

# Hub Electrode Analysis — Research Question 1

Generated: 2025-11-26

Source: [src/results/hubs/](#)

Summary:

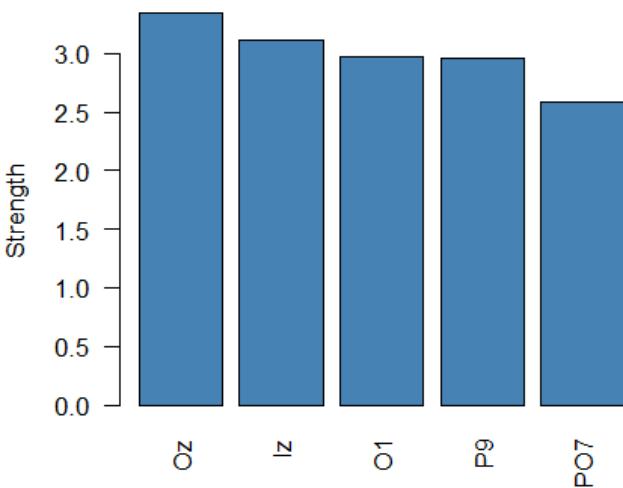
This report summarizes the hub electrode analysis comparing meditation and thinking states for Alpha and Beta bands.

Centrality measures used: Degree, Strength (weighted), Betweenness (normalized).

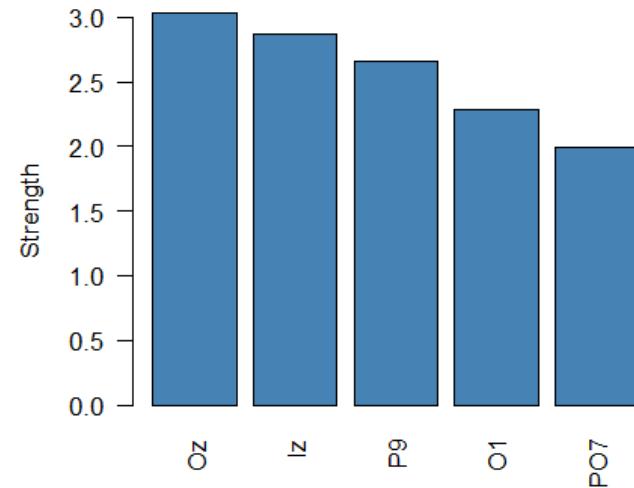
Thresholding for visualization: top 15% strongest edges (proportional density).

<b>band</b>	<b>state</b>	<b>region</b>	<b>avg_strength</b>	<b>avg_degree</b>	<b>avg_betweenness</b>	<b>hub_count</b>
1	alpha	meditation	occipital	2.304406725	30.875000	0.0238095238
2	alpha	meditation	other	0.614549744	8.903226	0.0087128157
3	alpha	meditation	frontal	0.597152858	8.590909	0.0017921147
4	alpha	meditation	parietal	0.490776038	7.428571	0.0116670324
5	alpha	meditation	central	0.433400534	6.222222	0.0071969050
6	alpha	meditation	temporal	0.061114704	1.000000	0.0001280082
7	alpha	thinking	occipital	2.129386502	29.000000	0.0224014337
8	alpha	thinking	other	0.628093649	9.354839	0.0086219712
9	alpha	thinking	frontal	0.554766057	8.181818	0.0010240655
10	alpha	thinking	parietal	0.499256139	7.714286	0.0154341306
11	alpha	thinking	central	0.408395627	6.000000	0.0052910053
12	alpha	thinking	temporal	0.000000000	0.000000	0.0000000000
13	beta	meditation	occipital	0.223037831	18.375000	0.0347542243
14	beta	meditation	central	0.138302299	10.722222	0.0093588212
15	beta	meditation	other	0.119809519	9.645161	0.0133871794
16	beta	meditation	frontal	0.111453610	8.772727	0.0039100684
17	beta	meditation	parietal	0.060410980	5.285714	0.0138248848
18	beta	meditation	temporal	0.009758091	0.750000	0.0067844342
19	beta	thinking	occipital	0.150114081	15.250000	0.0266257040
20	beta	thinking	central	0.138935680	13.111111	0.0125163566
21	beta	thinking	other	0.095614184	9.419355	0.0139405051
22	beta	thinking	parietal	0.081320913	8.428571	0.0264062614
23	beta	thinking	frontal	0.063681531	6.454545	0.0024205185
24	beta	thinking	temporal	0.013600076	1.500000	0.0015360983

