

Analysis of Traditional Scalp Acupuncture Point Locations as Local Cortical Region and Functional Network Node Targets in Non-Invasive Brain Network Neuromodulation

Section 6 - The Lateral Parietal Lobe

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Abstract

Background/Objective: Non-invasive neuromodulation techniques have increasingly been utilized and investigated as potential treatment approaches for neurological and psychiatric disorders. Increasing evidence supports the possibility of non-invasive neuromodulation affecting larger scale brain networks rather than just local stimulation targets. In this article, this concept and implications thereof are explored within the context of traditional acupuncture points located on the scalp and their cortical region correlates.

Method: This article addresses the conceptual framework of traditional acupuncture point locations on the scalp as potential local cortical region and/or neural network nodes of non-invasive neuromodulation modalities and may expand existing understanding of the influence of scalp acupuncture points based on these network connections. Studies that support this hypothesis are provided followed by an exploration of functionally and structurally connected brain parcellations elucidated by connectomic mapping and correlations with traditional acupuncture points. In this installment cortical regions of the lateral parietal lobe are explored.

Main Results/Conclusion: Studies stimulating brain regions by various non-invasive methods including manual and laser scalp acupuncture, repetitive Transcranial Magnetic Stimulation (rTMS), and transcranial Direct Current Stimulation (tDCS) offer evidence of underlying neuromodulatory mechanisms and clinical therapeutic effect in cases of various neuropathologies. These effects have evidence to support that in addition to local cortical region responses; structural and functional brain network modulatory influence including influence upon deeper brain structures, have been demonstrated. In light of this evidence, it is proposed that applying a network perspective to non-invasive transcranial stimulation may lend a broader understanding of therapeutic potential in using these techniques.

Keywords: scalp acupuncture, connectome, neuromodulation, brain networks, brain hubs, parietal lobe, lateral parietal, TPOJ

The Inferior Parietal Lobule and TPOJ Areas

Area PPop (Parietal Area F, Operculum)

Location:

On the anterior inferior parietal lobule where it joins the postcentral gyrus anteroinferiorly.

Functions:

- The rostral inferior parietal lobule is involved in motor planning and action-related functions e.g activated when observing tools being used
- Part of a mirror neuron system in which actions or behaviors are learned by observing the actions of others.
- The rostral inferior parietal lobule has been implicated in the task-positive network.

Functional Connectivity:

Sensory strip: Area 2

Premotor regions: SCEF, FEF, PEF, 6ma, 6mp, 6a, 6r, 6v

Middle cingulate regions: a24pr, p24pr, p32pr, 24dv, 5mv, 23c

Lateral frontal lobe: IFSa, 46, 9-46d

Superior insula opercular regions: OP4, OP2-3, OP1, PFcm, FOP1, FOP3, FOP4, FOP5

Lower opercula and Heschl's gyrus: LBelt, PBelt, PI, A4, MI, 52, RI, Pol1, Pol2

Temporal lobe: TE2p, PHT

Lateral parietal lobe: PFT, PF, PGp, IP0, AIP, MIP, LIPv, LIPd, 7PC, 7PL, 7AL

Medial parietal lobe: 7AM, DVT

Medial occipital lobe: V1, V2, V3

Dorsal visual stream: V3a, V6

Ventral visual stream: V8, FFC

Lateral occipital lobe: LO3, TPOJ2, PH, FST

White matter connections:

Local short association fibers connect with PF, PFcm, PFT, 4, OP1, OP4

Traditional Acupoint Correlates:

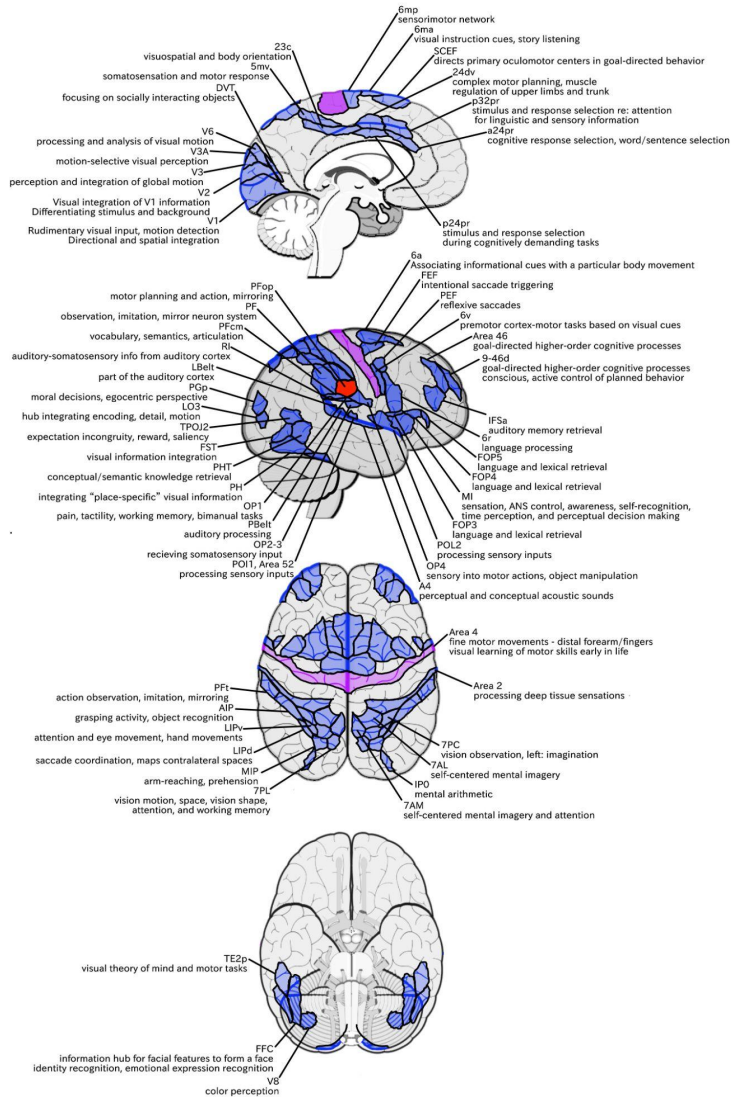
N/A (~½ distance between GB6 and GB17)

Functionally Connected Acupoints:

BL4 (46/9-46d)	BL6 (6a)
BL7 (2/7AL/7PC)	BL8 (IP0)
GB4 (6r)	GB5 (A4/Pol2)
GB7 (TE2p)	GB8 (PHT)
GB9 (PH/PHT/FST)	GB15 (46)
GB16 (FEF)	GB18 (AIP/LIPv)
ST8 (6r/6v/PEF)	TW20 (TE2p)
GV18 (V1/V2)	GV21 (SCEF)

Structurally Connected Acupoints:

GB17 (4)	GV20 (4)
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Area PFt (Parietal Area F, part t)

Location:

On the posterior bank of the postcentral sulcus, on the anterosuperior edge of the inferior parietal lobule. It lies on the inferior edge of the intraparietal sulcus, just where it meets the postcentral sulcus.

Functions:

- Important in the action observation and imitation network
- Grasping objects under visual guidance
- Implicated in the mirror neuron system
- Activated in observing tool use to move objects

Functional Connectivity:

Sensory strip: Area 1, 2

Premotor regions: SCEF, FEF, PEF, 6ma, 6mp, 6a, 6d, 6r, 6v

Middle cingulate regions: p32pr, 5mv, 23c

Lateral frontal lobe: IFSa, IFJp, 46

Superior insula opercular regions: OP4, OP1, PFcm, FOP2, FOP4

Lower opercula and Heschl's gyrus: MI, Pol1, Pol2

Temporal lobe: PHA3, PHT

Lateral parietal lobe: PFop, PF, PGp, IP2, IP0, IPS1, AIP, VIP, MIP, LIPv, LIPd, 7PC, 7PL, 7AL

Medial parietal lobe: 7AM

Ventral visual stream: FFC

Lateral occipital lobe: PH, FST

White matter connections:

Structurally connected to local parcellations, the inferior parietal lobule and opercular parcellations through the arcuate/superior longitudinal fasciculus (SLF). Connections from PFt project diagonally to the inferior parietal lobule and anterior inferior to the operculum. Operculum projections end at OP4, 43, 6r, and 4. Inferior parietal projections end at 2 and AIP. Local short association bundles are PF and PFop

Traditional Acupoint Correlates:

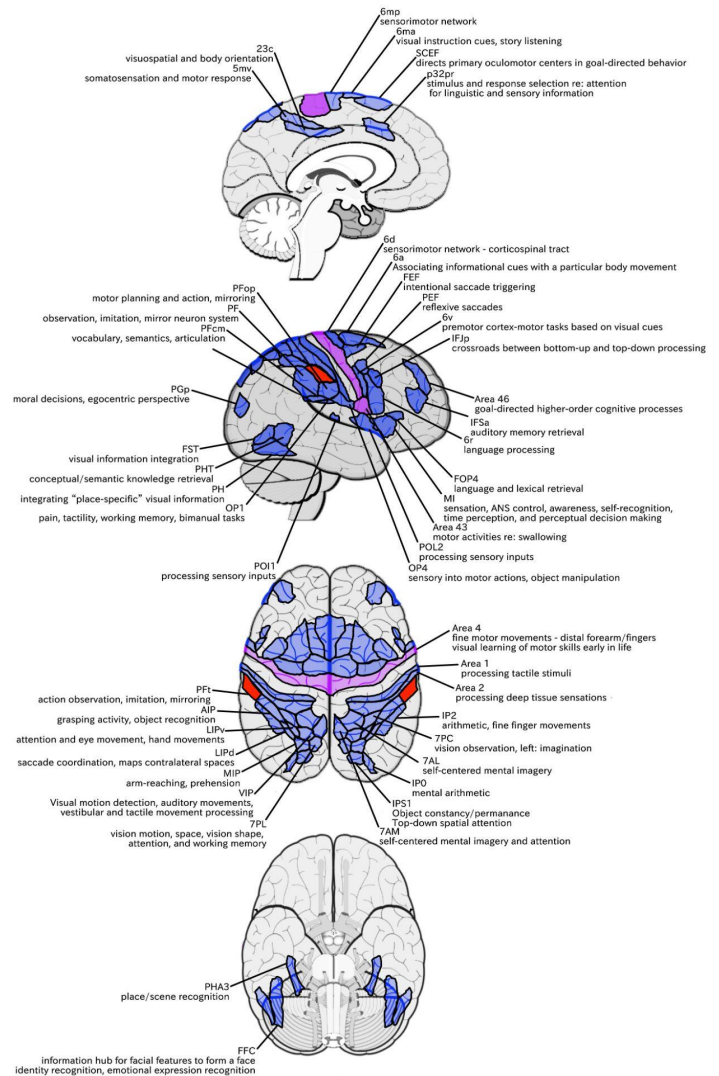
N/A (~ ¼ distance between GB17 and GB7)

Functionally Connected Acupoints:

BL4 (46)	BL6 (6a/6d)
BL7 (2/7AL/7PC)	BL8 (IP0/IPS1)
GB4 (6r)	GB5 (Pol2)
GB8 (PHT)	GB9 (PH/PHT/FST)
GB15 (46)	GB16 (FEF)
GB17 (2)	GB18 (AIP/LIPv)
ST8 (6r/6v/PEF/IFJp)	GV21 (SCEF)

Structurally Connected Acupoints:

GB4 (43/6r)	GB17 (2/4)
GB18 (AIP)	ST8 (6r)
GV20 (4)	



Area PF (Parietal Area F)

Location:

On the lateral surface of the superior portion of the supramarginal gyrus.

