# Supplemental Material

1. Text. Overview

We compared the common model of information spaces based on CHA to a common model based on response hyperalignment (RHA)[16]. Comparison of the effects of CHA and RHA on ISC of representational geometry and bsMVPC of movie time-segments showed that, whereas alignment of connectivity profiles was slightly better after CHA than after RHA (Supplementary Figure S1), alignment of patterns of response was slightly better after RHA than after CHA (Supplementary Figures S2 and S3). We also illustrate the fine-grain structure in group mean connectivity patterns after CHA (Figure 7), and in Supplementary Figure 4 we show all individual connectivity patterns in the same left lateral-occipital/inferior-temporal cortical field with connectivity targets in left mid fusiform and mid superior temporal sulcus cortices. Supplementary Table S1 show the coordinates used as the centers of functional ROIs used to quantify results in Figures 2, 3, and 4, Supplementary Table S2 lists the tasks and task contrasts from the HCP database used in Figure 6.

## 2. Figures S1, S2, and S3. Comparison of CHA and RHA
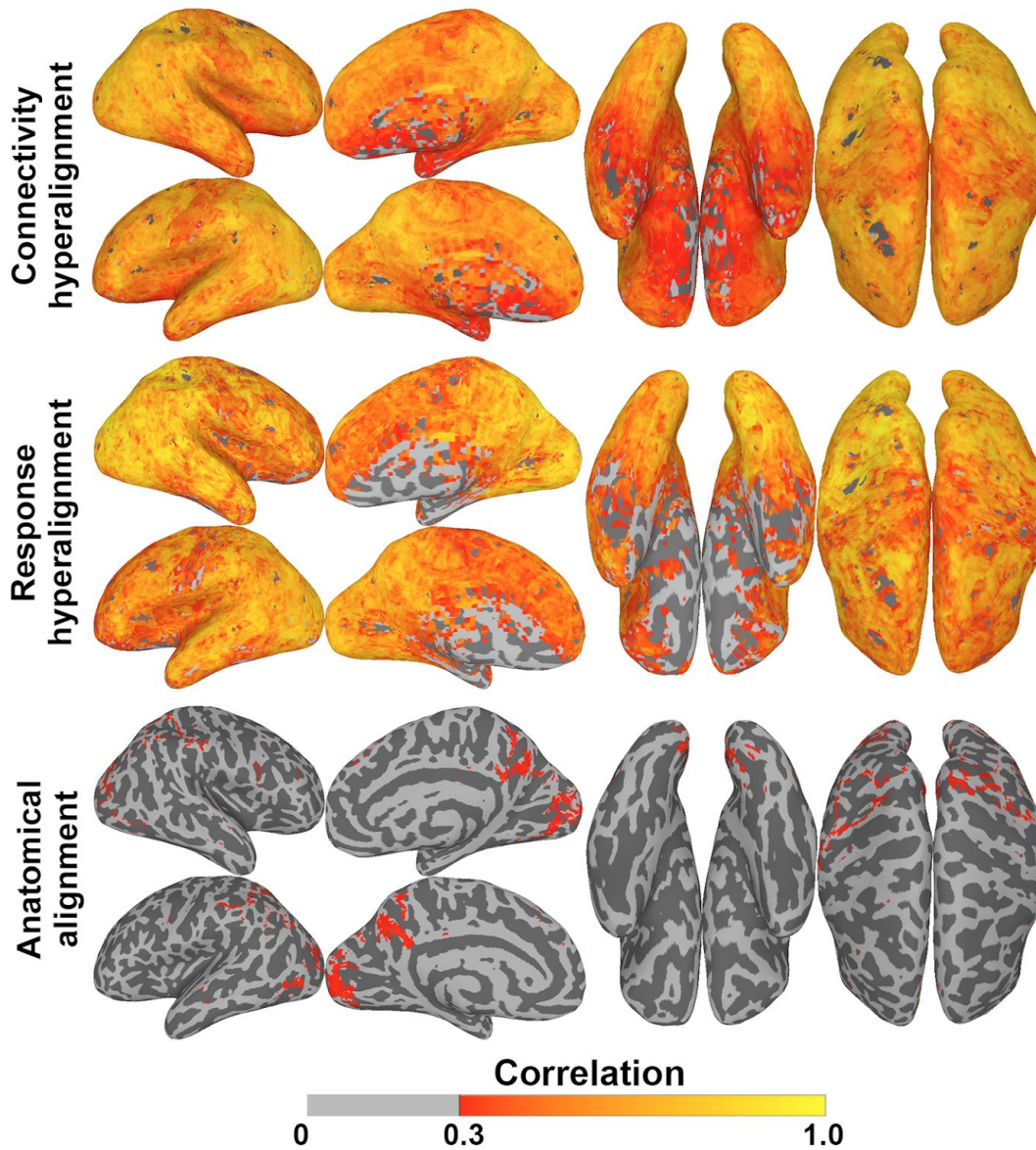
Supplementary Figure S1. ISC of connectivity profiles calculated from responses to the movie.