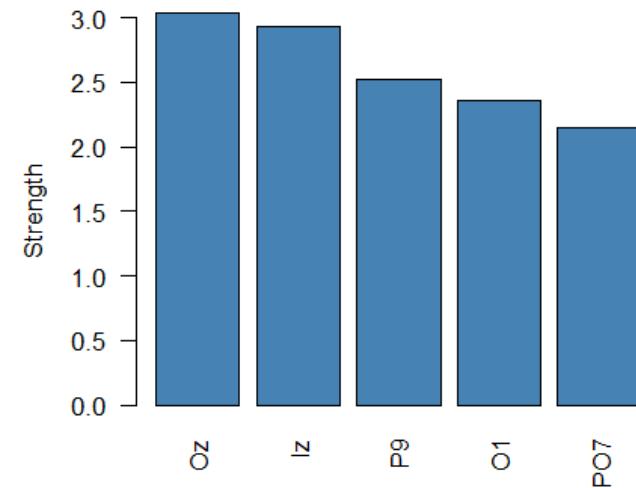
**Top 5 Hubs: alpha\_med1**



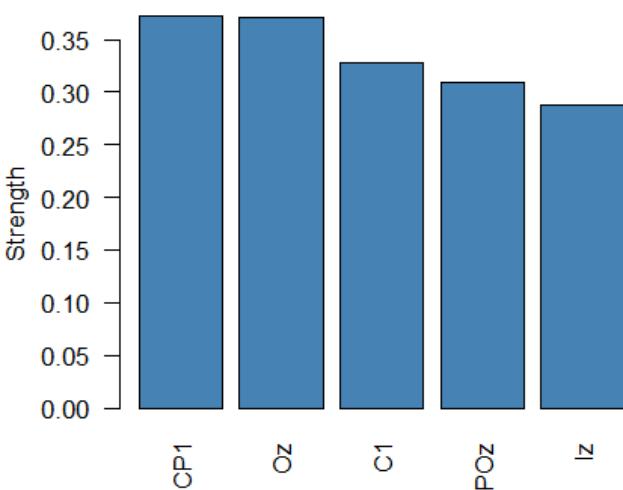
**Top 5 Hubs: alpha\_med2**



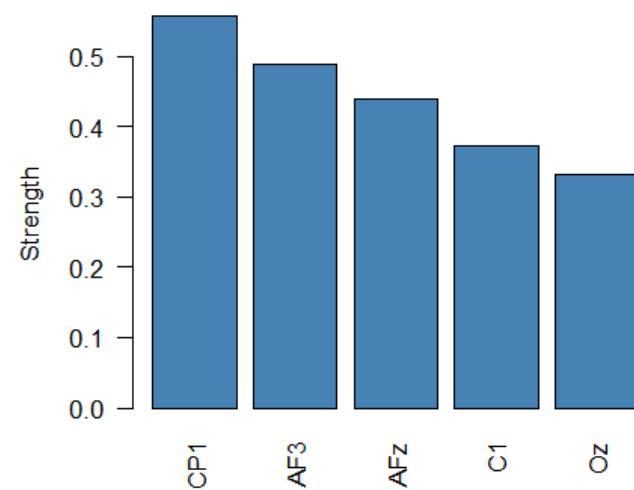
