	-0.195	0.803	-0.243	1.000
L aIFG	Lexical decision: high vs. low action	0.182	0.687	0.265	1.000
L aIFG	Sound judgment: high vs. low sound	3.997	0.659	6.064	<0.001
L aIFG	Sound judgment: high vs. low action	0.169	0.672	0.252	1.000
L aIFG	Action judgment: high vs. low sound	2.044	0.6	3.407	0.005
L aIFG	Action judgment: high vs. low action	3.88	0.585	6.63	<0.001
L MFG	Lexical decision: high vs. low sound	-0.182	0.599	-0.304	1.000
L MFG	Lexical decision: high vs. low action	-0.508	0.585	-0.867	1.000
L MFG	Sound judgment: high vs. low sound	5.977	0.569	10.498	<0.001
L MFG	Sound judgment: high vs. low action	1.797	0.581	3.092	0.013
L MFG	Action judgment: high vs. low sound	0.56	0.587	0.954	1.000
L MFG	Action judgment: high vs. low action	4.193	0.666	6.296	<0.001
L pMTG	Lexical decision: high vs. low sound	-0.078	0.674	-0.116	1.000
L pMTG	Lexical decision: high vs. low action	-0.56	0.605	-0.925	1.000
L pMTG	Sound judgment: high vs. low sound	3.763	0.82	4.59	<0.001
L pMTG	Sound judgment: high vs. low action	1.484	0.55	2.698	0.036
L pMTG	Action judgment: high vs. low sound	0.977	0.663	1.473	0.521
L pMTG	Action judgment: high vs. low action	1.693	0.615	2.753	0.031
L pIPL	Lexical decision: high vs. low sound	0.286	0.56	0.511	1.000
L pIPL	Lexical decision: high vs. low action	-0.234	0.64	-0.366	1.000
L pIPL	Sound judgment: high vs. low sound	4.062	0.698	5.822	<0.001
L pIPL	Sound judgment: high vs. low action	1.341	0.573	2.34	0.086
L pIPL	Action judgment: high vs. low sound	1.862	0.706	2.639	0.042
L pIPL	Action judgment: high vs. low action	2.852	0.77	3.704	0.002
ATL	Lexical decision: high vs. low sound	0.833	0.649	1.284	0.724
ATL	Lexical decision: high vs. low action	-0.638	0.6	-1.064	1.000
ATL	Sound judgment: high vs. low sound	2.969	0.635	4.674	<0.001
ATL	Sound judgment: high vs. low action	-0.13	0.685	-0.19	1.000
ATL	Action judgment: high vs. low sound	0.885	0.546	1.622	0.395
ATL	Action judgment: high vs. low action	2.591	0.75	3.455	0.005
PCC/Precuneus	Lexical decision: high vs. low sound	-0.195	0.638	-0.306	1.000
PCC/Precuneus	Lexical decision: high vs. low action	0.404	0.643	0.628	1.000

PCC/Precuneus	Sound judgment: high vs. low sound	5.052	0.623	8.109	<0.001
PCC/Precuneus	Sound judgment: high vs. low action	3.203	0.722	4.437	<0.001
PCC/Precuneus	Action judgment: high vs. low sound	1.667	0.658	2.532	0.054
PCC/Precuneus	Action judgment: high vs. low action	5.625	0.811	6.94	<0.001
dmPFC	Lexical decision: high vs. low sound	-0.026	0.575	-0.045	1.000
dmPFC	Lexical decision: high vs. low action	0.729	0.657	1.11	0.958
dmPFC	Sound judgment: high vs. low sound	5.156	0.693	7.443	<0.001
dmPFC	Sound judgment: high vs. low action	1.484	0.75	1.978	0.192
dmPFC	Action judgment: high vs. low sound	2.109	0.581	3.628	0.003
dmPFC	Action judgment: high vs. low action	5.807	0.848	6.845	<0.001

Table S15. Paired t-tests comparing the MVPA decoding accuracies between conditions within each ROI.