Functions:

- Functions similar to those localized to area PFT
- Important in the action observation and imitation network and has been implicated in the mirror neuron system
- Activated when individuals observe the use of tools to move objects

Functional Connectivity:

- Premotor regions: SCEF, FEF, 6ma, 6a, 6r
- Middle cingulate regions: a24pr, p24pr, p32pr, 5mv, 23c
- Lateral frontal lobe: IFSa, IFJp, a9-46v, p9-46v, 46, 9-46d
- Superior insula opercular regions: OP4, PFcm, FOP1, FOP3, FOP5
- Lower opercula and Heschl's gyrus: AVI, MI, 52, Po11, Po12
- Temporal lobe: PHT
- Lateral parietal lobe: PFT, PFop, PGp, IP0, IP2, AIP, MIP, LIPd, 7PL, 7AL
- Medial parietal lobe: 7AM, PCV, DVT
- Medial occipital lobe: V1

White matter connections:

Structurally connected to the arcuate/SLF and local parcellations. Arcuate/SLF connections course anteriorly from PF to somatosensory areas 1, 3a, 4, 43, and OP4, and inferiorly to middle and inferior temporal gyrus parcellations TE1a, STSva, and TE2a. Local short association bundles connect with AIP, PFcm, PFm, PFop, PFT, PSL, and STV

Traditional Acupoint Correlates:

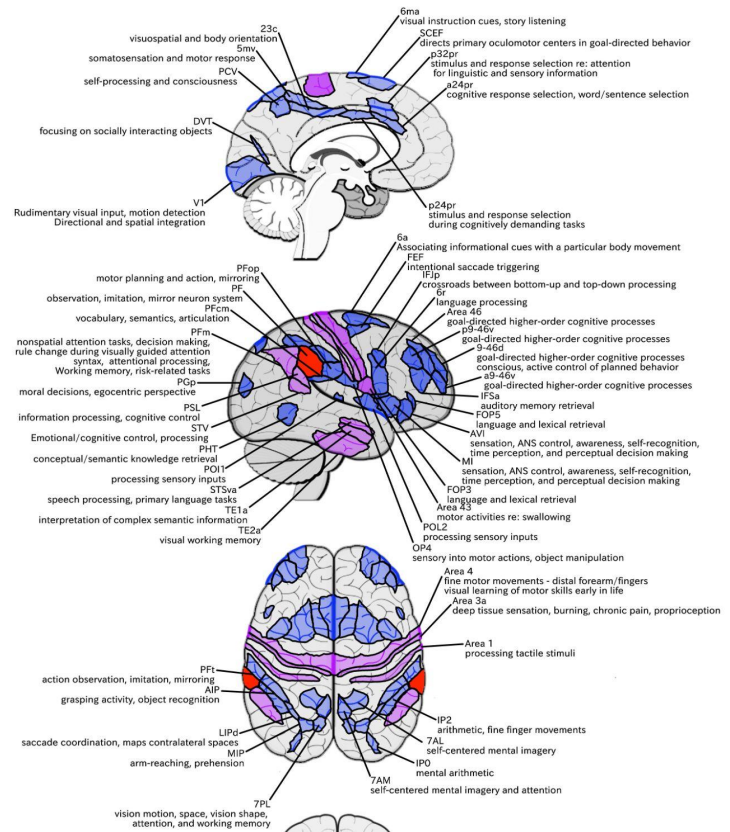
N/A (~1/3 distance between GB17 and GB8)

Functionally Connected Acupoints:

- | | |
|----------------|------------------|
| BL4 (9-46d/46) | BL6 (6a) |
| BL7 (7AL) | BL8 (IP0) |
| GB4 (6r) | GB5 (Po12) |
| GB8 (PHT) | GB9 (PHT) |
| GB13 (p9-46v) | GB15 (p9-46v/46) |
| GB16 (FEF) | ST8 (6r/IFJp) |
| GV18 (V1) | GV21 (SCEF) |

Structurally Connected Acupoints:

- | | |
|---------------|------------------|
| GB4 (43) | GB6 (STSva/TE1a) |
| GB17 (1/3a/4) | GB18 (PFm) |
| TW22 (TE2a) | GV20 (1/3a/4) |



Area PFm (Parietal Area F, part m)

Location:

On the anterior superior surface of the angular gyrus, and straddles the sulcus to lie on the posterior superior bank of the supramarginal gyrus.

Functions:

- Activation in nonspatial attention tasks, decision making when switching choices, rule change during visually guided attention, and reorientation
- Provides syntactical components to language processing
- Role in attentional processing and activated in working memory, motor cue, and risk-related tasks

Functional Connectivity:

Lateral frontal lobe: 8AV, 8AD, 8BL, 8C, s6-8, i6-8, a47r, p47r, a10p, p10p, 9a, a9-46v, p9-46v, 44

Medial frontal lobe: d32

Insula: AVI

Temporal lobe: STSvp, TE1m, TE1p, TE2a

Lateral parietal lobe: PGs, PGi, IP2, IP1

Medial parietal lobe: 7m, 7pm, POS2, 31a, 31pv, d23ab, 23d, RSC

White matter connections:

Structurally connected to the arcuate/SLF. Arcuate/SLF connections course anteriorly from PFm to 8C and 8BM, and inferiorly to middle temporal gyrus at TE1a, TE1m, TE1p, STSva, STSvp, and PHT. Local short association bundles connect with AIP, 7PC, IP1, IP2, LIPd, LIPv, PGi, PGs, 2, and 1

Traditional Acupoint Correlates:

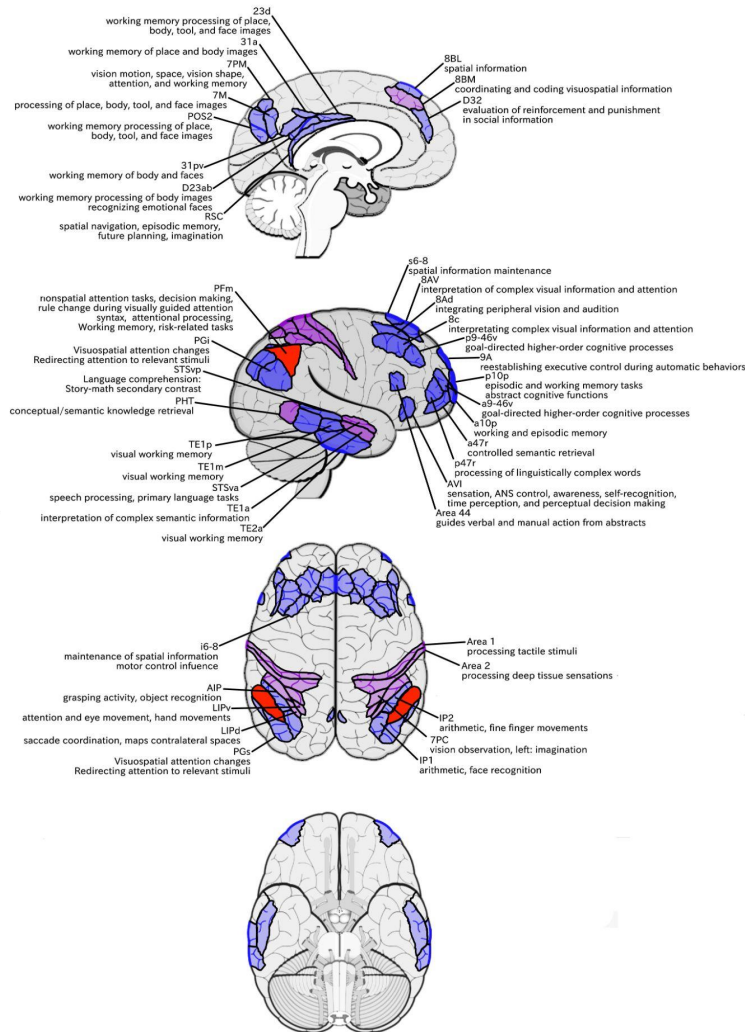
GB18

Functionally Connected Acupoints:

BL3 (8AD/8BL)	BL4 (8AD/8AV)
BL5 (8AD/8AV/i6-8)	BL8 (IP1)
GB6 (STSvp/TE1m)	GB7 (TE1m/TE1p/TE2a)
GB8 (TE1p)	GB13 (p9-46v)
GB14 (a10p/a47r/p10p)	GB15 (8AD/8AV/8C/p9-46v)
GB18 (PGs/IP1)	TW22 (TE2a)
GV19 (7PM)	GV22 (8BL)

Structurally Connected Acupoints:

BL7 (2/7PC)	GB6 (STSva/TE1a)
GB8 (PHT)	GB9 (PHT)
GB17 (½)	GB18 (AIP/LIPv/PGs/IP1)



Area PGs (Parietal Area G superior)

Location:

On the superior surface of the angular gyrus

Functions:

- Active when changing visuospatial attention from one area to another
- Involved in the response to biological motion
- Major node in the task-negative network, which mostly functions to redirect attention towards relevant stimuli
- Relevant in number processing
- Not well differentiated from PGI

Functional Connectivity:

Lateral frontal lobe: 8AV, 8AD, 8BL, 8C, s6-8, i6-8, a47r, 47m, 10d, 9p
 Medial frontal lobe: 9m, 10v, 10r, 8BM, a24, d32, s32
 Temporal lobe: PHA1, PHA2, PreS, EC, hippocampus, STSva, STSvp, TGd, TE1a, TE1m, TE1p, TE2a
 Lateral parietal lobe: PFm, PGI, IP1
 Medial parietal lobe: 7m, 7pm, POS1, POS2, 31a, 31pd, 31pv, d23ab, v23ab, 23d, RSC

White matter connections:

Structurally connected to the arcuate/SLF. Arcuate/SLF connections course anteriorly from PGs to inferior frontal sulcus parcellations IFJa, IFJp, and IFSp, and inferiorly to occipitotemporal junction areas PHT, FST, and TPOJ2.

Local short association bundles connect with PFm, PGI, PGp, IP0, IP1, IP2, and MIP

Traditional Acupoint Correlates:

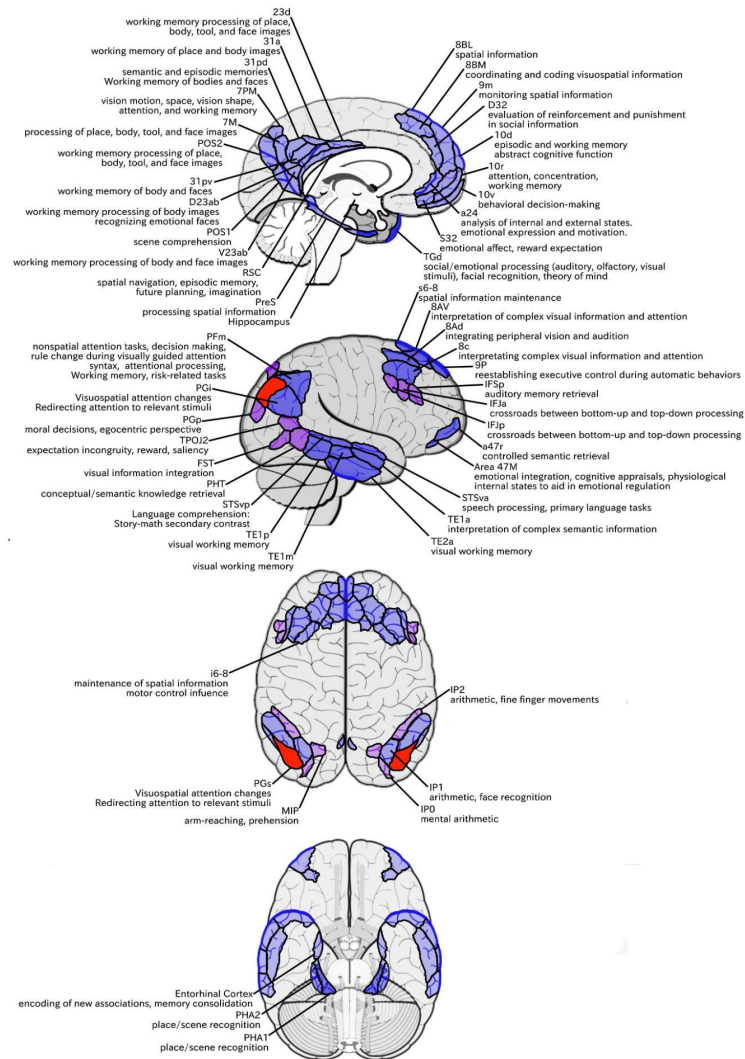
GB18

Functionally Connected Acupoints:

