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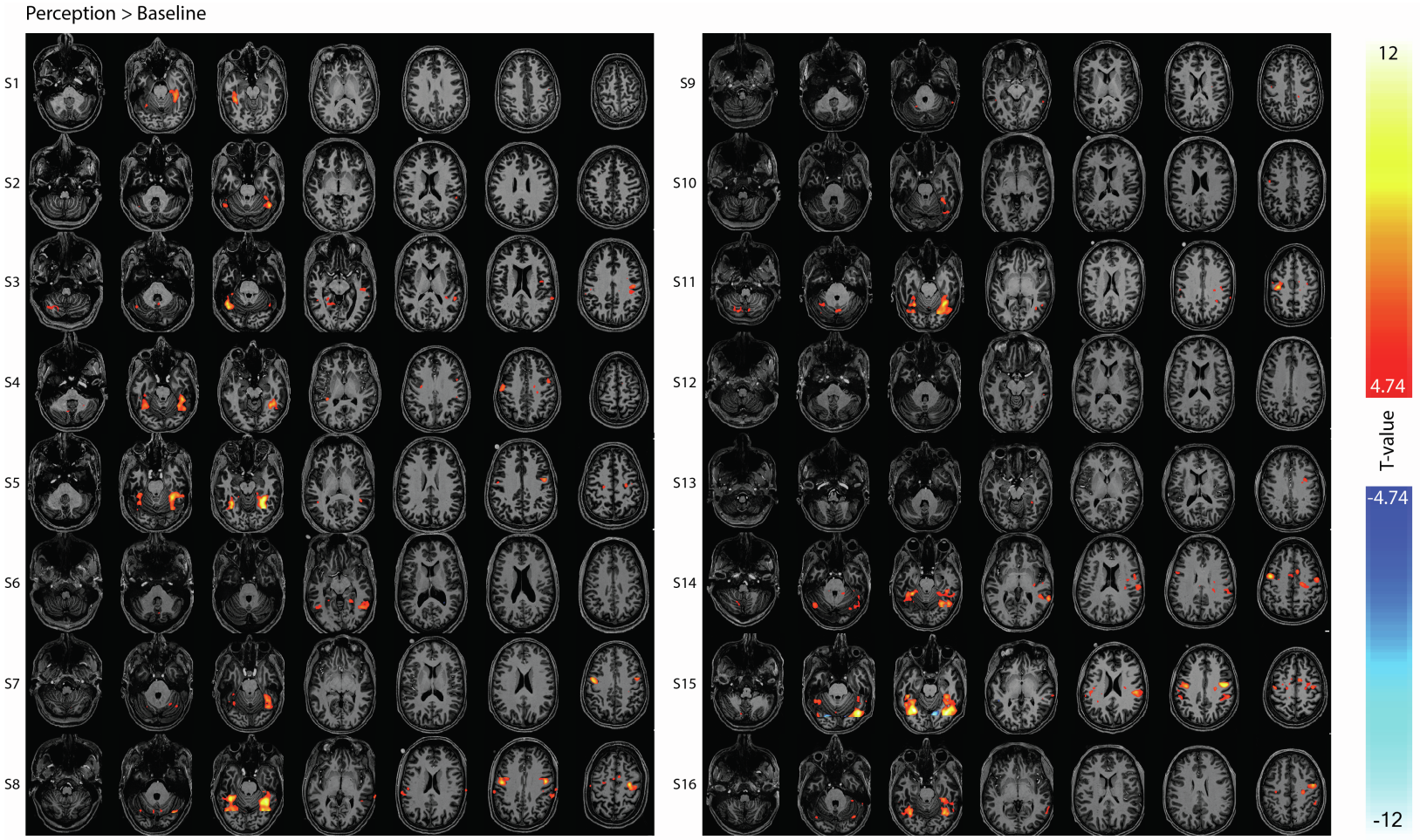