ROI	Comparison	Mean	SD	T	p (corr.)
L aIFG	Lexical decision vs. action judgment for high vs. low action	-3.698	5.419	-4.316	0.001
L aIFG	Lexical decision vs. action judgment for high vs. low sound	-2.24	5.234	-2.706	0.070
L aIFG	Lexical decision vs. sound judgment for high vs. low action	0.013	6.625	0.012	1.000
L aIFG	Lexical decision vs. sound judgment for high vs. low sound	-4.193	6.909	-3.838	0.003
L aIFG	Lexical decision: sound vs. action	-0.378	5.846	-0.408	1.000
L aIFG	Sound judgment vs. action judgment for high vs. low action	-3.711	4.985	-4.708	<0.001
L aIFG	Sound judgment vs. action judgment for high vs. low sound	1.953	5.571	2.217	0.227
L aIFG	Sound judgment: sound vs. action	3.828	6.13	3.949	0.002
L aIFG	Action judgment: sound vs. action	-1.836	5.283	-2.198	0.238
L MFG	Lexical decision vs. action judgment for high vs. low action	-4.701	4.831	-6.154	<0.001
L MFG	Lexical decision vs. action judgment for high vs. low sound	-0.742	4.917	-0.955	1.000
L MFG	Lexical decision vs. sound judgment for high vs. low action	-2.305	4.945	-2.948	0.038
L MFG	Lexical decision vs. sound judgment for high vs. low sound	-6.159	5.416	-7.192	<0.001
L MFG	Lexical decision: sound vs. action	0.326	4.28	0.481	1.000
L MFG	Sound judgment vs. action judgment for high vs. low action	-2.396	5.276	-2.872	0.046
L MFG	Sound judgment vs. action judgment for high vs. low sound	5.417	5.43	6.309	<0.001
L MFG	Sound judgment: sound vs. action	4.18	5.85	4.518	<0.001
L MFG	Action judgment: sound vs. action	-3.633	5.167	-4.446	<0.001
L pMTG	Lexical decision vs. action judgment for high vs. low action	-2.253	5.158	-2.762	0.061
L pMTG	Lexical decision vs. action judgment for high vs. low sound	-1.055	5.248	-1.271	1.000
L pMTG	Lexical decision vs. sound judgment for high vs. low action	-2.044	5.462	-2.367	0.161
L pMTG	Lexical decision vs. sound judgment for high vs. low sound	-3.841	6.847	-3.548	0.007
L pMTG	Lexical decision: sound vs. action	0.482	5.565	0.548	1.000
L pMTG	Sound judgment vs. action judgment for high vs. low action	-0.208	4.609	-0.286	1.000
L pMTG	Sound judgment vs. action judgment for high vs. low sound	2.786	6.215	2.836	0.050
L pMTG	Sound judgment: sound vs. action	2.279	5.892	2.446	0.133
L pMTG	Action judgment: sound vs. action	-0.716	6.163	-0.735	1.000
L pIPL	Lexical decision vs. action judgment for high vs. low action	-3.086	5.874	-3.323	0.014
L pIPL	Lexical decision vs. action judgment for high vs. low sound	-1.576	5.078	-1.962	0.398
L pIPL	Lexical decision vs. sound judgment for high vs. low action	-1.576	4.996	-1.994	0.372
L pIPL	Lexical decision vs. sound judgment for high vs. low sound	-3.776	5.22	-4.575	<0.001
L pIPL	Lexical decision: sound vs. action	0.521	3.739	0.881	1.000

L pIPL	Sound judgment vs. action judgment for high vs. low action	-1.51	5.375	-1.777	0.583
L pIPL	Sound judgment vs. action judgment for high vs. low sound	2.201	6.619	2.103	0.294
L pIPL	Sound judgment: sound vs. action	2.721	5.968	2.884	0.045
L pIPL	Action judgment: sound vs. action	-0.99	5.943	-1.053	1.000
ATL	Lexical decision vs. action judgment for high vs. low action	-3.229	5.031	-4.06	0.002
ATL	Lexical decision vs. action judgment for high vs. low sound	-0.052	5.806	-0.057	1.000
ATL	Lexical decision vs. sound judgment for high vs. low action	-0.508	5.485	-0.586	1.000
ATL	Lexical decision vs. sound judgment for high vs. low sound	-2.135	5.833	-2.315	0.182
ATL	Lexical decision: sound vs. action	1.471	5.585	1.666	0.726
ATL	Sound judgment vs. action judgment for high vs. low action	-2.721	6.108	-2.818	0.053
ATL	Sound judgment vs. action judgment for high vs. low sound	2.083	5.475	2.406	0.147
ATL	Sound judgment: sound vs. action	3.099	4.707	4.164	0.001
ATL	Action judgment: sound vs. action	-1.706	6.403	-1.685	0.700
PCC/Precuneus	Lexical decision vs. action judgment for high vs. low action	-5.221	6.492	-5.087	<0.001
PCC/Precuneus	Lexical decision vs. action judgment for high vs. low sound	-1.862	6.636	-1.774	0.587
PCC/Precuneus	Lexical decision vs. sound judgment for high vs. low action	-2.799	5.701	-3.105	0.025
PCC/Precuneus	Lexical decision vs. sound judgment for high vs. low sound	-5.247	5.926	-5.6	<0.001
PCC/Precuneus	Lexical decision: sound vs. action	-0.599	4.314	-0.878	1.000
PCC/Precuneus	Sound judgment vs. action judgment for high vs. low action	-2.422	6.684	-2.292	0.192
PCC/Precuneus	Sound judgment vs. action judgment for high vs. low sound	3.385	5.149	4.158	0.001
PCC/Precuneus	Sound judgment: sound vs. action	1.849	5.349	2.186	0.244
PCC/Precuneus	Action judgment: sound vs. action	-3.958	6.132	-4.083	0.001
dmPFC	Lexical decision vs. action judgment for high vs. low action	-5.078	6.277	-5.116	<0.001
dmPFC	Lexical decision vs. action judgment for high vs. low sound	-2.135	5.095	-2.651	0.081
dmPFC	Lexical decision vs. sound judgment for high vs. low action	-0.755	6.774	-0.705	1.000
dmPFC	Lexical decision vs. sound judgment for high vs. low sound	-5.182	5.722	-5.728	<0.001
dmPFC	Lexical decision: sound vs. action	-0.755	5.223	-0.914	1.000
dmPFC	Sound judgment vs. action judgment for high vs. low action	-4.323	6.645	-4.114	0.001
dmPFC	Sound judgment vs. action judgment for high vs. low sound	3.047	5.647	3.412	0.011
dmPFC	Sound judgment: sound vs. action	3.672	6.974	3.33	0.013
dmPFC	Action judgment: sound vs. action	-3.698	6.672	-3.505	0.008