- | | |
|-----------------------------|----------------------|
| BL3 (8AD/8BL/9P) | BL4 (8AD/8AV) |
| BL5 (8AD/8AV/i6-8) | BL8 (IP1) |
| GB6 (STSva/STSvp/TE1a/TE1m) | GB7 (TE1m/TE1p/TE2a) |
| GB8 (TE1p) | GB15 (8AD/8AV/8C) |
| GB18 (PFm/IP1) | TW22 (TE2a) |
| GV19 (7PM) | GV22 (8BL) |
| GV23 (9m/10d) | GV24 (10d) |
| Yintang (10v) | |

Structurally Connected Acupoints:

- | | |
|---------------|----------------|
| BL8 (IP0/IP1) | GB8 (PHT) |
| GB9 (PHT/FST) | GB18 (PFm/IP1) |
| ST8 (IFJp) | |



Area PGI (Parietal Area G inferior)

Location:

On the inferior surface of the angular gyrus

Functions:

- Many of the same functions as area PGs
- Active when changing visuospatial attention from one area to another
- Major node in the task-negative network, which mostly functions to redirect attention towards relevant stimuli
- Compared to PGs: more active when processing faces compared to a body, more active when listening to a story compared to unrelated words, and more active when listening to a story vs answering arithmetic problems

Functional Connectivity:

Lateral frontal lobe: 8AV, 8AD, 8BL, 8C, 47s, 47l, a47r, 44, 45, 10d, 9a, 9p

Medial frontal lobe: SFL, 9m, 10v, 10r, 8BM, d32

Temporal lobe: STSda, STSdp, STSva, STSvp, hippocampus, TGd, TE1a, TE1m, TE1p, TE2a

Lateral parietal lobe: PFm, PGs

Medial parietal lobe: 7m, POS1, 31a, 31pd, 31pv, d23ab, v23ab

White matter connections:

Structurally connected to inferior parcellations of the occipitotemporal junction. Some individuals have connections to the arcuate/SLF with anterior projections to the premotor areas but this is inconsistent. Local short association bundles connect to the occipitotemporal junction at PHT, TE1p, STSvp, STSdp, TPOJ1, and TE1m

Traditional Acupoint Correlates:

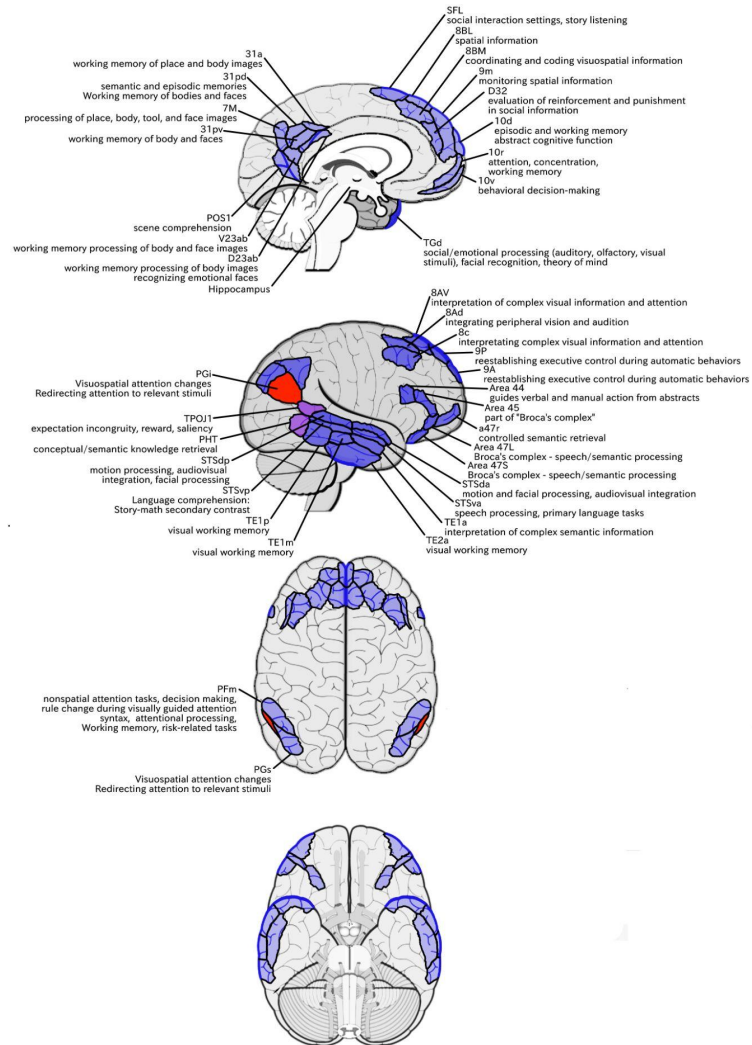
N/A (~½ distance from BL8 to GB8)

Functionally Connected Acupoints:

BL3 (8AD/8BL/9P)	BL4 (8AD/8AV)
BL5 (8AD/8AV)	
GB6 (STSda/STSdp/STSva/STSvp/TE1a/TE1m)	
GB7 (TE1m/TE1p/TE2a)	GB8 (TE1p)
GB15 (8AD/8AV/8C)	GB18 (PFm/PGs)
TW22 (TE2a)	GV22 (8BL)
GV23 (9m/10d)	GV24 (10d)
Yintang (10v)	

Structurally Connected Acupoints:

GB6 (STSdp/STSvp/TE1m)	GB7 (TE1m/TE1p)
GB8 (PHT/TE1p)	GB9 (PHT)



Area PGp (Parietal Area G posterior)

Location:

On the posterior most portion of the inferior parietal lobule.

Functions:

- Represents a link between the occipital and parietal cortices given the similarity in their molecular expression pattern to the higher ventral extrastriate area, which has been suggested to have connection and functionality related to visuospatial processing
- Moral decision-making and egocentric/allocentric perspective function
- Caudal portions of the inferior parietal lobule determine semantic content and assist in the interpretation of meaning within information
- Memory retrieval

Functional Connectivity:

- Premotor regions: FEF, PEF, 6a, 6ma
- Middle cingulate regions: a24pr, p32pr, 5mv, 23c
- Lateral frontal lobe: IFSa, 46
- Superior insula and opercular regions: PFcm, FOP4
- Lower opercula and Heschl's gyrus: Pol1, Pol2
- Temporal lobe: PHA1, PHA2, PHA3, TE2p, PHT
- Lateral parietal lobe: AIP, MIP, VIP, LIPd, LIPv, PFop, PF, PFT, IP2, IP0, IPS1, 7AL, 7PL, 7PC
- Medial parietal lobe: 7AM, 7PM, POS1, POS2, DVT, PCV
- Medial occipital lobe: PRoS, V1, V2, V3
- Dorsal visual stream: V3a, V3b, V6, V6a
- Ventral visual stream: FFC, VVC, VMV2
- Lateral occipital lobe: V3cd, LO3, PH, TPOJ2, TPOJ3, FST

White matter connections:

Structurally connected with the inferior longitudinal fasciculus (ILF) and the superior parietal lobule. Connections with the ILF project from PGp to the basal surface of the occipitotemporal junction and fusiform gyrus, ending at parcellations PH, FFC, and TF. Superior parietal lobe fibers connect with 7PL and IPS1. Local short association fibers connect with IP0, PGs, TPOJ3, MT and visual processing areas LO3, LO1, V3CD, and V4

Traditional Acupoint Correlates:

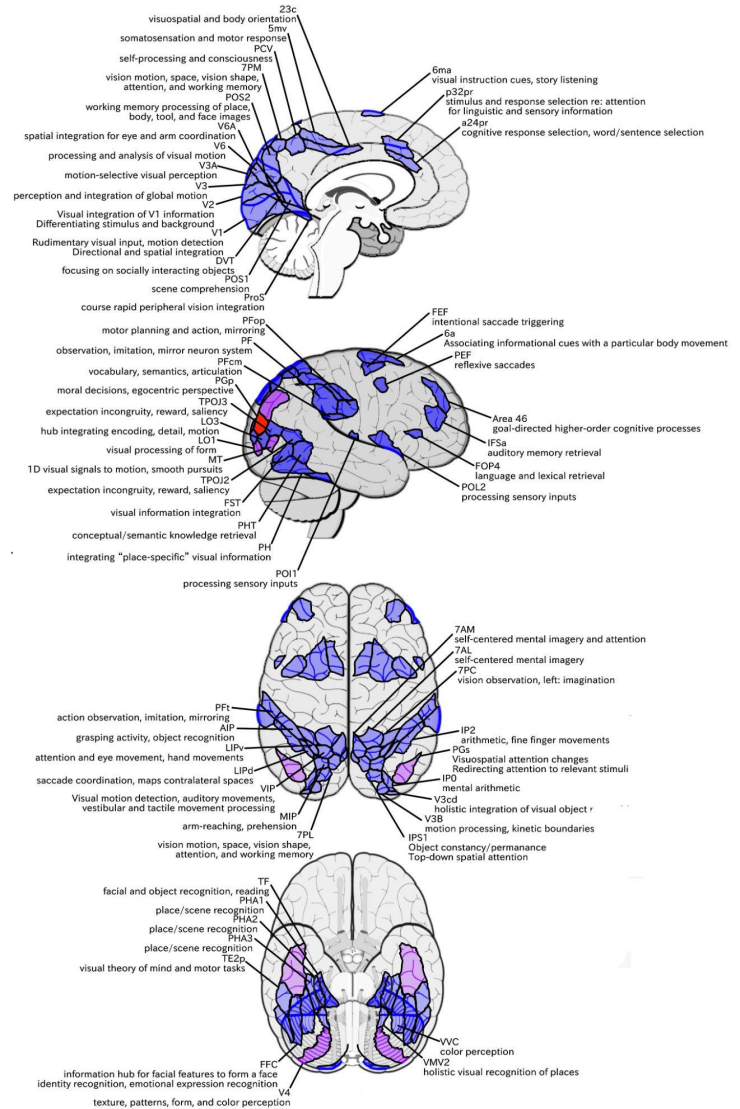
N/A (~½ distance from BL8 to GB8)

Functionally Connected Acupoints:

- | | |
|-----------------|--------------------|
| BL4 (46) | BL6 (6a) |
| BL7 (7AL/7PC) | BL8 (IP0/IPS1/V3b) |
| GB5 (Pol2) | GB7 (TE2p) |
| GB8 (PHT) | GB9 (PH/PHT/FST) |
| GB15 (46) | GB16 (FEF) |
| GB18 (AIP/LIPv) | ST8 (PEF) |
| TW20 (TE2p) | GV18 (V1/V2) |
| GV19 (V6a/7PM) | |

Structurally Connected Acupoints:

- | | |
|----------------|----------|
| BL8 (IP0/IPS1) | GB9 (PH) |
| GB18 (PGs) | |



Area TPOJ1 (Temporo-Parietal-Occipital Junction 1)

Location:

In the posterior superior temporal sulcus, just as it angles upward to indent the angular gyrus. It makes up both banks and the depth of this portion of the sulcus.

Functions:

- Detecting incongruities between expected and presented stimuli, reward processing, and saliency
- Theory of mind, and the processing and detection of incongruous concepts and their subsequent resolution

-The TPOJ region has specifically been shown to be activated during self-related processing, and receives input from different sensory afferent neurons

Functional Connectivity:

Sensory strip: area 1, 2, 3a, 3b

Motor strip: area 4

Premotor regions: 55b, FEF

Lateral frontal lobe: IFJa, IFSp

Insula and opercular regions: OP4, PFcm, RI, STV, PSL, A4, A5, PBelt, LBelt

Temporal lobe: STSdp

Medial occipital lobe: V2, V3, V4

Ventral visual stream: FFC

Lateral occipital lobe: TPOJ2, TPOJ3

White matter connections:

Structurally connected to the arcuate/SLF and inferior parietal lobe. Arcuate/SLF connections wrap around the sylvian fissure toward the frontal lobe to end at premotor parcellations IFJa, IFJp, and 6r. From the arcuate/SLF there are also connections to the inferior parietal lobule that end at PFm, PGi, and PGs.