**Top 5 Hubs: alpha\_thinking**



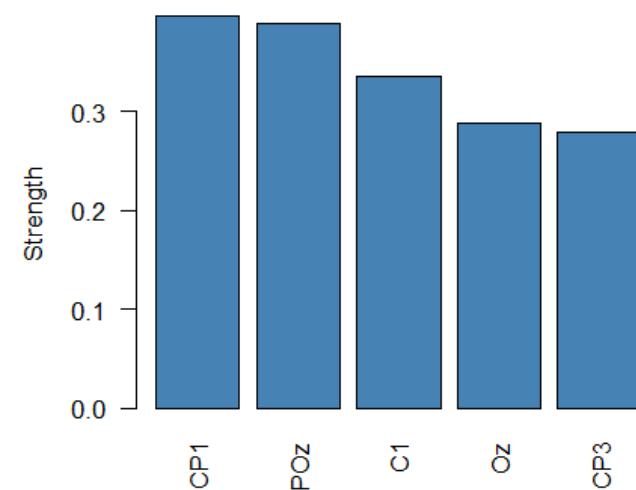
**Top 5 Hubs: beta\_med1**



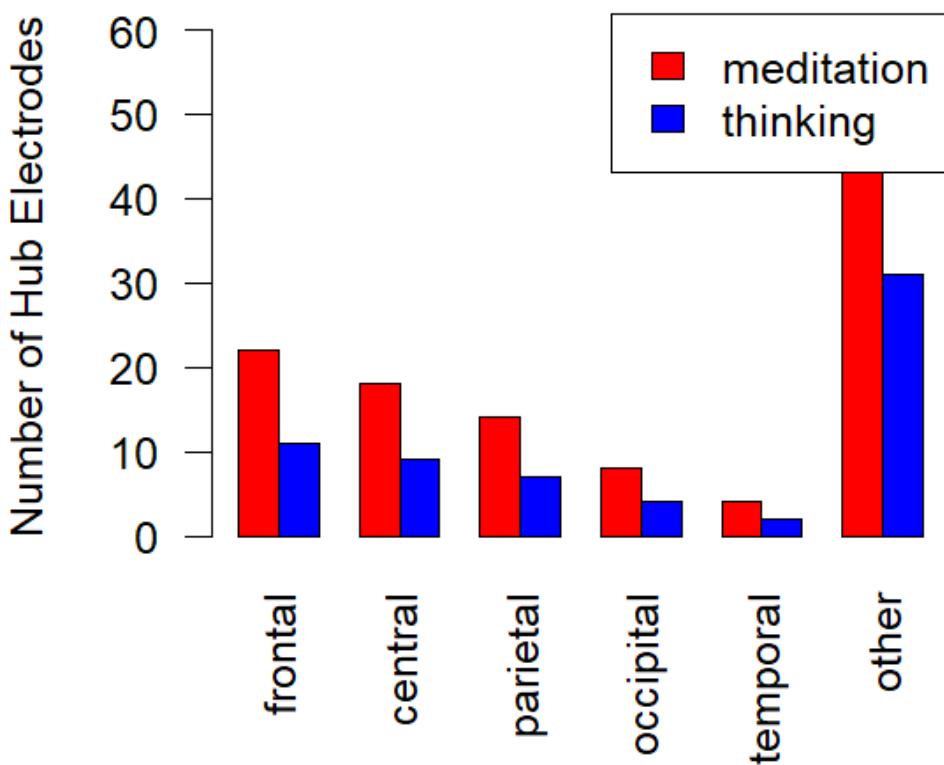
**Top 5 Hubs: beta\_med2**



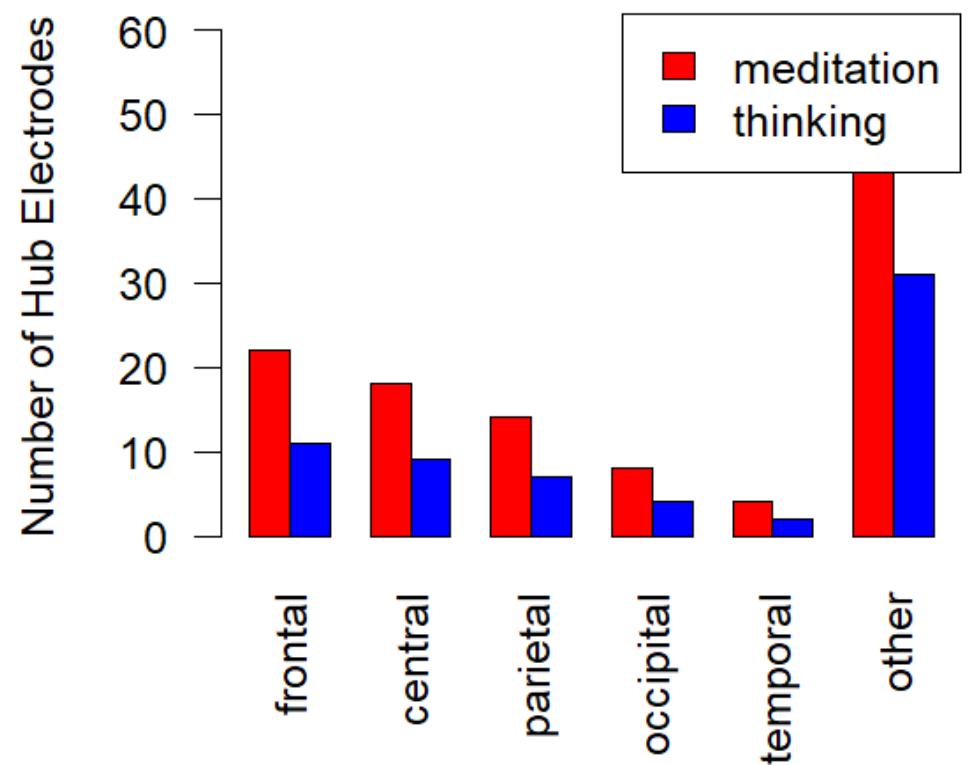