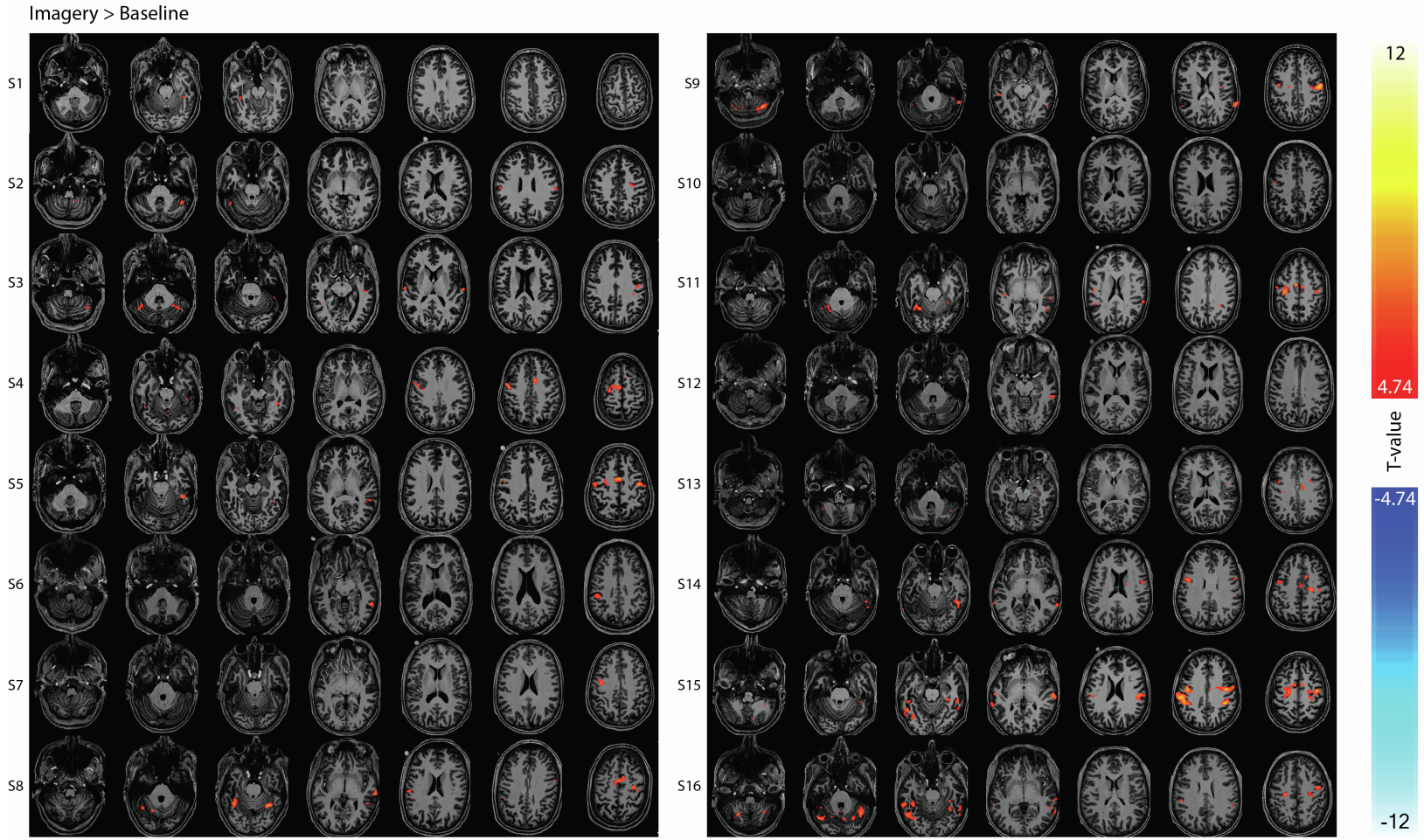
Supplemental information