Local short association fibers connect with TPOJ2, STSvp, and STSdp

Traditional Acupoint Correlates:

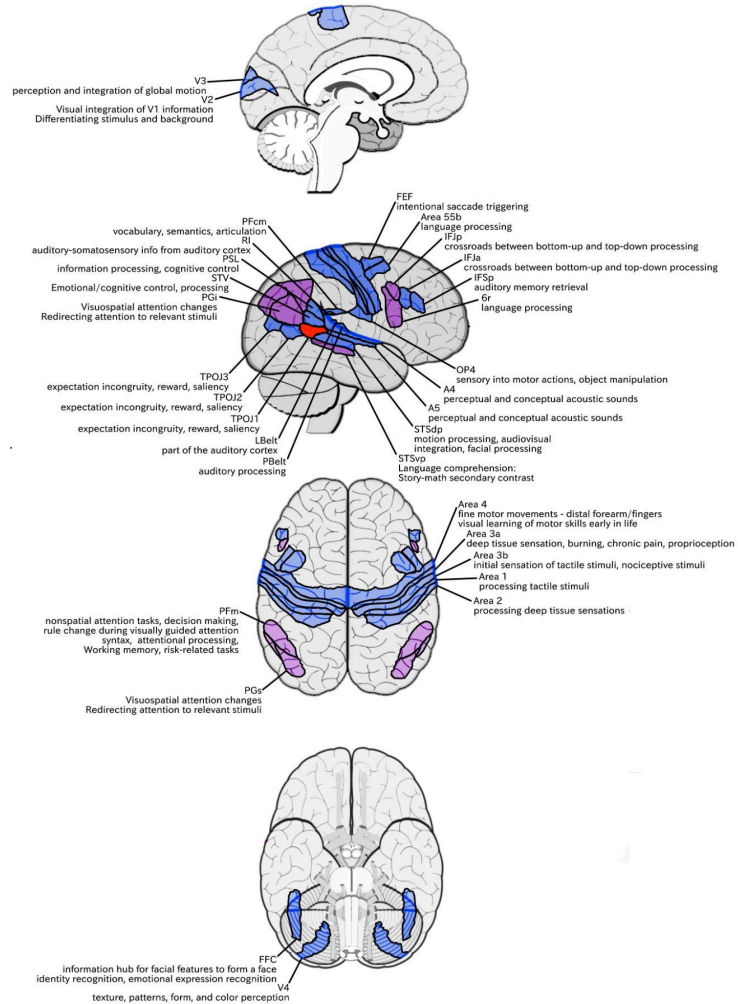
N/A (superior to GB8)

Functionally Connected Acupoints:

- | | |
|--------------------|----------------|
| BL7 (2) | GB5 (A4/A5) |
| GB6 (STSdp) | GB16 (55b/FEF) |
| GB17 (1/2/3a/3b/4) | GV18 (V2) |
| GV20 (1/3a/3b/4) | |

Structurally Connected Acupoints:

- | | |
|----------------|-------------------|
| GB4 (6r) | GB6 (STSdp/STSvp) |
| GB18 (PFm/PGs) | ST8 (6r/IFJp) |



Area TPOJ2

(Temporo-Parietal-Occipital Junction 2)

Location:

On the anterior, superior part of the lateral occipital cortex. It straddles the sulcus and is on the posteroinferior bank of the angular gyrus

Functions:

- Detecting incongruities between expected and presented stimuli, reward processing, and saliency
- Theory of mind, and the processing and detection of incongruous concepts and their subsequent resolution
- The TPOJ region has specifically been shown to be activated during self-related processing, and receives input from different sensory afferent neurons
- Compared to TPOJ1: greater activity when individuals are viewing an image of a body compared to an average image of places, tools, and faces
- Deactivated when viewing place images and when listening to a story vs unrelated words.

Functional Connectivity:

- Sensory strip: area 2
- Premotor regions: 6a, 6v, SCEF, FEF
- Cingulate regions: 5mv, 23c, p24pr
- Insula and opercular regions: OP4, 43, PFcm, 52, RI, STV, A4, Pol1, Pol2, PBelt
- Temporal lobe: PHT, TE2p
- Lateral parietal lobe: PFop, PGp, IPS1, IP0, AIP, LIPv, 7AL, 7PL, 7PC
- Medial parietal lobe: 7AM, PCV, DVT
- Medial occipital lobe: V2, V3
- Dorsal visual stream: V3a, V6, V6a
- Ventral visual stream: FFC
- Lateral occipital lobe: FST, PH, LO3, MST, TPOJ1, TPOJ3

White matter connections:

Structurally connected to the arcuate/SLF and inferior parietal lobule. Arcuate/SLF connections wrap around the sylvian fissure toward the frontal lobe to end at premotor parcellations IFJa, IFJp, 6v, and 6r. From the arcuate/SLF there are also connections to the inferior parietal lobule that end at PFm, PGi, and PGs. Local short association fibers connect with TPOJ1

Traditional Acupoint Correlates:

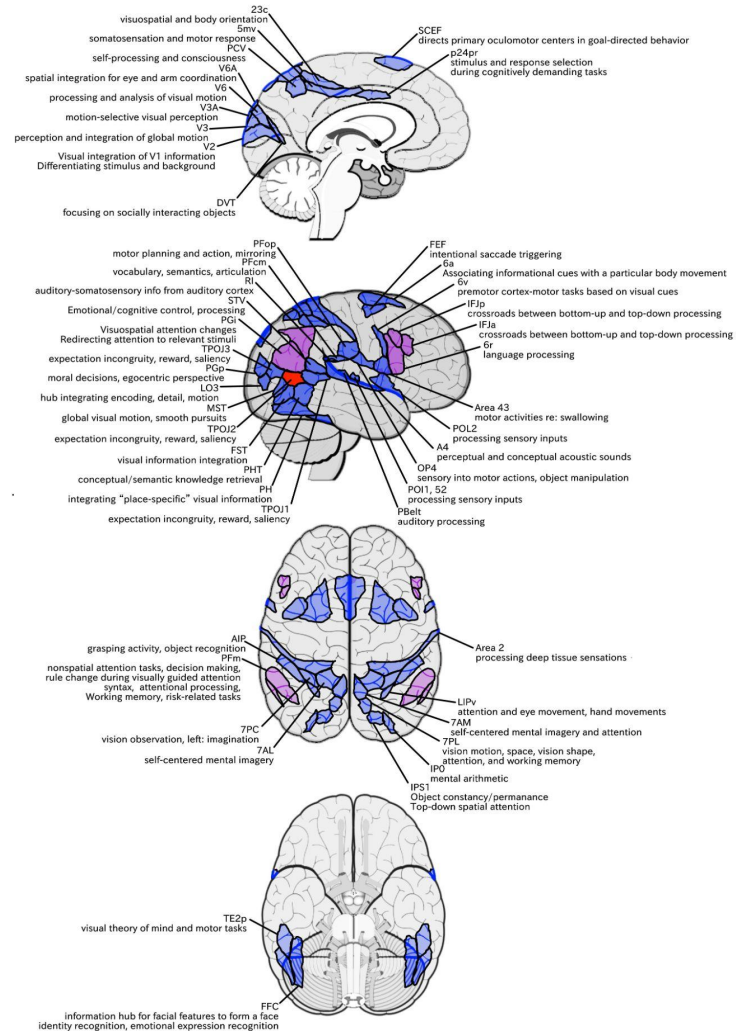
N/A (superior to GB9)

Functionally Connected Acupoints:

- | | |
|----------------|------------------|
| BL6 (6a) | BL7 (2/7AL/7PC) |
| BL8 (IP0/IPS1) | GB4 (43) |
| GB5 (A4/Pol2) | GB7 (TE2p) |
| GB8 (PHT) | GB9 (PH/PHT/FST) |
| GB16 (FEF) | GB18 (AIP/LIPv) |
| ST8 (6v) | TW20 (TE2p) |
| GV18 (V2) | GV21 (SCEF) |

Structurally Connected Acupoints:

- | | |
|------------------|----------------|
| GB4 (6r) | GB18 (PFm/PGs) |
| ST8 (6r/6v/IFJp) | |



Area TPOJ3 (Temporo-Parietal-Occipital Junction 3)

Location:

On the posterior inferior portion of the inferior parietal lobule

Functions:

-Strongly activated when viewing faces compared to when viewing shapes

-Compared to TPOJ2: more active during working memory tasks, and less active during motor cue and shape recognition tasks

Functional Connectivity:

Sensory strip: area 2

Premotor regions: 6a, FEF

Cingulate regions: 5mv, 23c

Insula and opercular regions: OP4, PFcm, STV

Temporal lobe: PHA2, PHA3, TE2p

Lateral parietal lobe: PGp, IP0, 7PC

Medial parietal lobe: 7AM, PCV, DVT

Medial occipital lobe: V2

Dorsal visual stream: V6

Ventral visual stream: FFC

Lateral occipital lobe: FST, PH, LO3, MST, TPOJ1, TPOJ2

White matter connections:

Structurally connected with local parcellations and the ILF. Connections with the ILF project through the inferior temporal lobe to end at TF, TGv, and PeEc areas. There are also projections to the premotor cortex but this is inconsistent across individuals.

Local short association bundles connect with MT, MST, LO3, FST, TPOJ3, TE2p, PH, and PGI

Traditional Acupoint Correlates:

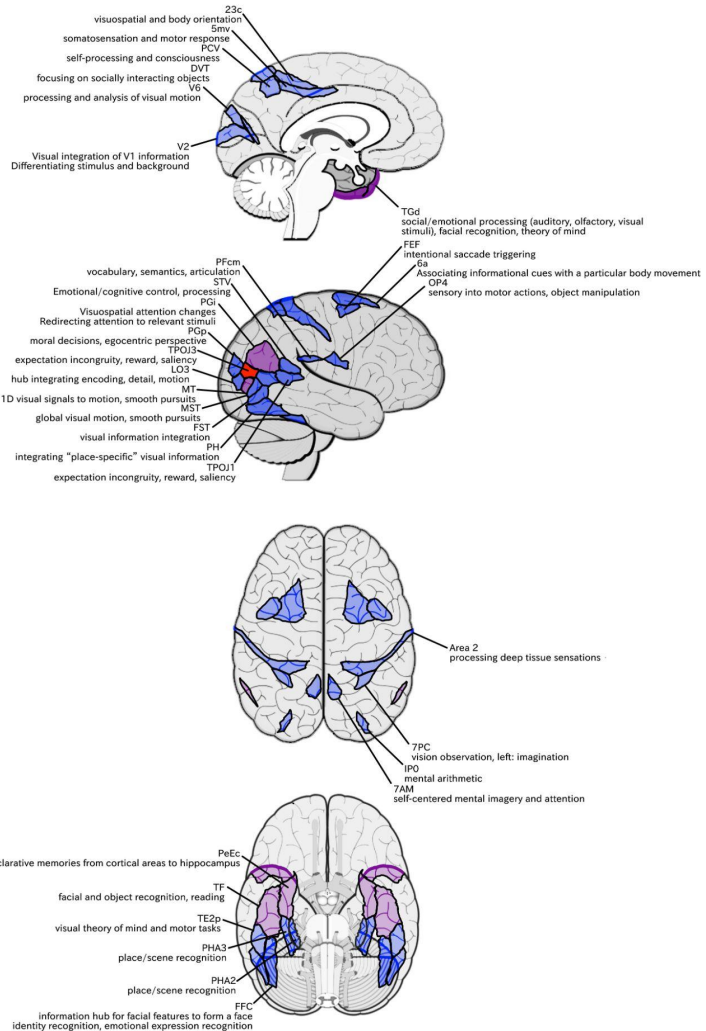
N/A (superior and posterior to GB9)

Functionally Connected Acupoints:

BL6 (6a)	BL7 (2/7PC)
BL8 (IP0)	GB7 (TE2p)
GB9 (PH/FST)	GB16 (FEF)
GB17 (2)	TW20 (TE2p)
GV18 (V2)	

Structurally Connected Acupoints:

GB7 (TE2p)	GB9 (PH/FST)
TW20 (TE2p)	



Intraparietal Sulcus Area

Area IP2 (Intraparietal 2)

Location:

On the anterior most portion of the inferior bank of the intraparietal sulcus

Functions:

- Significant activation during mental arithmetic activities
- Anterior IPS areas appear to support more complex parts of numeric and mathematical information processing
- Anterolateral bank of the IPS is involved in the modulatory sensorimotor integration processes related to fine finger movements

Functional Connectivity:

Premotor regions: 6ma, 6a, 6r

Cingulate regions: 33pr, 8BM

Lateral frontal lobe: IFSa, IFJp, a9-46v, p9-46v, 46, 11L, 8C, i6-8, a47r, p47r

Insula and opercular regions: AVI

Temporal lobe: PHT, TE1p

Lateral parietal lobe: PFT, PF, PFm, PGp, IP0, IP1, AIP, MIP, LIPd, 7PL

Medial parietal lobe: 7AM, 7PM, 31a, POS2, RSC

Occipital lobe: PH

White matter connections:

Structurally connected with the SLF. Connections with the SLF project anteriorly to the premotor cortex to end at 55b and PEF. Local short association fibers connect with PFm, LIPd, AIP, and IP1. White matter tracts in the right hemisphere have more inferior connections with the inferior frontal gyrus

Traditional Acupoint Correlates:

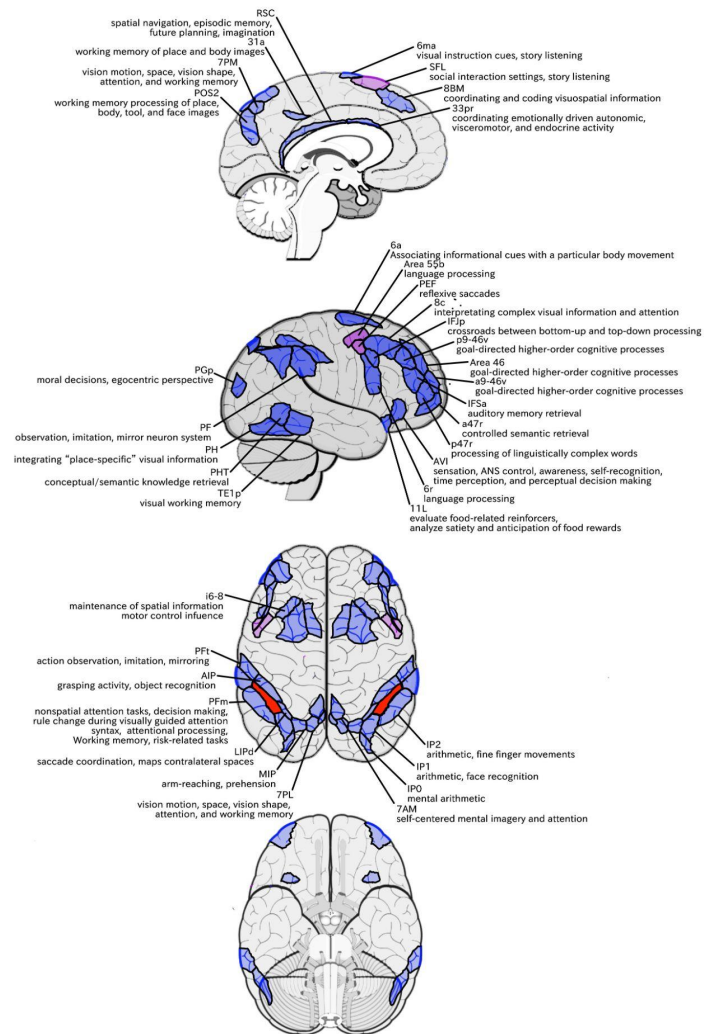
N/A (1/3 distance from GB18 to GB17)

Functionally Connected Acupoints:

BL4 (46)	BL5 (i6-8)
BL6 (6a)	BL8 (IP0/IP1)
GB4 (6r)	GB7 (TE1p)
GB8 (PHT/TE1p)	GB9 (PH/PHT)
GB13 (p9-46v)	GB15 (8C/p9-46v/46)
GB18 (AIP/PFm/IP1)	ST8 (6r/IFJp)
GV19 (7PM)	

Structurally Connected Acupoints:

GB16 (55b)	GB18 (AIP/PFm/IP1)
ST8 (PEF)	



Area IP1 (Intraparietal 1)

Location:

On the middle portion of the inferior bank of the intraparietal sulcus

Functions:

- Significant activation during mental arithmetic activities, and, as part of the anterior IPS, supports more complex parts of numeric and mathematical information processing
- Greater activation in primary contrasts, when interpreting motor cues and when hearing a story compared to when hearing arithmetic problems
- Compared to IP2: more active when individuals are processing faces than when processing shapes, and is less deactivated when hearing a story vs unrelated words

Functional Connectivity:

Premotor regions: 6a

Cingulate regions: 33pr, 8BM

Lateral frontal lobe: IFSa, IFSp, IFJp, a9-46v, p9-46v, 8AV, 8C, i6-8, a47r, p47r

Temporal lobe: TE1m, TE1p, PHT, PreS

Lateral parietal lobe: PFm, PGs, IP0, IP2, AIP, MIP, LIPd

Medial parietal lobe: 7PM, 31a, d23ab, POS2, RSC

Occipital lobe: V1

White matter connections:

Structurally connected with the SLF. Connections with the SLF project anteriorly to the premotor cortex to end at 55b, FEF, and PEF. Local short association fibers connect with PFm, LIPd, IP0, IPS1, and PGs. White matter tracts in the right hemisphere have more inferior connections with the inferior frontal gyrus

Traditional Acupoint Correlates:

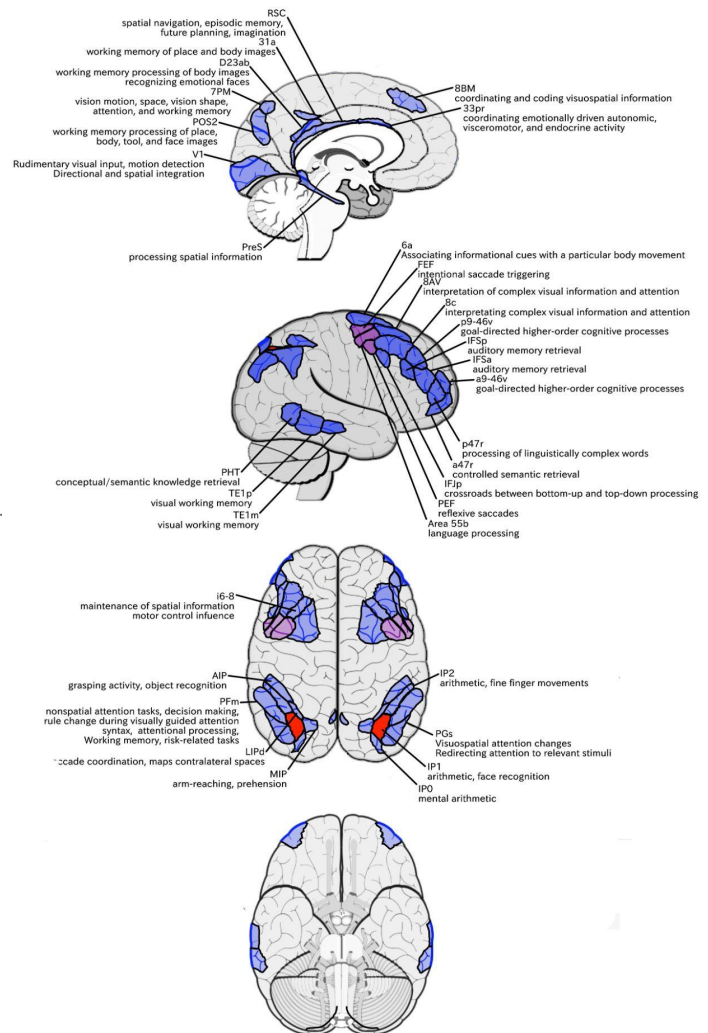
BL8, GB18

Functionally Connected Acupoints:

BL4 (8AV)	BL5 (8AV/i6-8)
BL6 (6a)	BL8 (IP0)
GB7 (TE1m/TE1p)	GB8 (PHT/TE1p)
GB9 (PHT)	GB13 (p9-46v)
GB15 (8AV/8C/p9-46v)	GB18 (AIP/PFm/PGs)
ST8 (IFJp)	GV18 (V1)
GV19 (7PM)	

Structurally Connected Acupoints:

BL8 (IP0/IPS1)	GB16 (5b/FEF)
GB18 (PFm/PGs)	ST8 (PEF)



Area IP0 (Intraparietal 0)

Location:

On the posterior most portion of the inferior bank of the intraparietal sulcus\

Functions:

-Significant activation during mental arithmetic activities
 -Posterior IPS regions may play a role in the transformation of symbolic/nonsymbolic numeric information into spatial and semantic representation

-Compared to IP1: deactivated when viewing faces than an average compilation of body, tool, and place images, and activated vs deactivated when viewing places compared to a compilation of face, body, and tool images; it is also less deactivated when hearing a language story vs an unrelated grouping of words

Functional Connectivity:

- Premotor regions: SCEF, FEF, PEF, 6a, 6r, 6ma
- Cingulate regions: 5mv, 23c
- Lateral frontal lobe: IFSa, IFSp, IFJa, IFJp, i6-8, p9-46v, 46
- Temporal lobe: PeEc, PHA2, PHA3, TE1p, TE2p, PHT
- Lateral parietal lobe: AIP, MIP, VIP, LIPd, LIPv, PFop, PF, PFT, PGp, IP2, IP1, IPS1, 7PL, 7PC
- Medial parietal lobe: 7AM, 7PM, DVT, PCV
- Medial occipital lobe: ProS, V1, V2, V3, V4
- Dorsal visual stream: V3a, V3b, V7, V6, V6a
- Ventral visual stream: FFC, VVC, V8, VMV2, VMV3
- Lateral occipital lobe: V3cd, LO1, LO3, PH, TPOJ2, TPOJ3, FST

White matter connections:

Structurally connected with local parcellations and to the middle longitudinal fasciculus (MdLF). Connections with the MdLF travel deep to the parietal lobe to the superior temporal gyrus to end at A4.
 Local short association bundles connect with IP1, IPS1, V3B, V6A, DVT, and V6

Traditional Acupoint Correlates:

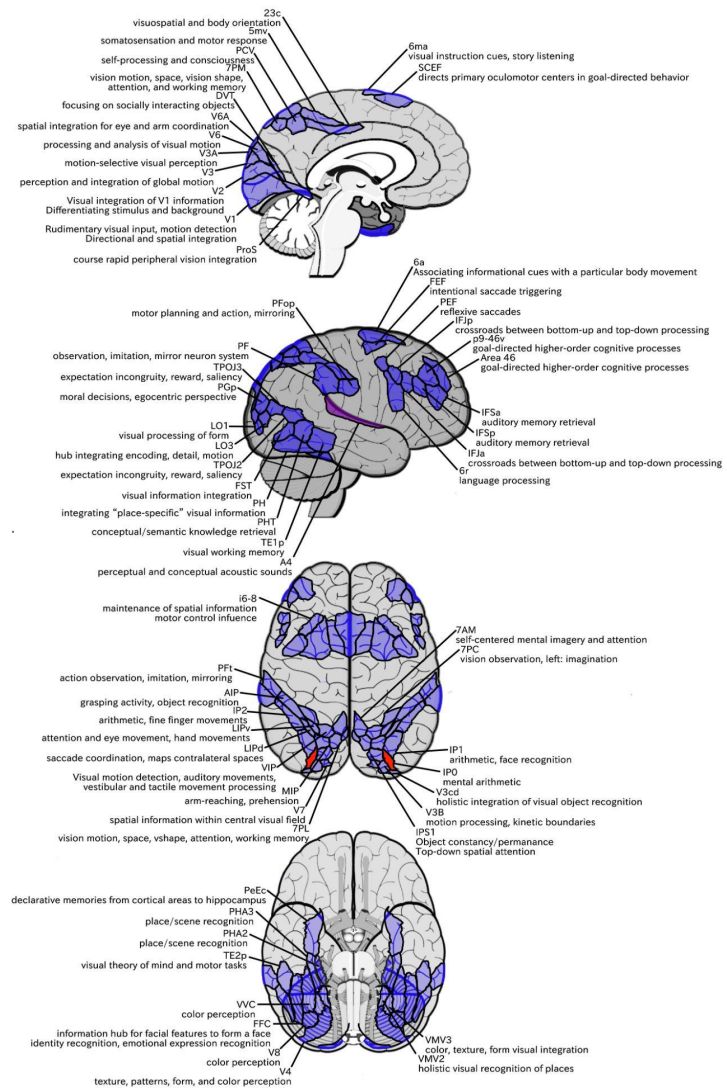
BL8

Functionally Connected Acupoints:

- | | |
|-----------------------|-------------------|
| BL4 (46) | BL5 (i6-8) |
| BL6 (6a) | BL7 (7PC) |
| BL8 (IP1/IPS1/V3b/V7) | GB4 (6r) |
| GB7 (TE1m/TE2p) | GB8 (PHT/TE1p) |
| GB9 (PH/PHT/FST) | GB13 (p9-46v) |
| GB15 (p9-46v/46) | GB16 (FEF) |
| GB18 (AIP/LIPv/IP1) | ST8 (6r/IFJp/PEF) |
| TW20 (TE2p) | GV18 (V1/V2) |
| GV19 (7PM/V6a) | GV21 (SCEF) |

Structurally Connected Acupoints:

- | | |
|----------------|------------|
| BL8 (IP1/IPS1) | GB5 (A4) |
| GB18 (IP1) | GV19 (V6a) |



Area IPS1 (Intraparietal Sulcus 1)

Location:

on the posterior, superior bank of the intraparietal sulcus. It should not be confused with IP1, which is on the inferior bank of the sulcus. IPS1 is the posterior most region on the superior bank of the intraparietal sulcus.