**Top 5 Hubs: beta\_thinking**



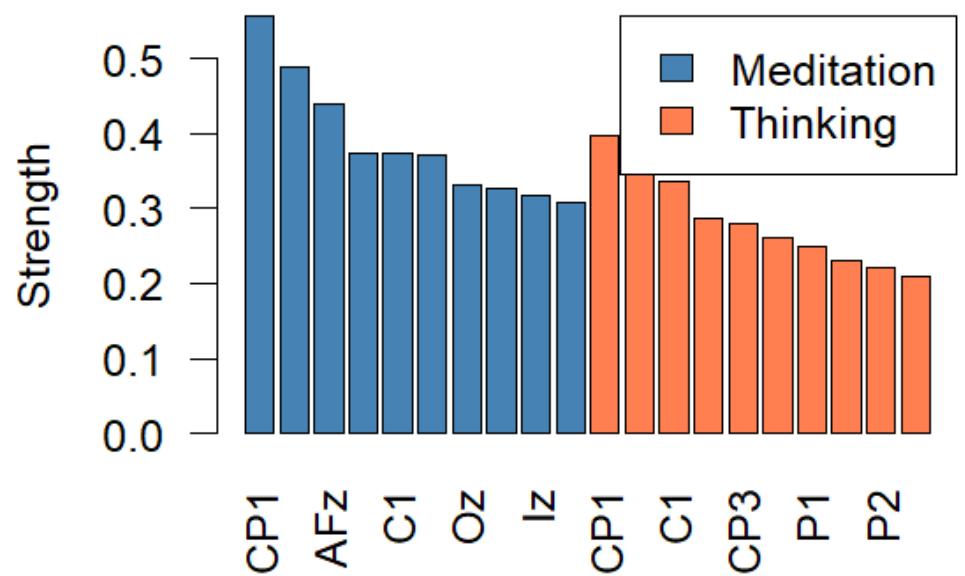
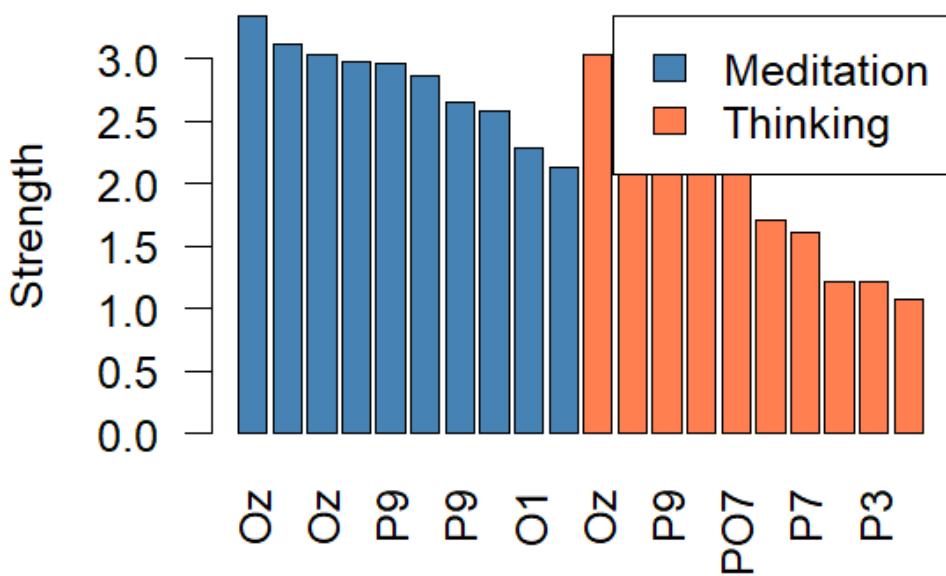
### Alpha Band: Hub Distribution by Region