Laminar dissociation of feedforward and feedback in high-level ventral visual cortex during imagery and perception

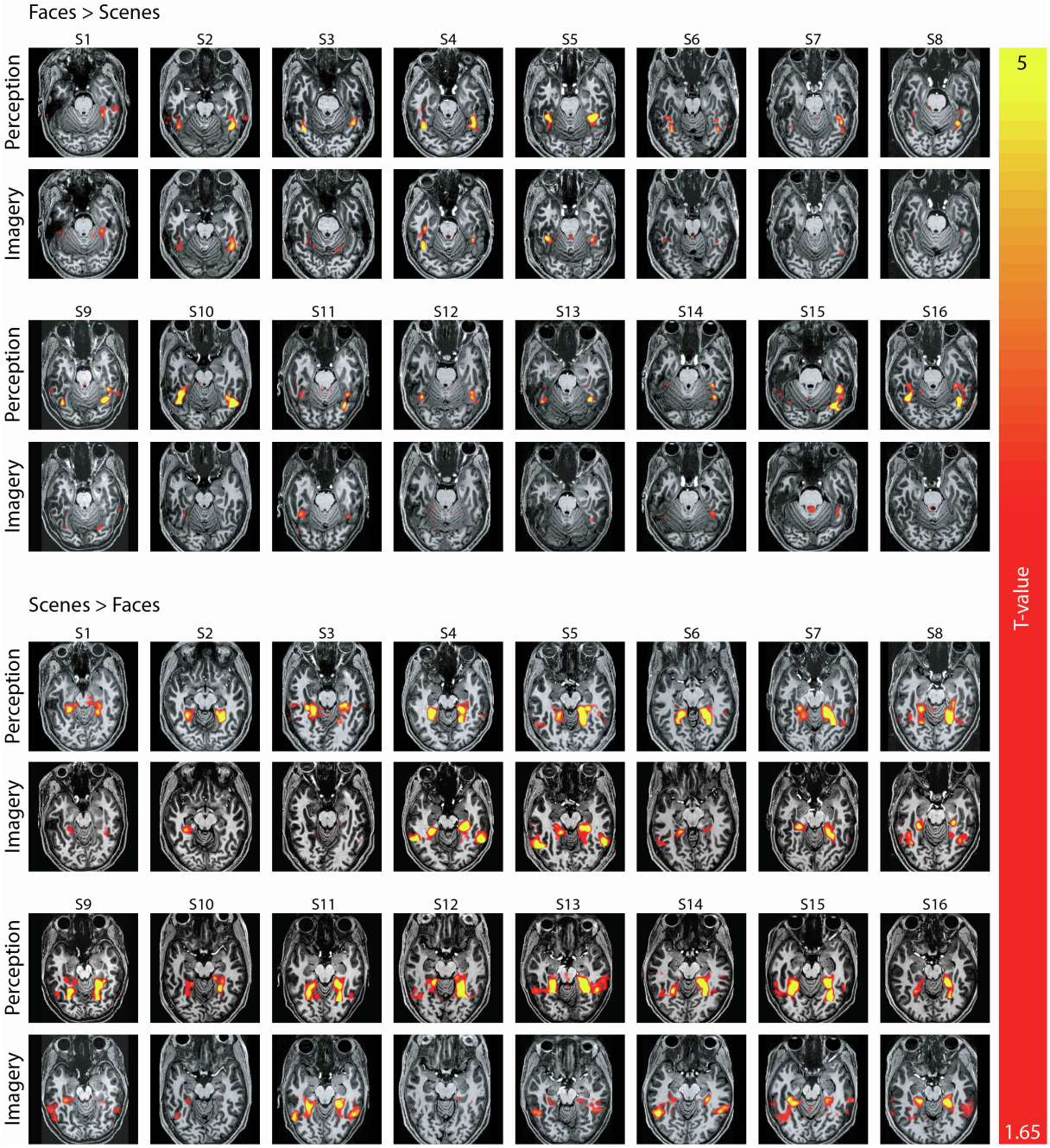
Tony Carricarte, Polina Iamshchinina, Robert Trampel, Denis Chaimow, Nikolaus Weiskopf, and Radoslaw M. Cichy



Supplemental Figure 1 related to Figure 1E. Responses at the macroscale level of cortical organization in the brain during perception. Neural responses during perception. Each row corresponds to a subject specific (S1 to S16) T-activation map of the perception > baseline contrast across different slices along the z-axis superimposed on that subject's individual T1-weighted image. Results are family-wise error corrected $p < 0.05$ for visualization purposes only.