MVPA decoding in large-scale functional networks

The following tables report the results of statistical analyses on the decoding accuracies for MVPA decoding in the large-scale functional networks of Yeo et al. (2011). For statistical inference, we first conducted one-sample t-tests for above-chance decoding in each network. Second, we performed paired t-tests comparing the decoding accuracies for each condition between networks. Finally, we conducted paired t-tests comparing the decoding accuracies between conditions within each network. P-values were corrected for multiple comparisons using Bonferroni correction for the number of networks.

Table S16. One-sample t-tests on the decoding accuracies of each network against chance level (50%).

Network	Analysis	Mean	SD	T	p (corr.)
Visual	Lexical decision: high vs. low sound	0.625	0.693	0.902	1.000
Visual	Lexical decision: high vs. low action	-0.195	0.733	-0.266	1.000
Visual	Sound judgment: high vs. low sound	2.76	0.617	4.473	<0.001
Visual	Sound judgment: high vs. low action	1.901	0.583	3.26	0.008
Visual	Action judgment: high vs. low sound	0.651	0.613	1.061	1.000
Visual	Action judgment: high vs. low action	3.49	0.664	5.254	<0.001
Somatomotor	Lexical decision: high vs. low sound	0.326	0.627	0.519	1.000
Somatomotor	Lexical decision: high vs. low action	0.638	0.632	1.01	1.000
Somatomotor	Sound judgment: high vs. low sound	3.281	0.68	4.824	<0.001
Somatomotor	Sound judgment: high vs. low action	-0.443	0.626	-0.707	1.000
Somatomotor	Action judgment: high vs. low sound	1.732	0.749	2.313	0.091
Somatomotor	Action judgment: high vs. low action	3.672	0.755	4.865	<0.001
Dorsal Attention	Lexical decision: high vs. low sound	0.703	0.599	1.174	0.866
Dorsal Attention	Lexical decision: high vs. low action	-0.326	0.688	-0.473	1.000
Dorsal Attention	Sound judgment: high vs. low sound	6.445	0.783	8.232	<0.001
Dorsal Attention	Sound judgment: high vs. low action	3.164	0.57	5.55	<0.001
Dorsal Attention	Action judgment: high vs. low sound	2.266	0.665	3.408	0.005
Dorsal Attention	Action judgment: high vs. low action	6.667	0.786	8.487	<0.001
Saliency Ventral Attention	Lexical decision: high vs. low sound	0.911	0.673	1.355	0.642
Saliency Ventral Attention	Lexical decision: high vs. low action	0.104	0.737	0.141	1.000
Saliency Ventral Attention	Sound judgment: high vs. low sound	3.984	0.637	6.253	<0.001
Saliency Ventral Attention	Sound judgment: high vs. low action	0.964	0.509	1.894	0.230
Saliency Ventral Attention	Action judgment: high vs. low sound	2.044	0.705	2.901	0.021
Saliency Ventral Attention	Action judgment: high vs. low action	4.062	0.724	5.611	<0.001
Limbic	Lexical decision: high vs. low sound	0.781	0.543	1.439	0.554
Limbic	Lexical decision: high vs. low action	-0.911	0.704	-1.294	1.000
Limbic	Sound judgment: high vs. low sound	2.591	0.686	3.778	0.002
Limbic	Sound judgment: high vs. low action	0.534	0.575	0.928	1.000
Limbic	Action judgment: high vs. low sound	1.055	0.644	1.637	0.384
Limbic	Action judgment: high vs. low action	2.266	0.557	4.071	0.001
Frontoparietal Control	Lexical decision: high vs. low sound	0.417	0.561	0.743	1.000
Frontoparietal Control	Lexical decision: high vs. low action	-0.352	0.699	-0.503	1.000
Frontoparietal Control	Sound judgment: high vs. low sound	7.526	0.749	10.052	<0.001
Frontoparietal Control	Sound judgment: high vs. low action	2.812	0.666	4.221	<0.001
Frontoparietal Control	Action judgment: high vs. low sound	2.708	0.583	4.643	<0.001
Frontoparietal Control	Action judgment: high vs. low action	6.094	0.722	8.445	<0.001
Default	Lexical decision: high vs. low sound	-0.13	0.487	-0.267	1.000
Default	Lexical decision: high vs. low action	-0.065	0.669	-0.097	1.000
Default	Sound judgment: high vs. low sound	6.536	0.745	8.776	<0.001
Default	Sound judgment: high vs. low action	4.036	0.674	5.988	<0.001

Default	Action judgment: high vs. low sound	2.135	0.63	3.387	0.006
Default	Action judgment: high vs. low action	6.276	0.797	7.876	<0.001

Table S17. Paired t-tests comparing the decoding accuracies for each condition between networks.