ISCs of representational geometry in each voxel are mapped onto cortical surfaces after CHA,

RHA, and anatomical alignment, RHA, and CHA. Maps of ISCs after CHA and anatomical

alignment are identical to maps shown in Fig 2 and are reproduced here to facilitate

comparison to RHA.
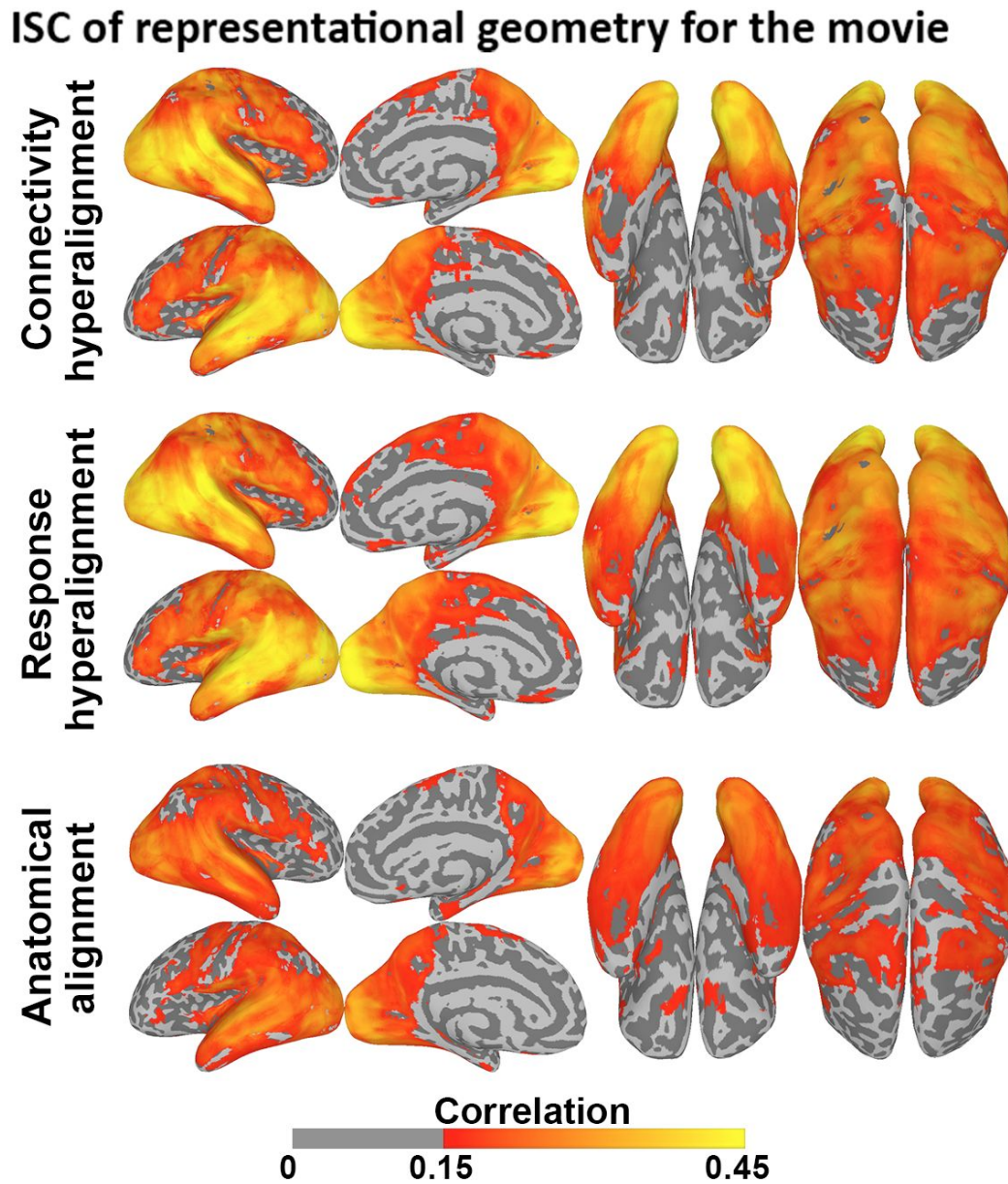
Supplementary Figure S2. ISC of representational geometries in the responses to movie time-points. ISCs of representational geometry in each voxel are mapped onto cortical surfaces after CHA, RHA, and anatomical alignment, RHA, and CHA. Maps of ISCs after CHA and anatomical alignment are identical to maps shown in Fig 5 and are reproduced here to facilitate comparison to RHA.