Functions:

- Processing object-based information. This suggests that this region is important in object constancy, which describes the ability of an individual to interpret object permanence
- Important in mentally visualizing the process of grasping objects as well as action associations and object function
- Transmission of top-down spatial attention information to the visual cortex during sustained attention tasks

Functional Connectivity:

- Sensory strip: area 1,2
- Motor strip: 4
- Premotor regions: SCEF, FEF
- Temporal lobe: TE2p, PHT
- Lateral parietal lobe: AIP, MIP, VIP, LIPd, LIPv, PGp, PFt, IP0, 7PL, 7PC
- Medial parietal lobe: DVT
- Medial occipital lobe: V1, V2, V3, V4
- Dorsal visual stream: V3a, V3b, V7, V6, V6a
- Ventral visual stream: V8, PIT, FFC, VVC, VMV1, VMV2, VMV3
- Lateral occipital lobe: V3cd, V4t, LO1, LO2, LO3, PH, TPOJ2, MT, MST, FST

White matter connections:

Structurally connected to the inferior fronto-occipital fasciculus (IFOF), MdLF, and local parcellations. The IFOF courses from IPS1 through the posterior temporal lobe and extreme/external capsule to frontal lobe parcellations. IFOF terminations are inconsistent across individuals but the majority end at the superior temporal gyrus involving parcellations 8BL, 9a, and 9p. Connections with the MdLF travel deep to the parietal lobe to the superior temporal gyrus and planum temporale to end at A4, PBelt, and MBelt. Local short association fibers connect with MIP, V7, V6A, and V3B

Traditional Acupoint Correlates:

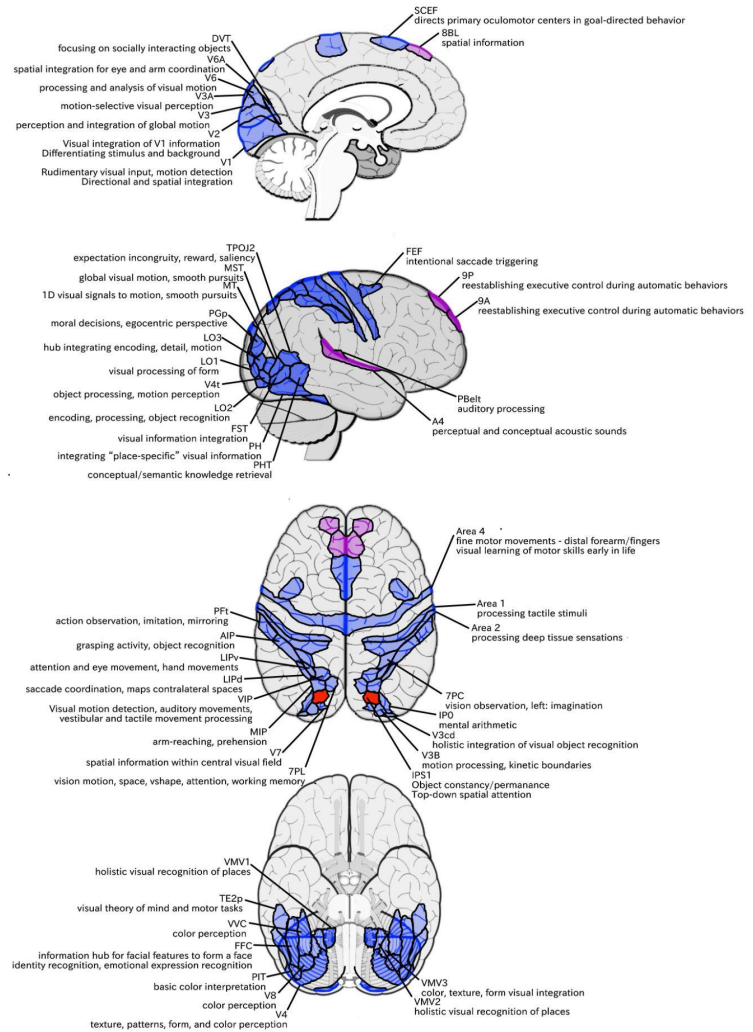
BL8

Functionally Connected Acupoints:

- | | |
|------------------|------------------|
| BL7 (2/7PC) | BL8 (IP0/V3b/V7) |
| GB7 (TE2p) | GB8 (PHT) |
| GB9 (PH/PHT/FST) | GB16 (FEF) |
| GB17 (1/2/4) | GB18 (AIP/LIPv) |
| TW20 (TE2p) | GV18 (V1/V2) |
| GV20 (1 / 4) | GV21 (SCEF) |

Structurally Connected Acupoints:

- | | |
|--------------|------------|
| BL3 (8BL/9P) | BL8 (V3b) |
| GB5 (A4) | GV19 (V6a) |



Area AIP (Anterior Intraparietal)

Location:

On the superior bank of the intraparietal sulcus at its most anterior aspect. It extends onto the superior surface of the adjacent superior parietal lobule, and its anterior tip lies in the bank of the postcentral sulcus.

Functions:

-Grasping activity as well as object recognition. Neurons in this part of the cortex are oriented for grip and hand shape, and the inferior temporal cortex provides input related to object information

-Receives input from the ventral and dorsolateral visual streams

-Tactile shape-processing and understanding orientation in space

Functional Connectivity:

Sensory strip: area 2

Premotor regions: SCEF, FEF, PEF, 6a, 6r, 6ma

Lateral frontal lobe: IFSa, IFJp, 46, p9-46v

Medial frontal lobe: 5mv, 23c

Insula opercular regions: Pol2, FOP2, FOP4, OP4

Temporal lobe: PHA3, TE2p, PHT

Lateral parietal lobe: 7PC, 7PL, 7AL, MIP, VIP, LIPd, LIPv, PFop, PFt, PGp, IP2, IP1, IP0

Medial parietal lobe: DVT, 7AM, 7PM

Medial occipital lobe: V2

Ventral visual stream: FFC

Lateral occipital lobe: V3cd, PH, TPOJ2, FST

White matter connections:

Structurally connected to the pars opercularis and local parcellations. Connections from AIP to the pars opercularis travel anteroinferiorly to end at 43 and 6r.

Local short association bundles connect with 2, PFt, PFcm, PF, IP2, and 7PC

Traditional Acupoint Correlates:

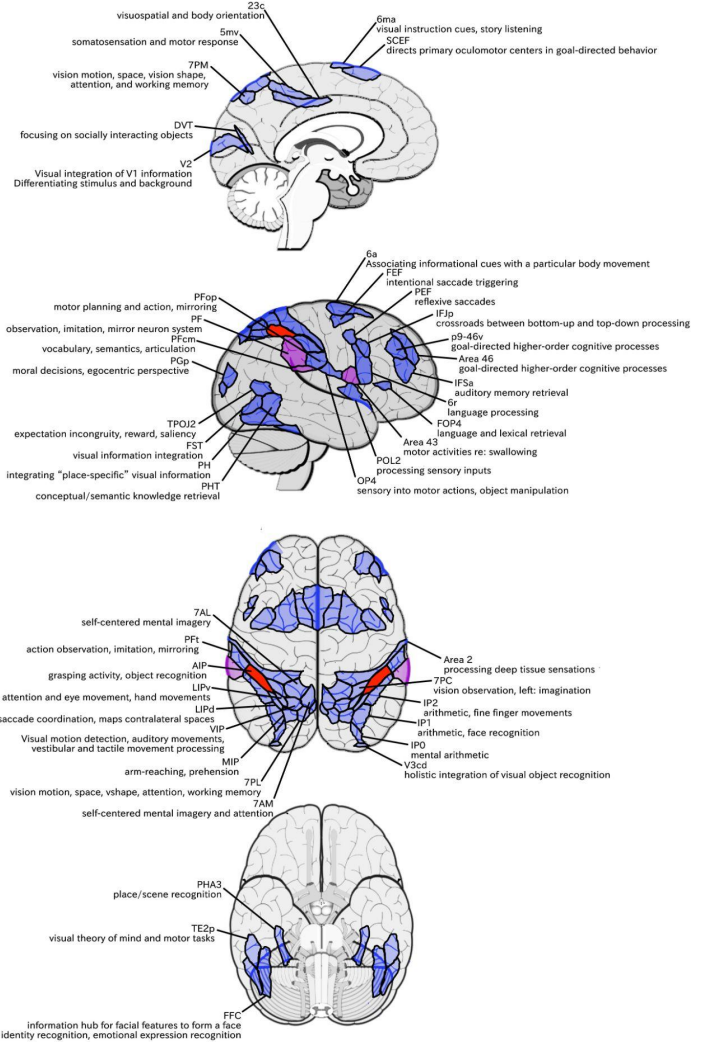
GB18

Functionally Connected Acupoints:

BL4 (46)	BL6 (6a)
BL7 (2/7AL/7PC)	BL8 (IP0/IP1)
GB4 (6r)	GB5 (Pol2)
GB7 (TE2p)	GB8 (PHT)
GB9 (PH/PHT/FST)	GB13 (p9-46v)
GB15 (p9-46v/46)	GB16 (FEF)
GB18 (LIPv/IP1)	ST8 (6r/IFJp/PEF)
TW20 (TE2p)	GV18 (V2)
GV19 (7PM)	GV21 (SCEF)

Structurally Connected Acupoints:

BL7 (2/7PC)	GB4 (6r/43)
GB17 (2)	ST8 (6r)



Area LIPd (Lateral Intraparietal, dorsal)

Location:

Located centrally on the superior bank of the intraparietal sulcus. Note that the nomenclature here can be confusing. LIPd is actually ventral to LIPv

Functions:

- Control of attention and eye movements
- Saccade coordination and mapping of contralateral spaces

Functional Connectivity:

Premotor regions: SCEF, FEF, PEF, 6a, 6r

Lateral frontal lobe: IFSa, IFSp, IFJa, p47r, i6-8, 8C, 9-46d, 46, a9-46v, p9-46v

Medial frontal lobe: 8BM, p32pr, 5mv, 23c

Insula opercular regions: Pol2, FOP4, FOP5, MI, AVI

Temporal lobe: PHA3, TE1p, PHT

Lateral parietal lobe: 7PC, 7PL, AIP, MIP, VIP, LIPv, PF, PGp, IP2, IP1, IP0, IPS1

Medial parietal lobe: PCV, DVT, 7AM, 7PM

Medial occipital lobe: V1, V2, V3

Lateral occipital lobe: PH, FST

White matter connections:

Structurally connected to the premotor region and local parcellations. In some individuals the anterior projections from LIPd end at the motor cortex and do not extend to premotor areas. Premotor connections end at 55b and PEF.