Analysis	Comparison	Mean	SD	T	p (corr.)
Action judgment: high vs. low action	Control vs. Default	-0.182	3.537	-0.326	1.000
Action judgment: high vs. low action	Dorsal Attention vs. Control	0.573	4.01	0.904	1.000
Action judgment: high vs. low action	Dorsal Attention vs. Default	0.391	3.904	0.633	1.000
Action judgment: high vs. low action	Dorsal Attention vs. Limbic	4.401	4.3	6.474	<0.001
Action judgment: high vs. low action	Dorsal vs. Ventral Attention	2.604	4.459	3.694	0.005
Action judgment: high vs. low action	Limbic vs. Control	-3.828	4.144	-5.842	<0.001
Action judgment: high vs. low action	Limbic vs. Default	-4.01	4.2	-6.039	<0.001
Action judgment: high vs. low action	Somatomotor vs. Control	-2.422	3.766	-4.067	0.001
Action judgment: high vs. low action	Somatomotor vs. Default	-2.604	4.298	-3.832	0.009
Action judgment: high vs. low action	Somatomotor vs. Dorsal Attention	-2.995	3.95	-4.795	<0.001
Action judgment: high vs. low action	Somatomotor vs. Limbic	1.406	3.382	2.63	0.281
Action judgment: high vs. low action	Somatomotor vs. Ventral Attention	-0.391	3.752	-0.659	1.000
Action judgment: high vs. low action	Ventral Attention vs. Control	-2.031	3.843	-3.343	0.022
Action judgment: high vs. low action	Ventral Attention vs. Default	-2.214	3.922	-3.57	0.007
Action judgment: high vs. low action	Ventral Attention vs. Limbic	1.797	3.447	3.297	0.015
Action judgment: high vs. low action	Visual vs. Control	-2.604	3.947	-4.173	0.001
Action judgment: high vs. low action	Visual vs. Default	-2.786	4.002	-4.403	<0.001
Action judgment: high vs. low action	Visual vs. Dorsal Attention	-3.177	2.915	-6.893	<0.001
Action judgment: high vs. low action	Visual vs. Limbic	1.224	3.438	2.252	0.085
Action judgment: high vs. low action	Visual vs. Somatomotor	-0.182	3.923	-0.294	1.000
Action judgment: high vs. low action	Visual vs. Ventral Attention	-0.573	4.213	-0.86	1.000
Action judgment: high vs. low sound	Control vs. Default	0.573	3.125	1.16	1.000
Action judgment: high vs. low sound	Dorsal Attention vs. Control	-0.443	3.846	-0.728	1.000
Action judgment: high vs. low sound	Dorsal Attention vs. Default	0.13	3.296	0.25	1.000
Action judgment: high vs. low sound	Dorsal Attention vs. Limbic	1.211	4.215	1.817	0.539
Action judgment: high vs. low sound	Dorsal vs. Ventral Attention	0.221	3.843	0.364	1.000
Action judgment: high vs. low sound	Limbic vs. Control	-1.654	4.151	-2.519	0.112
Action judgment: high vs. low sound	Limbic vs. Default	-1.081	4.243	-1.611	0.807
Action judgment: high vs. low sound	Somatomotor vs. Control	-0.977	3.128	-1.975	0.835
Action judgment: high vs. low sound	Somatomotor vs. Default	-0.404	3.697	-0.691	1.000
Action judgment: high vs. low sound	Somatomotor vs. Dorsal Attention	-0.534	3.738	-0.903	1.000
Action judgment: high vs. low sound	Somatomotor vs. Limbic	0.677	5.566	0.769	1.000
Action judgment: high vs. low sound	Somatomotor vs. Ventral Attention	-0.313	3.872	-0.51	1.000
Action judgment: high vs. low sound	Ventral Attention vs. Control	-0.664	3.887	-1.081	1.000
Action judgment: high vs. low sound	Ventral Attention vs. Default	-0.091	3.442	-0.167	1.000
Action judgment: high vs. low sound	Ventral Attention vs. Limbic	0.99	4.725	1.325	1.000
Action judgment: high vs. low sound	Visual vs. Control	-2.057	4.123	-3.156	0.013
Action judgment: high vs. low sound	Visual vs. Default	-1.484	4.222	-2.223	0.382
Action judgment: high vs. low sound	Visual vs. Dorsal Attention	-1.615	4.343	-2.351	0.224
Action judgment: high vs. low sound	Visual vs. Limbic	-0.404	4.928	-0.518	1.000
Action judgment: high vs. low sound	Visual vs. Somatomotor	-1.081	4.762	-1.435	0.875
Action judgment: high vs. low sound	Visual vs. Ventral Attention	-1.393	4.445	-1.982	0.376
Lexical decision: high vs. low action	Control vs. Default	-0.286	3.173	-0.571	1.000
Lexical decision: high vs. low action	Dorsal Attention vs. Control	0.026	4.152	0.04	1.000
Lexical decision: high vs. low action	Dorsal Attention vs. Default	-0.26	4.026	-0.409	1.000
Lexical decision: high vs. low action	Dorsal Attention vs. Limbic	0.586	5.182	0.715	1.000
Lexical decision: high vs. low action	Dorsal vs. Ventral Attention	-0.43	4.667	-0.582	1.000
Lexical decision: high vs. low action	Limbic vs. Control	-0.56	4.426	-0.8	1.000
Lexical decision: high vs. low action	Limbic vs. Default	-0.846	4.239	-1.263	1.000
Lexical decision: high vs. low action	Somatomotor vs. Control	0.99	3.878	1.614	1.000
Lexical decision: high vs. low action	Somatomotor vs. Default	0.703	4.121	1.079	1.000
Lexical decision: high vs. low action	Somatomotor vs. Dorsal Attention	0.964	4.546	1.341	0.736
Lexical decision: high vs. low action	Somatomotor vs. Limbic	1.549	4.617	2.122	0.429
Lexical decision: high vs. low action	Somatomotor vs. Ventral Attention	0.534	4.299	0.785	1.000
Lexical decision: high vs. low action	Ventral Attention vs. Control	0.456	3.923	0.735	1.000
Lexical decision: high vs. low action	Ventral Attention vs. Default	0.169	4.166	0.257	1.000