bsMVPC of movie time segments
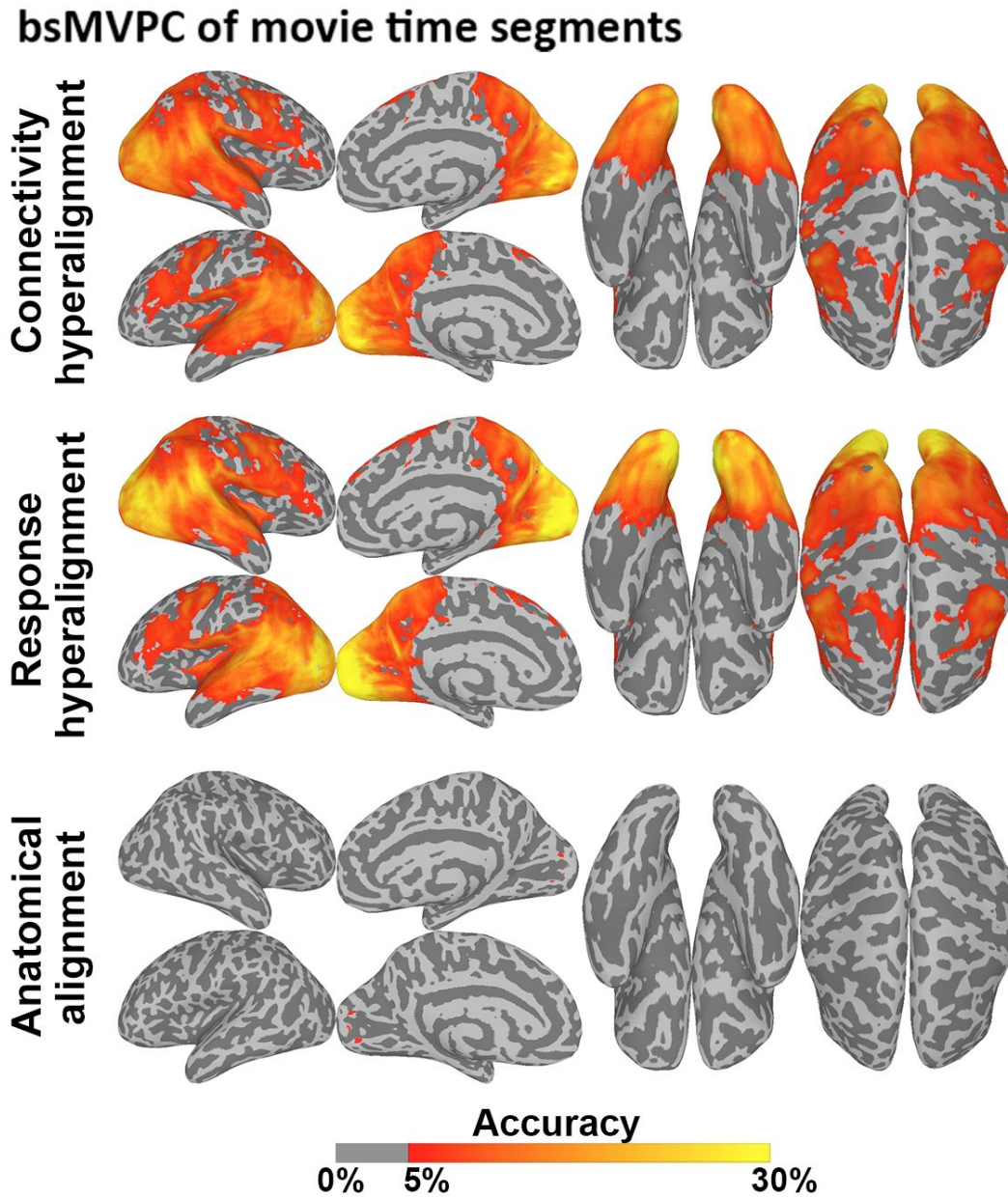
Supplementary Figure S3. Between-subject classification of movie segments. Classification accuracies in each searchlight mapped on cortical surfaces after CHA, RHA, and anatomical alignment.