Local short association bundles connect with PGs, AIP, IP1, and IP2

Traditional Acupoint Correlates:

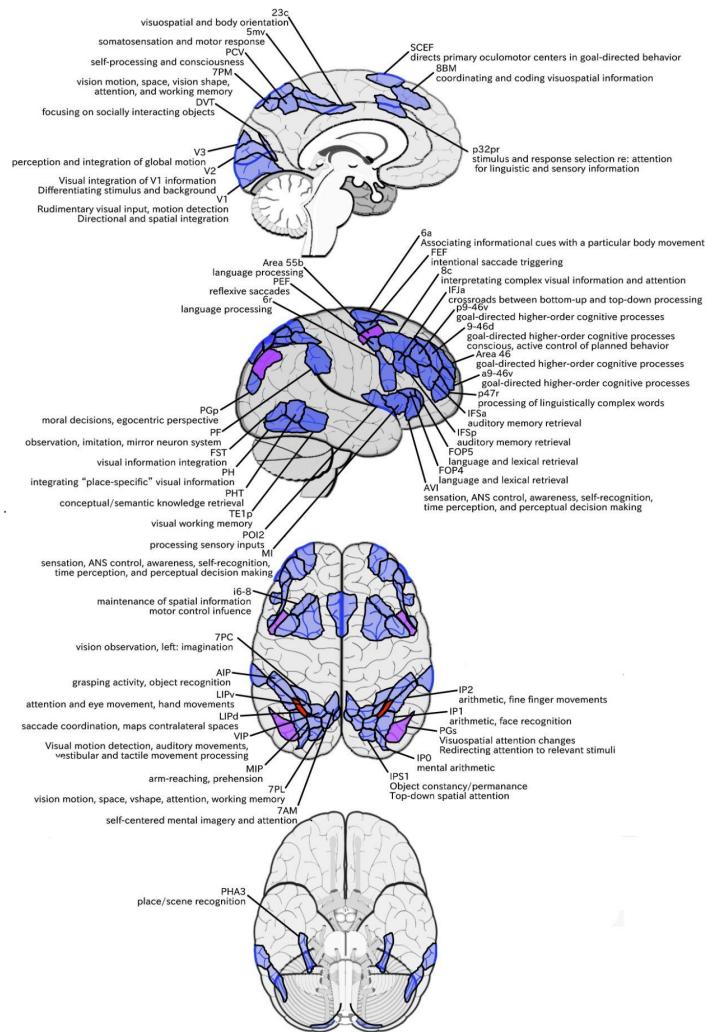
N/A (~½ distance between BL7 and BL8)

Functionally Connected Acupoints:

BL4 (46/9-46d)	BL5 (i6-8)
BL6 (6a)	BL7 (7PC)
BL8 (IP0/IP1/IPS1)	GB4 (6r)
GB5 (Pol2)	GB7 (TE1p)
GB8 (PHT/TE1p)	GB9 (PH/PHT/FST)
GB13 (p9-46v)	GB15 (8C/p9-46v/46)
GB16 (FEF)	GB18 (AIP/LIPv/IP1)
ST8 (6r/PEF)	GV18 (V1/V2)
GV19 (7PM)	GV21 (SCEF)

Structurally Connected Acupoints:

BL8 (IP1)	GB16 (55b)
GB18 (AIP/PGs/IP1)	ST8 (PEF)



Area LIPv (Lateral Intraparietal, ventral)

Location:

On the inferior edge of the superior parietal sulcus. Note that it does not enter the banks of the intraparietal sulcus, but instead is located on the upper surface of the superior parietal lobule

Functions:

- Control of attention and eye movements
- Visually guided reaching and pointing, hand movements, and change in visuomotor contingencies

Functional Connectivity:

Sensory strip: area 1,2

Motor strip: area 4

Premotor regions: SCEF, FEF, PEF, 6a, 6r, 6v

Medial frontal lobe: p32pr, 5mv, 23c

Insula opercular regions: FOP4

Temporal lobe: PHT, TE2p

Lateral parietal lobe: 7PC, 7PL, AIP, MIP, VIP, LIPv, PFop, PFT, PGp, IP0, IPS1

Medial parietal lobe: DVT

Medial occipital lobe: V1, V2, V3, V4

Dorsal visual stream: V3a, V3b, V7, V6a, V6

Ventral visual stream: V8, PIT, FFC, VVC, VMV1, VMV2, VMV3

Lateral occipital lobe: V3cd, V4t, PH, LO1, LO2, LO3, TPOJ2, MT, MST, FST

White matter connections:

Structurally connected to local parcellations. Local short association bundles connect with 2, AIP, 7PC, IP2, LIPd, LIPv, and MIP.

White matter tracts from LIPv in the right hemisphere have more consistent connections with the IFOF. However, this tract is not present in all individuals

Traditional Acupoint Correlates:

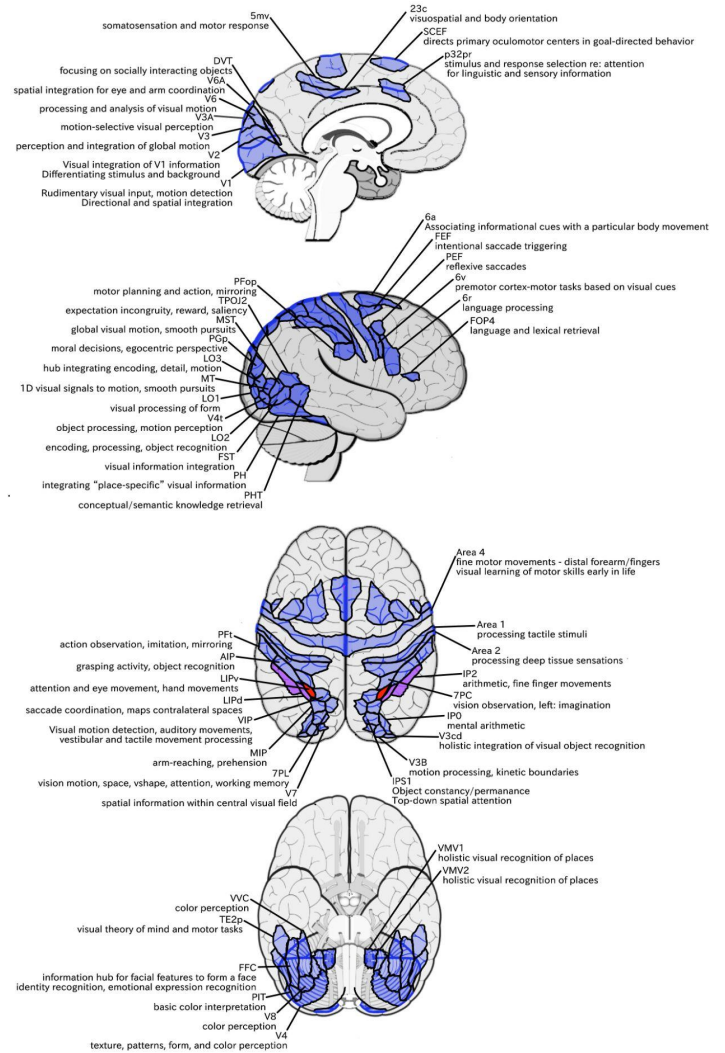
N/A (~½ distance between BL7 and BL8)

Functionally Connected Acupoints:

- | | |
|-----------------------|-----------------|
| BL6 (6a) | BL7 (2/7PC) |
| BL8 (IP0/IPS1/V3b/V7) | GB4 (6r) |
| GB7 (TE2p) | GB8 (PHT) |
| GB9 (PH/PHT/FST) | GB16 (FEF) |
| GB17 (1/2/4) | GB18 (AIP/LIPv) |
| ST8 (6r/6v/PEF) | TW20 (TE2p) |
| GV18 (V1/V2) | GV20 (1/4) |
| GV21 (SCEF) | |

Structurally Connected Acupoints:

- | | |
|-----------------|----------|
| BL7 (2/7PC) | GB17 (2) |
| GB18 (AIP/LIPv) | |



Area MIP (Medial Intraparietal)

Location:

In the posterior portion of the superior bank of the intraparietal sulcus. It extends onto the superior surface of the adjacent portion of the superior parietal lobule

Functions:

- Control of arm-reaching movements as well as prehension
- Important for reception of proprioceptive signals
- Neurons are modulated by reaching activity as well as visual and somatosensory stimulation
- Transformation of visual information into motor action for precise movement

Functional Connectivity:

Premotor regions: SCEF, FEF, PEF, 6a, 6r, 6v, 6ma

Lateral frontal lobe: IFSa, IFJa, IFJp, 46, p9-46v

Medial frontal lobe: 5mv, 23c

Temporal lobe: PHA3, PHT, TE2p

Lateral parietal lobe: 7PC, 7PL, 7AL, AIP, VIP, LIPv, LIPd, PF, PFT, PGp, IP2, IP1, IP0, IPS1

Medial parietal lobe: DVT, 7AM, 7PM

Medial occipital lobe: V1, V2

Ventral visual stream: FFC

Lateral occipital lobe: PH, FST

White matter connections:

Structurally connected to the IFOF, MdLF, and local parcellations. IFOF connections travel from MIP through the posterior temporal lobe and extreme/external capsule to the frontal lobe to end at 8BL, 9p, and 45. Connections with MdLF travel deep to the parietal lobe to the planum temporale to end at PBelt and MBelt. The majority of local short association bundles project inferior to 7PL, IP0, IP1, and IPS1

Traditional Acupoint Correlates:

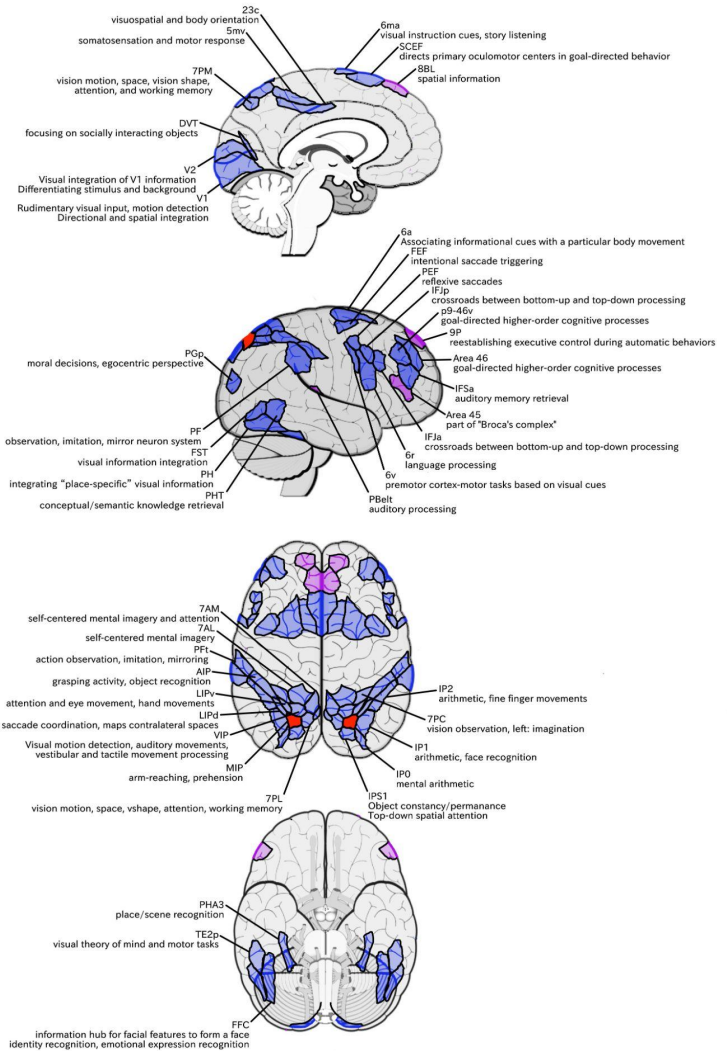
N/A (anterior to BL8)

Functionally Connected Acupoints:

BL4 (46)	BL6 (6a)
BL7 (7AL/7PC)	BL8 (IP0/IP1/IPS1)
GB4 (6r)	GB7 (TE2p)
GB8 (PHT)	GB9 (PH/PHT/FST)
GB13 (p9-46v)	GB15 (p9-46v/46)
GB16 (FEF)	GB18 (AIP/LIPv/IP1)
ST8 (6r/6v/IFJp/PEF)	TW20 (TE2p)
GV18 (V1/V2)	GV19 (7PM)
GV21 (SCEF)	

Structurally Connected Acupoints:

BL3 (8BL/9P)	BL8 (IP0/IP1/IPS1)
GB18 (IP1)	GV22 (8BL)



Superior Parietal Lobule Areas

Area 7PC (7 postcentral)

Location:

In the anterior, inferior superior parietal lobule. It extends into the adjacent posterior bank of the postcentral sulcus

Functions:

- Vision motion, observation, space, and execution
- Left hemisphere: associated with imagination
- Right hemisphere: vision shape, language comprehension, sexuality, and working memory
- Visual and somatosensory stimulation with strong connection to somatosensory areas

Functional Connectivity:

Sensory strip: area 1, 2, 3a, 3b

Motor strip: area 4

Premotor regions: SCEF, FEF, PEF, 6ma, 6mp, 6a, 6d, 6r, 6v

Medial frontal lobe: 24dd, 24dv, p32pr, 5L, 5mv, 23c

Insula opercular region: A4, PBelt, PFcm, FOP2, OP4, OP1

Temporal lobe: PHT, TE2p

Lateral parietal lobe: 7PL, AIP, VIP, MIP, LIPv, LIPd, PFop, PFt, PGp, IP0, IPS1

Medial parietal lobe: DVT, 7AM

Medial occipital lobe: V2

Dorsal visual stream: V3b, V6a, V6

Ventral visual stream: FFC

Lateral occipital lobe: V3cd, V4t, PH, LO3, TPOJ2, TPOJ3, MST, FST

White matter connections:

Structurally connected to local parcellations and the IFOF. Connections from the IFOF course through the posterior temporal gyrus to 8BL, 6a, 6ma, and SFL. Most people have IFOF projections but is not present in everyone.