Lexical decision: high vs. low action	Ventral Attention vs. Limbic	1.016	4.115	1.561	1.000
Lexical decision: high vs. low action	Visual vs. Control	0.156	4.324	0.229	1.000
Lexical decision: high vs. low action	Visual vs. Default	-0.13	4.288	-0.192	1.000
Lexical decision: high vs. low action	Visual vs. Dorsal Attention	0.13	4.908	0.168	1.000
Lexical decision: high vs. low action	Visual vs. Limbic	0.716	4.928	0.919	1.000
Lexical decision: high vs. low action	Visual vs. Somatomotor	-0.833	4.812	-1.095	1.000
Lexical decision: high vs. low action	Visual vs. Ventral Attention	-0.299	4.698	-0.403	1.000
Lexical decision: high vs. low sound	Control vs. Default	0.547	3.532	0.979	1.000
Lexical decision: high vs. low sound	Dorsal Attention vs. Control	0.286	3.457	0.524	1.000
Lexical decision: high vs. low sound	Dorsal Attention vs. Default	0.833	3.552	1.484	0.807
Lexical decision: high vs. low sound	Dorsal Attention vs. Limbic	-0.078	4.43	-0.112	1.000
Lexical decision: high vs. low sound	Dorsal vs. Ventral Attention	-0.208	4.343	-0.303	1.000
Lexical decision: high vs. low sound	Limbic vs. Control	0.365	4.608	0.5	1.000
Lexical decision: high vs. low sound	Limbic vs. Default	0.911	3.474	1.659	0.886
Lexical decision: high vs. low sound	Somatomotor vs. Control	-0.091	4.419	-0.13	1.000
Lexical decision: high vs. low sound	Somatomotor vs. Default	0.456	3.828	0.753	1.000
Lexical decision: high vs. low sound	Somatomotor vs. Dorsal Attention	-0.378	3.802	-0.628	1.000
Lexical decision: high vs. low sound	Somatomotor vs. Limbic	-0.456	5.107	-0.564	1.000
Lexical decision: high vs. low sound	Somatomotor vs. Ventral Attention	-0.586	4.448	-0.833	1.000
Lexical decision: high vs. low sound	Ventral Attention vs. Control	0.495	4.254	0.736	1.000
Lexical decision: high vs. low sound	Ventral Attention vs. Default	1.042	4.043	1.63	0.802
Lexical decision: high vs. low sound	Ventral Attention vs. Limbic	0.13	4.447	0.185	1.000
Lexical decision: high vs. low sound	Visual vs. Control	0.208	4.601	0.286	1.000
Lexical decision: high vs. low sound	Visual vs. Default	0.755	3.88	1.231	1.000
Lexical decision: high vs. low sound	Visual vs. Dorsal Attention	-0.078	4.323	-0.114	1.000
Lexical decision: high vs. low sound	Visual vs. Limbic	-0.156	4.435	-0.223	1.000
Lexical decision: high vs. low sound	Visual vs. Somatomotor	0.299	4.158	0.456	1.000
Lexical decision: high vs. low sound	Visual vs. Ventral Attention	-0.286	4.404	-0.411	1.000
Sound judgment: high vs. low action	Control vs. Default	-1.224	3.891	-1.989	0.154
Sound judgment: high vs. low action	Dorsal Attention vs. Control	0.352	3.476	0.64	1.000
Sound judgment: high vs. low action	Dorsal Attention vs. Default	-0.872	3.519	-1.568	0.388
Sound judgment: high vs. low action	Dorsal Attention vs. Limbic	2.63	3.88	4.288	0.005