3. Figure S4. Illustration of fine-grained structure of connectivity patterns.
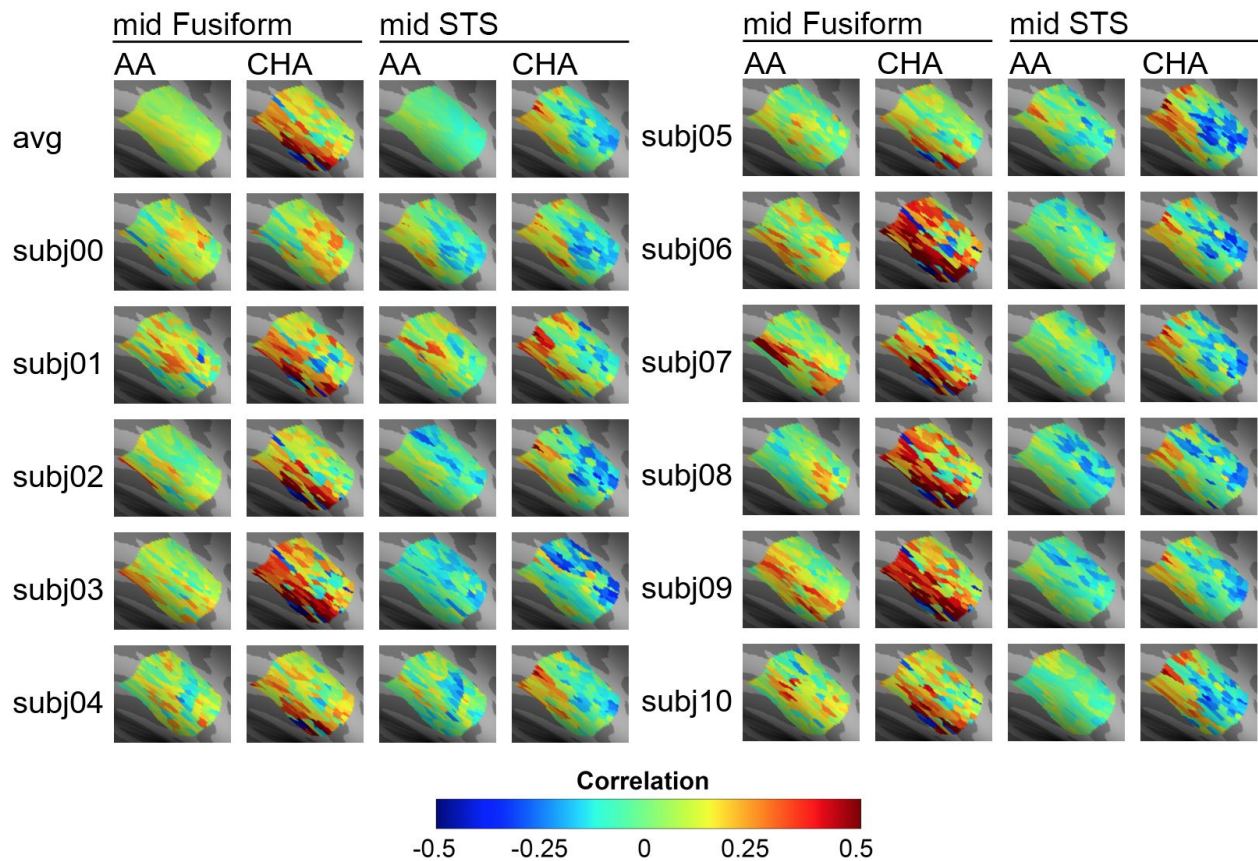
Supplementary Figure S4. Individual connectivity patterns in a left