### Beta Band: Hub Distribution by Region



## Alpha Band: Top 10 Hubs (Meditation vs Thinking)



	<b>electrode</b>	<b>degree</b>	<b>strength</b>	<b>betweenness</b>	<b>band</b>	<b>state</b>	<b>region</b>
1	Oz	41	3.352143	0.004608295	alpha	meditation	occipital
2	Iz	40	3.116827	0.035842294	alpha	meditation	occipital
3	O1	40	2.973023	0.030721966	alpha	meditation	occipital
4	P9	39	2.964921	0.028161802	alpha	meditation	other
5	PO7	37	2.580937	0.070148490	alpha	meditation	parietal

	<b>electrode</b>	<b>degree</b>	<b>strength</b>	<b>betweenness</b>	<b>band</b>	<b>state</b>	<b>region</b>
1	Oz	40	3.036548	0.06144393	alpha	meditation	occipital
2	Iz	39	2.864191	0.02252944	alpha	meditation	occipital
3	P9	38	2.660283	0.05529954	alpha	meditation	other
4	O1	34	2.283870	0.02201741	alpha	meditation	occipital
5	PO7	31	1.993972	0.03993856	alpha	meditation	parietal

	<b>electrode</b>	<b>degree</b>	<b>strength</b>	<b>betweenness</b>	<b>band</b>	<b>state</b>	<b>region</b>
1	Oz	39	3.040969	0.029185868	alpha	thinking	occipital
2	Iz	40	2.933939	0.052227343	alpha	thinking	occipital
3	P9	36	2.526062	0.039426523	alpha	thinking	other
4	O1	34	2.353857	0.007680492	alpha	thinking	occipital
5	PO7	33	2.153489	0.099334357	alpha	thinking	parietal

	<b>electrode</b>	<b>degree</b>	<b>strength</b>	<b>betweenness</b>	<b>band</b>	<b>state</b>	<b>region</b>
1	CP1	32	0.3726697	0.01177675	beta	meditation	central
2	Oz	35	0.3710249	0.07782898	beta	meditation	occipital
3	C1	29	0.3276061	0.05171531	beta	meditation	other
4	POz	30	0.3088569	0.08960573	beta	meditation	other
5	Iz	27	0.2876922	0.05069124	beta	meditation	occipital

	<b>electrode</b>	<b>degree</b>	<b>strength</b>	<b>betweenness</b>	<b>band</b>	<b>state</b>	<b>region</b>
1	CP1	35	0.5580702	0.07373272	beta	meditation	central
2	AF3	31	0.4884171	0.03379416	beta	meditation	frontal
3	AFz	28	0.4392792	0.03020993	beta	meditation	other
4	C1	24	0.3725560	0.04249872	beta	meditation	other
5	Oz	23	0.3325895	0.03020993	beta	meditation	occipital

	<b>electrode</b>	<b>degree</b>	<b>strength</b>	<b>betweenness</b>	<b>band</b>	<b>state</b>	<b>region</b>
1	CP1	35	0.3972899	0.06605223	beta	thinking	central
2	POz	37	0.3896768	0.10394265	beta	thinking	other
3	C1	30	0.3357180	0.08090118	beta	thinking	other
4	Oz	29	0.2875357	0.07219662	beta	thinking	occipital
5	CP3	26	0.2790269	0.01024066	beta	thinking	central