Sound judgment: high vs. low action	Dorsal vs. Ventral Attention	2.201	3.494	3.983	<0.001
Sound judgment: high vs. low action	Limbic vs. Control	-2.279	4.163	-3.462	0.003
Sound judgment: high vs. low action	Limbic vs. Default	-3.503	3.912	-5.663	<0.001
Sound judgment: high vs. low action	Somatomotor vs. Control	-3.255	3.97	-5.186	<0.001
Sound judgment: high vs. low action	Somatomotor vs. Default	-4.479	4.807	-5.894	<0.001
Sound judgment: high vs. low action	Somatomotor vs. Dorsal Attention	-3.607	4.172	-5.467	<0.001
Sound judgment: high vs. low action	Somatomotor vs. Limbic	-0.977	4.218	-1.464	0.921
Sound judgment: high vs. low action	Somatomotor vs. Ventral Attention	-1.406	3.977	-2.236	0.218
Sound judgment: high vs. low action	Ventral Attention vs. Control	-1.849	4.084	-2.863	0.047
Sound judgment: high vs. low action	Ventral Attention vs. Default	-3.073	4.728	-4.111	0.001
Sound judgment: high vs. low action	Ventral Attention vs. Limbic	0.43	3.737	0.727	1.000
Sound judgment: high vs. low action	Visual vs. Control	-0.911	3.742	-1.54	1.000
Sound judgment: high vs. low action	Visual vs. Default	-2.135	3.494	-3.865	0.002
Sound judgment: high vs. low action	Visual vs. Dorsal Attention	-1.263	3.348	-2.386	0.167
Sound judgment: high vs. low action	Visual vs. Limbic	1.367	4.486	1.927	0.210
Sound judgment: high vs. low action	Visual vs. Somatomotor	2.344	4.048	3.662	0.002
Sound judgment: high vs. low action	Visual vs. Ventral Attention	0.937	3.681	1.611	0.552
Sound judgment: high vs. low sound	Control vs. Default	0.99	3.468	1.804	0.779
Sound judgment: high vs. low sound	Dorsal Attention vs. Control	-1.081	4.056	-1.685	0.699
Sound judgment: high vs. low sound	Dorsal Attention vs. Default	-0.091	4.07	-0.142	1.000
Sound judgment: high vs. low sound	Dorsal Attention vs. Limbic	3.854	4.915	4.959	<0.001
Sound judgment: high vs. low sound	Dorsal vs. Ventral Attention	2.461	3.475	4.479	0.001
Sound judgment: high vs. low sound	Limbic vs. Control	-4.935	3.429	-9.103	<0.001
Sound judgment: high vs. low sound	Limbic vs. Default	-3.945	3.287	-7.59	<0.001
Sound judgment: high vs. low sound	Somatomotor vs. Control	-4.245	3.795	-7.073	<0.001
Sound judgment: high vs. low sound	Somatomotor vs. Default	-3.255	3.861	-5.332	<0.001
Sound judgment: high vs. low sound	Somatomotor vs. Dorsal Attention	-3.164	4.473	-4.474	<0.001
Sound judgment: high vs. low sound	Somatomotor vs. Limbic	0.69	3.819	1.143	1.000
Sound judgment: high vs. low sound	Somatomotor vs. Ventral Attention	-0.703	3.354	-1.326	1.000
Sound judgment: high vs. low sound	Ventral Attention vs. Control	-3.542	3.638	-6.158	<0.001
Sound judgment: high vs. low sound	Ventral Attention vs. Default	-2.552	3.922	-4.115	0.003
Sound judgment: high vs. low sound	Ventral Attention vs. Limbic	1.393	3.993	2.207	0.233