Supplemental Figure 2 related to Figure 1E. Responses at the macroscale level of cortical organization in the brain during imagery. Neural responses during imagery. Each row corresponds to a subject specific (S1 to S16) T-activation map of the imagery > baseline contrast across different slices along the z-axis superimposed on that subject's individual T1-weighted image. Results are family-wise error corrected $p < 0.05$ for visualization purposes only.

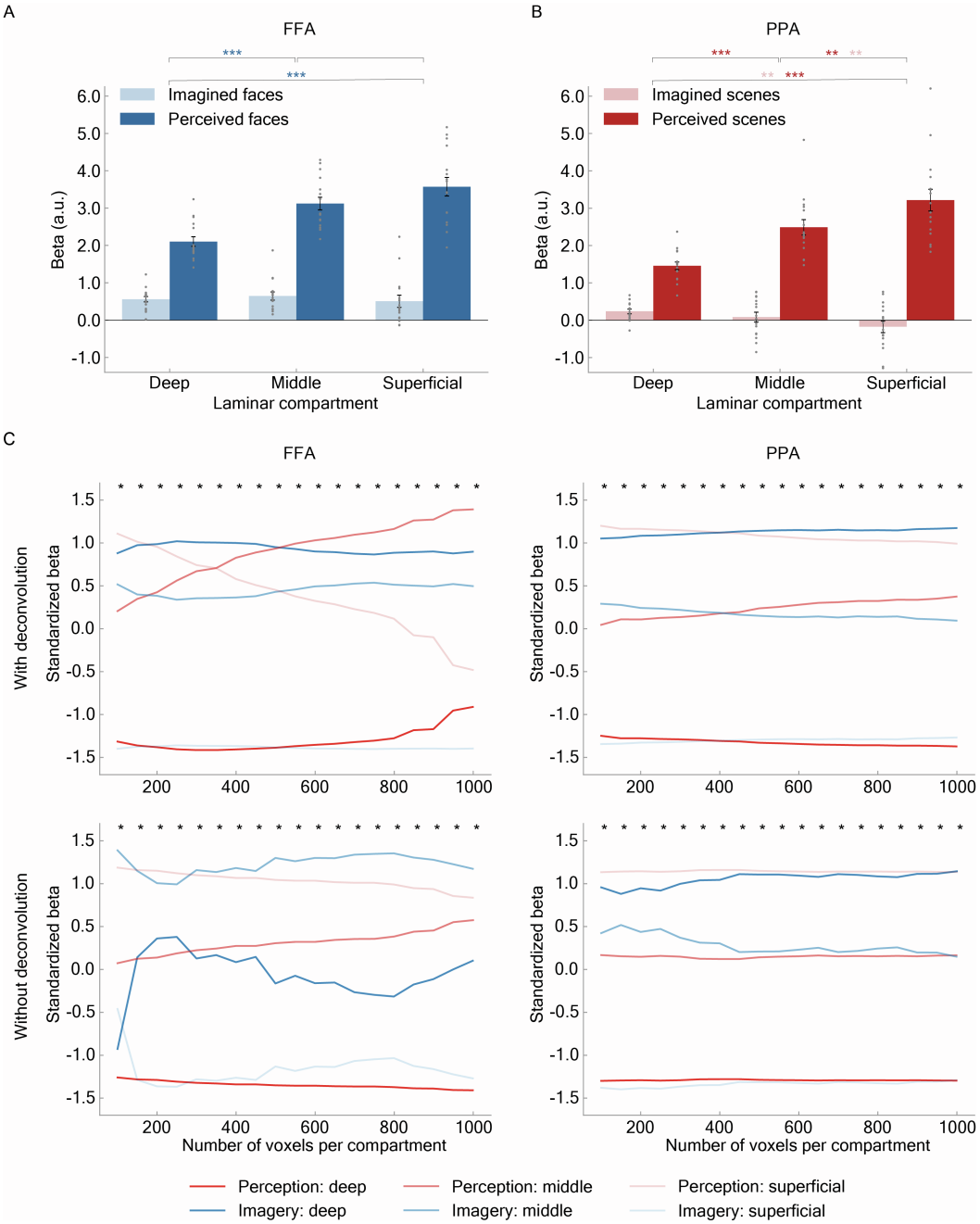


Supplemental Figure 3 related to Figure 1E. Responses at the macroscale level of cortical organization in high-level ventral visual cortex during perception and imagery. Neural responses overlap during perception and imagery. Each image corresponds to a subject specific (S1 to S16) T-activation map of the contrast faces > scenes and scenes > faces superimposed on that subject's individual T1-weighted image.