lateral-occipital/inferior-temporal cortical field for connectivities with targets in left mid lateral

fusiform gyrus and left mid superior temporal sulcus. Connectivity patterns are shown for

anatomically-aligned data and data transformed into the common model connectome.

Connectivities are correlations between time series responses to the movie. CHA

transformation matrices were derived from independent data from the other movie half. Group

mean connectivity patterns are shown in the first row for comparison (also shown in Figure 7).

4. Supplementary Tables

Supplementary Table 1. Selected cortical loci implicated in visual, auditory, cognitive, and social functions from Neurosynth.

Search Term	Hemisphere	MNI Coordinates (x, y, z)		
Visual				
V1	Left	-4	-82	-4
	Right	10	-94	2
MT	Left	-42	-72	2
	Right	44	-66	2
Visual word form area	Left	-46	-60	-14
FFA	Left	-42	-52	-20
	Right	40	-50	-22
Scenes (PPA)	Left	-26	-46	-10
	Right	34	-38	-12
Auditory				
Primary Auditory (A1)	Left	-44	-30	10
	Right	52	-14	4
Voice	Left	-60	-14	0
	Right	60	-4	-12
Music	Left	-52	-14	0
	Right	60	-20	4
Cognitive				
Calculations	Left	-30	-66	38
	Right	34	-64	44
Broca's area	Left	-52	14	12
Working memory	Left	-44	26	24
	Right	44	42	26

Social				
MPFC		6	54	14
TPJ	Left	50	-52	22
	Right	-52	-56	22
Precuneus		0	-56	40

V1 - primary visual cortex, MT - middle temporal visual motion area, FFA - fusiform face area, PPA - parahippocampal place area, MPFC - medial prefrontal cortex, TPJ - temporoparietal junction.

Supplementary Table 2. Task maps used from the HCP data.

Experiment/Task	Maps
MOTOR	CUE, LF, LH, RF, RH, T, CUE-AVG, LF-AVG, LH-AVG, RF-AVG, RH-AVG, T-AVG
LANGUAGE	MATH, STORY, MATH-STORY
WM (Working Memory)	2BK_BODY, 2BK_FACE, 2BK_PLACE, 2BK_TOOL, 0BK_BODY, 0BK_FACE, 0BK_PLACE, 0BK_TOOL, 2BK, 0BK, 2BK-0BK, BODY, FACE, PLACE, TOOL, BODY-AVG, FACE-AVG, PLACE-AVG, TOOL-AVG
RELATIONAL	MATH, REL, MATCH-REL
EMOTION	FACES, SHAPES, FACES-SHAPES
SOCIAL	RANDOM, TOM, TOM-RANDOM
GAMBLING	PUNISH, REWARD, PUNISH-REWARD

LF - Left Finger, RH - Right Hand, 2BK - Two-Back, TOM - Theory Of Mind