Sound judgment: high vs. low sound	Visual vs. Control	-4.766	4.921	-6.125	<0.001
Sound judgment: high vs. low sound	Visual vs. Default	-3.776	4.577	-5.218	<0.001
Sound judgment: high vs. low sound	Visual vs. Dorsal Attention	-3.685	5.232	-4.455	0.001
Sound judgment: high vs. low sound	Visual vs. Limbic	0.169	4.662	0.23	1.000
Sound judgment: high vs. low sound	Visual vs. Somatomotor	-0.521	4.396	-0.749	1.000
Sound judgment: high vs. low sound	Visual vs. Ventral Attention	-1.224	4.861	-1.592	1.000

Table S18. Paired t-tests comparing the decoding accuracies between conditions within each network.

Network	Comparison	Mean	SD	T	p (corr.)
Visual	Lexical decision vs. action judgment for high vs. low action	-3.685	6.855	-3.400	0.011
Visual	Lexical decision vs. action judgment for high vs. low sound	-0.026	6.083	-0.027	1.000
Visual	Lexical decision vs. sound judgment for high vs. low action	-2.096	5.303	-2.500	0.117
Visual	Lexical decision vs. sound judgment for high vs. low sound	-2.135	5.576	-2.422	0.141
Visual	Lexical decision: sound vs. action	0.820	5.474	0.948	1.000
Visual	Sound judgment vs. action judgment for high vs. low action	-1.589	5.504	-1.825	0.529
Visual	Sound judgment vs. action judgment for high vs. low sound	2.109	5.902	2.260	0.206
Visual	Sound judgment: sound vs. action	0.859	6.009	0.905	1.000
Visual	Action judgment: sound vs. action	-2.839	6.036	-2.974	0.035
Somatomotor	Lexical decision vs. action judgment for high vs. low action	-3.034	6.559	-2.925	0.040
Somatomotor	Lexical decision vs. action judgment for high vs. low sound	-1.406	6.142	-1.448	1.000
Somatomotor	Lexical decision vs. sound judgment for high vs. low action	1.081	5.266	1.298	1.000
Somatomotor	Lexical decision vs. sound judgment for high vs. low sound	-2.956	6.380	-2.930	0.039
Somatomotor	Lexical decision: sound vs. action	-0.313	5.683	-0.348	1.000
Somatomotor	Sound judgment vs. action judgment for high vs. low action	-4.115	5.508	-4.725	<0.001
Somatomotor	Sound judgment vs. action judgment for high vs. low sound	1.549	6.074	1.613	0.803
Somatomotor	Sound judgment: sound vs. action	3.724	6.199	3.799	0.003
Somatomotor	Action judgment: sound vs. action	-1.940	6.272	-1.956	0.403
Dorsal Attention	Lexical decision vs. action judgment for high vs. low action	-6.992	6.280	-7.042	<0.001
Dorsal Attention	Lexical decision vs. action judgment for high vs. low sound	-1.563	5.475	-1.805	0.552
Dorsal Attention	Lexical decision vs. sound judgment for high vs. low action	-3.490	4.755	-4.642	<0.001
Dorsal Attention	Lexical decision vs. sound judgment for high vs. low sound	-5.742	5.631	-6.449	<0.001
Dorsal Attention	Lexical decision: sound vs. action	1.029	5.604	1.161	1.000
Dorsal Attention	Sound judgment vs. action judgment for high vs. low action	-3.503	5.471	-4.049	0.002
Dorsal Attention	Sound judgment vs. action judgment for high vs. low sound	4.180	5.539	4.772	<0.001
Dorsal Attention	Sound judgment: sound vs. action	3.281	5.923	3.503	0.008
Dorsal Attention	Action judgment: sound vs. action	-4.401	6.822	-4.080	0.002
Saliency Ventral Attention	Lexical decision vs. action judgment for high vs. low action	-3.958	6.416	-3.902	0.003
Saliency Ventral Attention	Lexical decision vs. action judgment for high vs. low sound	-1.133	6.124	-1.170	1.000
Saliency Ventral Attention	Lexical decision vs. sound judgment for high vs. low action	-0.859	6.056	-0.897	1.000
Saliency Ventral Attention	Lexical decision vs. sound judgment for high vs. low sound	-3.073	5.669	-3.429	0.010
Saliency Ventral Attention	Lexical decision: sound vs. action	0.807	6.073	0.841	1.000
Saliency Ventral Attention	Sound judgment vs. action judgment for high vs. low action	-3.099	5.774	-3.394	0.011
Saliency Ventral Attention	Sound judgment vs. action judgment for high vs. low sound	1.940	5.756	2.132	0.276
Saliency Ventral Attention	Sound judgment: sound vs. action	3.021	5.145	3.713	0.004