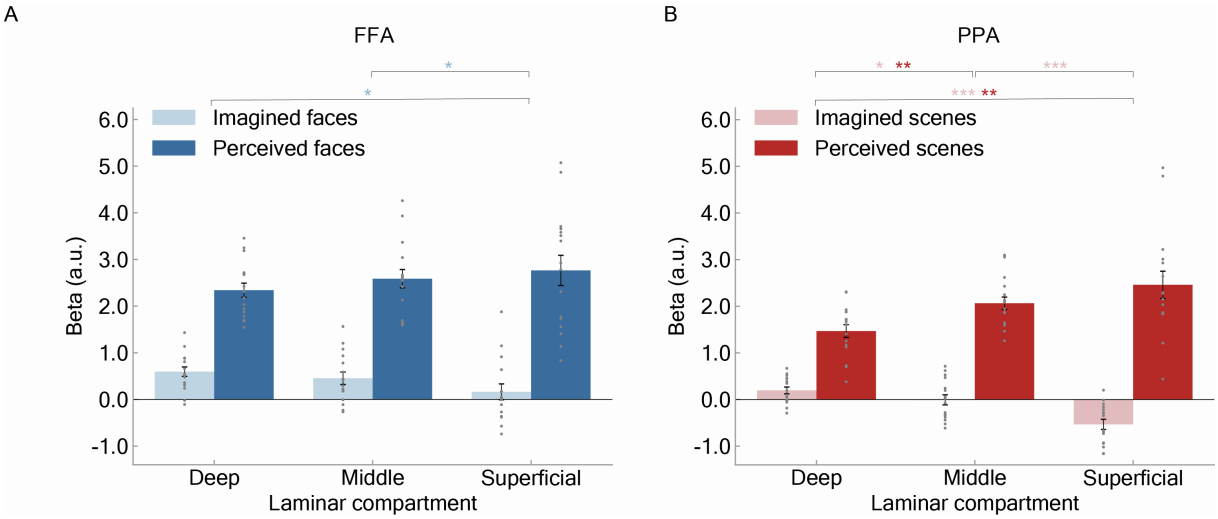
Supplemental Table 1 related to Figure 1E. Voxel overlap between perception and imagery at the macroscale level of cortical organization in high-level ventral visual cortex

SUB	FFA				PPA			
	Perception	Imagery	Both	% Imagery within perception	Perception	Imagery	Both	% Imagery within perception
1	108	182	-		2828	-	-	-
2	829	510	510	100%	7240	594	45	8%
3	401	-	-		2150	-	-	-
4	2322	1740	1611	93%	8271	4693	3102	66%
5	7392	912	907	99%	6815	3399	2867	84%
6	865	-	-		3067	349	317	91%
7	1211	-	-		5623	3337	3262	98%
8	801	-	-		7736	1561	1046	67%
9	1687	-	-		1314	40	-	-
10	4484	-	-		4112	-	-	-
11	893	115	49	43%	3772	1937	1721	89%
12	2749	-	-		13677	48	48	100%
13	752	-	-		13292	-	-	-
14	598	-	-		794	3	3	100%
15	722	-	-		15888	2246	2107	94%
16	4921	-	-		5739	5326	2560	48%
AVG	1920,94	691,80	769,25	84%	6394,88	1961,08	1552,55	79%

We used a criterion of $p < 1 \times 10^{-3}$ (uncorrected) for all comparisons. (AVG) Average across only those subjects (SUB) exhibiting voxel overlap in both perception and imagery.



Supplemental Figure 4 related to Figure 1G and 1H. The differential activation pattern across laminar compartments for imagery and perception is independent of superficial bias correction and ROI size. (**A**, **B**) Cortical responses to the preferred stimulus (averaged across participants) in (**A**) FFA and (**B**) PPA corresponding to Figure 1G, H, but without superficial bias deconvolution. We observed significant interaction effect between laminar compartment and stimulus mode (FFA: $F_{(2,30)}$ = 29.01, p_{corr} = 3.27 x 10^{-5}; PPA: $F_{(2,30)}$ = 85.69, p = 2.84 x 10^{-11}), indicating a differential laminar activation pattern for imagery and perception. Gray dots are single subject values, error bars represent the standard error of the mean. Asterisks denote significant post-hoc pairwise tests: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. (**C**) Standardized laminar responses to the preferred stimuli as a function of ROI size (i.e., number of voxels included per laminar compartment). Laminar responses to perceived and imagined stimulus objects in FFA (left column) and PPA (right column) with (upper row) and without (lower row) superficial bias deconvolution. Across a wide range of ROI sizes (from 100 to 1000 in 50 voxel steps), we observed a significant interaction effect ($p < 0.05$) between stimulus mode and laminar compartment (indicated by asterisks above the curves). This indicates a robust differential activation pattern for imagery and perception across cortical layers. We standardized beta estimates here for visualization purposes only.



Supplemental Figure 5 related to Figure 1G and 1H. The differential activation pattern across laminar compartments for imagery and perception is independent of voxel sampling approach. (**A**, **B**) Cortical responses to the preferred stimulus (averaged across participants) in (**A**) FFA and (**B**) PPA corresponding to Figure 1G, H, but with full overlapping of columnar compartments across cortical depth. Here, we selected the 1500 voxels with the highest t-values within the cortical ribbon and retained only those voxels with 100% overlapping columnar compartments. We observed significant interaction effect between laminar compartment and stimulus mode (FFA: $F_{(2,30)} = 6.07$, $p_{corr} = 0.02$; PPA: $F_{(2,30)} = 32.14$, $p_{corr} = 1.29 \times 10^{-5}$), indicating a differential laminar activation pattern for imagery and perception. Gray dots are single subject values, error bars represent the standard error of the mean. Asterisks denote significant post-hoc pairwise tests: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Supplemental Table 2 related to Figure 1F. Percentage overlap of columnar compartments across cortical depth in high-level ventral visual cortex

	FFA			PPA		
SUB	Deep	Middle	Superficial	Deep	Middle	Superficial
1	49,51	49,51	40,16	45,16	61,54	53,85
2	55,65	57,14	58,72	45,83	50,93	43,31
3	49,53	48,18	45,30	50,91	52,34	46,28
4	36,29	39,13	41,28	54,26	64,56	56,04
5	50,85	63,83	42,86	58,87	67,59	58,87
6	43,48	50,51	43,10	58,26	55,83	57,26
7	55,95	67,14	66,67	36,26	48,06	54,87
8	44,09	47,86	34,36	43,88	49,43	46,24
9	51,38	48,28	37,09	58,93	61,68	54,10
10	49,53	52,48	37,06	51,43	53,47	32,53
11	50,93	55,56	48,67	55,05	58,82	59,41
12	49,36	62,60	66,38	64,46	73,58	66,67
13	54,26	68,63	72,16	36,13	43,43	37,72
14	54,69	66,67	73,68	54,63	59,60	52,21
15	55,65	69,57	53,33	50,85	49,59	44,12
16	43,75	60,49	46,67	50,98	65,00	46,85
AVG	49,68	56,72	50,47	50,99	57,22	50,64

We quantified the percentage overlap by initially selecting the 500 voxels with the highest t-values within each laminar compartment per brain hemisphere. Then we retained only those voxels with 100% overlapping columnar compartments across the cortical ribbon. This resulted in voxels sharing full columnar overlap for each deep, middle and superficial laminar compartment. Next, we calculated the percentage overlap by dividing the total number of voxels with full columnar overlap at each laminar compartment by the overall number of voxels within each laminar compartment, and then multiplied the result by 100. (AVG) Average across all subjects (SUB).