Saliency Ventral Attention	Action judgment: sound vs. action	-2.018	6.714	-1.901	0.453
Limbic	Lexical decision vs. action judgment for high vs. low action	-3.177	5.771	-3.482	0.009
Limbic	Lexical decision vs. action judgment for high vs. low sound	-0.273	5.482	-0.315	1.000
Limbic	Lexical decision vs. sound judgment for high vs. low action	-1.445	6.093	-1.500	0.991
Limbic	Lexical decision vs. sound judgment for high vs. low sound	-1.810	5.766	-1.985	0.379
Limbic	Lexical decision: sound vs. action	1.693	4.828	2.217	0.227
Limbic	Sound judgment vs. action judgment for high vs. low action	-1.732	3.729	-2.937	0.039
Limbic	Sound judgment vs. action judgment for high vs. low sound	1.536	5.865	1.657	0.739
Limbic	Sound judgment: sound vs. action	2.057	5.018	2.593	0.093
Limbic	Action judgment: sound vs. action	-1.211	5.299	-1.445	1.000
Frontoparietal Control	Lexical decision vs. action judgment for high vs. low action	-6.445	5.597	-7.283	<0.001
Frontoparietal Control	Lexical decision vs. action judgment for high vs. low sound	-2.292	5.138	-2.821	0.052
Frontoparietal Control	Lexical decision vs. sound judgment for high vs. low action	-3.164	5.860	-3.415	0.011
Frontoparietal Control	Lexical decision vs. sound judgment for high vs. low sound	-7.109	5.833	-7.709	<0.001
Frontoparietal Control	Lexical decision: sound vs. action	0.768	5.776	0.841	1.000
Frontoparietal Control	Sound judgment vs. action judgment for high vs. low action	-3.281	6.022	-3.446	0.010
Frontoparietal Control	Sound judgment vs. action judgment for high vs. low sound	4.818	5.594	5.447	<0.001
Frontoparietal Control	Sound judgment: sound vs. action	4.714	6.500	4.586	<0.001
Frontoparietal Control	Action judgment: sound vs. action	-3.385	5.546	-3.861	0.003
Default	Lexical decision vs. action judgment for high vs. low action	-6.341	6.358	-6.308	<0.001
Default	Lexical decision vs. action judgment for high vs. low sound	-2.266	5.196	-2.758	0.062
Default	Lexical decision vs. sound judgment for high vs. low action	-4.102	5.254	-4.937	<0.001
Default	Lexical decision vs. sound judgment for high vs. low sound	-6.667	5.786	-7.288	<0.001
Default	Lexical decision: sound vs. action	-0.065	4.962	-0.083	1.000
Default	Sound judgment vs. action judgment for high vs. low action	-2.240	6.201	-2.284	0.195
Default	Sound judgment vs. action judgment for high vs. low sound	4.401	5.671	4.908	<0.001
Default	Sound judgment: sound vs. action	2.500	6.586	2.401	0.149
Default	Action judgment: sound vs. action	-4.141	5.830	-4.492	<0.001

Cross-decoding of task-relevant conceptual features

We also performed cross-decoding in each network of the 7-network parcellation by Yeo et al. (2011), training on the activity patterns for [sound judgment: high vs. low sound words], and testing on the activity patterns for [action judgment: high vs. low action words], as well as vice versa.

The following tables report the results of statistical analyses on the decoding accuracies. We first conducted one-sample t-tests for above-chance decoding in each network. Second, we performed paired t-tests comparing the decoding accuracies between networks. P-values were corrected for multiple comparisons using Bonferroni correction for the number of networks.

Table S19. One-sample t-tests on the decoding accuracies of each network against chance level (50%).

Network	Mean	SD	T	p (corr.)
Visual	1.133	0.361	3.139	0.011
Somatomotor	1.745	0.426	4.099	0.001
Dorsal Attention	2.637	0.447	5.905	<0.001
Saliency Ventral Attention	2.057	0.480	4.285	<0.001
Limbic	1.016	0.487	2.084	0.153
Frontoparietal Control	3.828	0.521	7.351	<0.001
Default	2.826	0.547	5.164	<0.001

Table S20. Paired t-tests comparing the decoding accuracies between networks.

Network	Mean	SD	T	p (corr.)
Control vs. Default	1.003	2.186	2.901	0.043
Dorsal Attention vs. Control	-1.191	3.383	-2.227	0.222
Dorsal Attention vs. Default	-0.189	3.482	-0.343	1.000
Dorsal Attention vs. Limbic	1.621	3.701	2.770	0.060
Dorsal Attention vs. Ventral Attention	0.579	3.233	1.133	1.000
Limbic vs. Control	-2.813	3.320	-5.358	<0.001
Limbic vs. Default	-1.810	3.135	-3.651	0.005
Ventral Attention vs. Control	-1.771	2.866	-3.908	0.003
Ventral Attention vs. Default	-0.768	2.968	-1.637	0.768
Ventral Attention vs. Limbic	1.042	2.803	2.350	0.167
Somatomotor vs. Control	-2.083	2.987	-4.412	0.001
Somatomotor vs. Default	-1.081	3.210	-2.129	0.277
Somatomotor vs. Dorsal Attention	-0.892	2.917	-1.934	0.423
Somatomotor vs. Limbic	0.729	3.483	1.324	1.000
Somatomotor vs. Ventral Attention	-0.312	3.129	-0.632	1.000
Visual vs. Control	-2.695	2.741	-6.219	<0.001
Visual vs. Default	-1.693	3.173	-3.374	0.012
Visual vs. Dorsal Attention	-1.504	2.539	-3.746	0.004
Visual vs. Limbic	0.117	3.221	0.230	1.000
Visual vs. Ventral Attention	-0.924	2.612	-2.238	0.217
Visual vs. Somatomotor	-0.612	2.525	-1.533	0.933

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