Local short association bundles are abundant and connect with LIPd, LIPv, MIP, 1, and 2.

White matter connections from 7PC in the right hemisphere have more consistent connections with motor and somatosensory cortices

Traditional Acupoint Correlates:

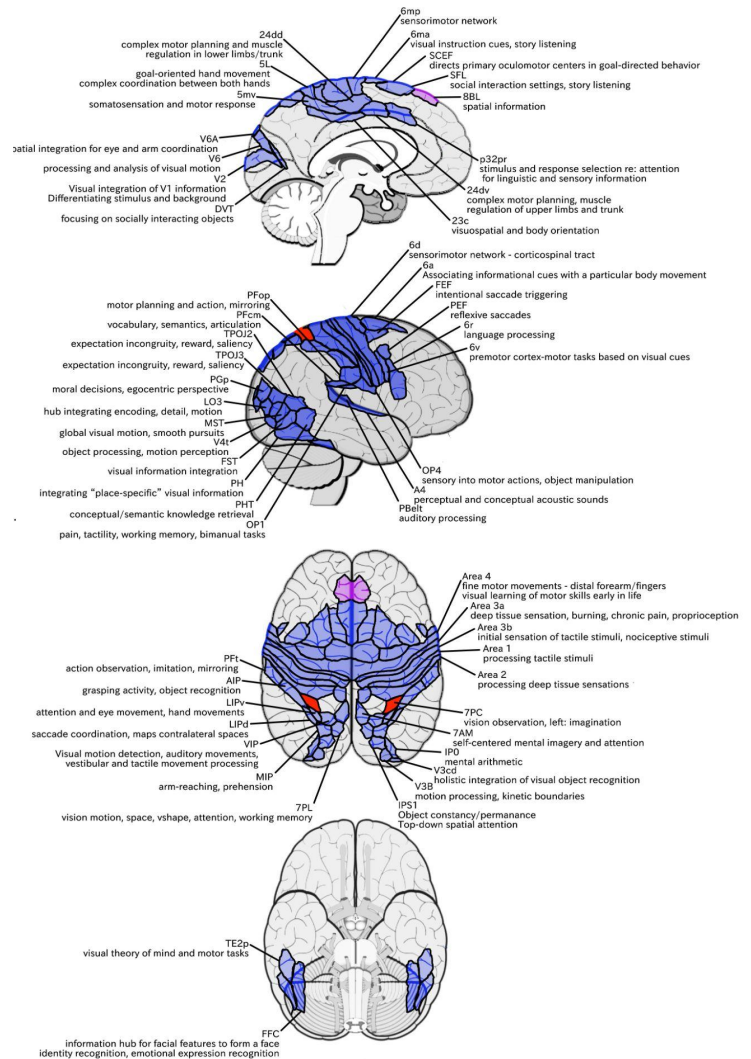
N/A (posterior to BL7)

Functionally Connected Acupoints:

BL6 (6a/6d)	BL7 (2)	BL8 (IP0/IPS1/V3b)
GB4 (6r)	GB5 (A4)	GB7 (TE2p)
GB8 (PHT)	GB9 (PH/PHT/FST)	GB16 (FEF)
GB17 (1/2/3a/3b/4)	GB18 (AIP/LIPv)	ST8 (6r/6v/PEF)
TW20 (TE2p)	GV18 (V2)	GV20 (1/3a/3b/4)
GV21 (SCEF)	GV21 (SCEF)	

Structurally Connected Acupoints:

BL3 (8BL)	BL6 (6a)
BL7 (2)	GB17 (1/2)
GB18 (LIPv)	GV20 (1)



Area 7AL (7 anterior-lateral)

Location:

On the anterior superior portion of the superior parietal lobule. It extends to the interhemispheric midline medially and the postcentral sulcus anteriorly

Functions:

- Several types of information processing including space, vision shape and motion, working memory, and execution
- Anterior portion: self-centered mental imagery and attentional processes
- Functional connectivity to the premotor cortex

-Compared to 7AM: greater activity when processing an average compilation of motor functions and more deactivated when viewing socially interacting geometric objects

Functional Connectivity:

- Sensory strip: area 1, 2, 3a, 3b
- Premotor regions: SCEF, FEF, 6ma, 6a, 6d, 6r
- Lateral frontal lobe: 9-46d, 46
- Medial frontal lobe: 24dv, a24pr, p24pr, p32pr, 5L, 5mv, 23c
- Insula opercular region: area 43, PFcm, FOP1, FOP2, FOP3, FOP4, FOP5, 52, MI, Pol1, Pol2, OP4, OP1
- Temporal lobe: PHT, TE2p
- Lateral parietal lobe: 7PC, 7PL, AIP, VIP, MIP, PFop, PF, Pft, PGp
- Medial parietal lobe: PCV, DVT, 7AM
- Dorsal visual stream: V6
- Lateral occipital lobe: TPOJ2, FST

White matter connections:

Structurally connected to the contralateral hemisphere, IFOF, thalamus and local parcellations. Connections with the IFOF course through the posterior temporal lobe and extreme/external capsule to the frontal lobe to parcellations 9a, 9p, 6a, and 6ma. Thalamic connections project inferior through the posterior thalamus and to the brainstem and superior colliculus. Contralateral connections end at 7AL and 7AM after coursing through the corpus callosum. The majority of local association bundles project posterior to 7PL, IP0, IP1, IPS1, LIPd, MIP; bundles are also connected with 2 and 5L. White matter connections from 7AL in the right hemisphere do not have as consistent connections with the superior frontal gyrus via the IFOF, when IFOF connections are present the tract terminates at the lateral frontal lobe

Traditional Acupoint Correlates:

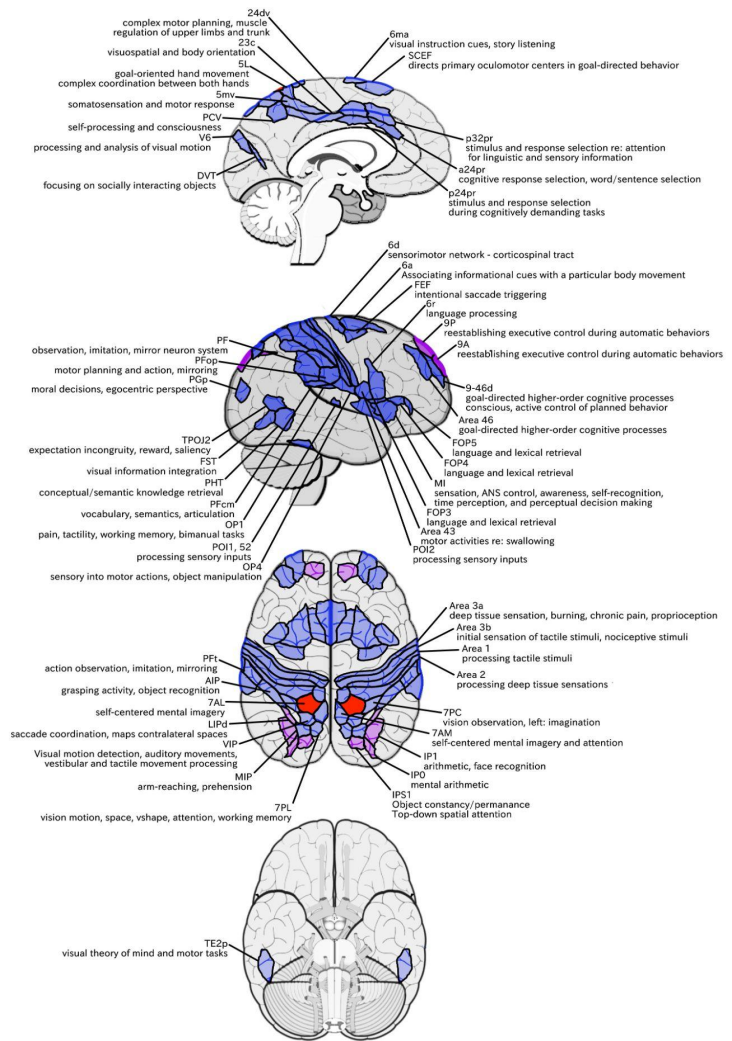
BL7

Functionally Connected Acupoints:

BL4 (9-46d/46)	BL6 (6a/6d)	BL7 (2/7PC)
GB4 (43/6r)	GB5 (Pol2)	GB7 (TE2p)
GB8 (PHT)	GB9 (PHT/FST)	GB15 (46)
GB16 (FEF)	GB17 (1/2/3a/3b)	ST8 (6r)
TW20 (TE2p)	GV20 (1/3a/3b)	GV21 (SCEF)

Structurally Connected Acupoints:

BL3 (9P)	BL6 (6a)
BL7 (2)	BL8 (IP0/IP1/IPS1)
GB18 (IP1)	GB17 (2)



Area 7AM (7 anterior-medial)

Location:

On the anterosuperior surface of the medial face of the superior parietal lobule

Functions:

-Several types of information processing including space, vision shape and motion, working memory, and execution
 -Anterior portion: self-centered mental imagery and attentional processes

-Compared to 7PL: less activated during working memory and auditory story tasks

-Compared to 7PM: less activated during working memory and shape recognition tasks.

Functional Connectivity:

Premotor regions: SCEF, FEF, PEF, 6ma, 6a, 6r

Lateral frontal lobe: IFSa, 9-46d, 46

Medial frontal lobe: a24pr, a32pr, p32pr, 5mv, 23c

Insula opercular region: MI, Po11, Po12, PFcm, FOP4

Temporal lobe: PHA3, PHT, TE2p

Lateral parietal lobe: 7PC, 7AL, 7PL, AIP, VIP, MIP, LIPd, PFop, PFT, PF, PGp, IP2, IP0

Medial parietal lobe: 7PM, PCV, POS2, DVT

Medial occipital lobe: V1

Dorsal visual stream: V6

Ventral visual stream: FFC

Lateral occipital lobe: PH, TPOJ2, TPOJ3, FST

White matter connections:

Structurally connected to the contralateral hemisphere and thalamus.

Some individuals have IFOF connections but these tracts are inconsistent. Contralateral connections course through the corpus callosum to end at 7AM and 7PM. Thalamic connections project inferior through the posterolateral thalamus to the brainstem and superior colliculus.

Local association bundles connect with VIP and 7PL

Traditional Acupoint Correlates:

N/A (anterior-lateral to GV19)

Functionally Connected Acupoints:

BL4 (9-46d/46)

BL8 (IP0)

GB7 (TE2p)

GB16 (FEF)

TW20 (TE2p)

GV21 (SCEF)

BL6 (6a)

GB4 (6r)

GB8 (PHT)

GB18 (AIP)

GV18 (V1)

BL7 (7AL/7PC)

GB5 (Po12)

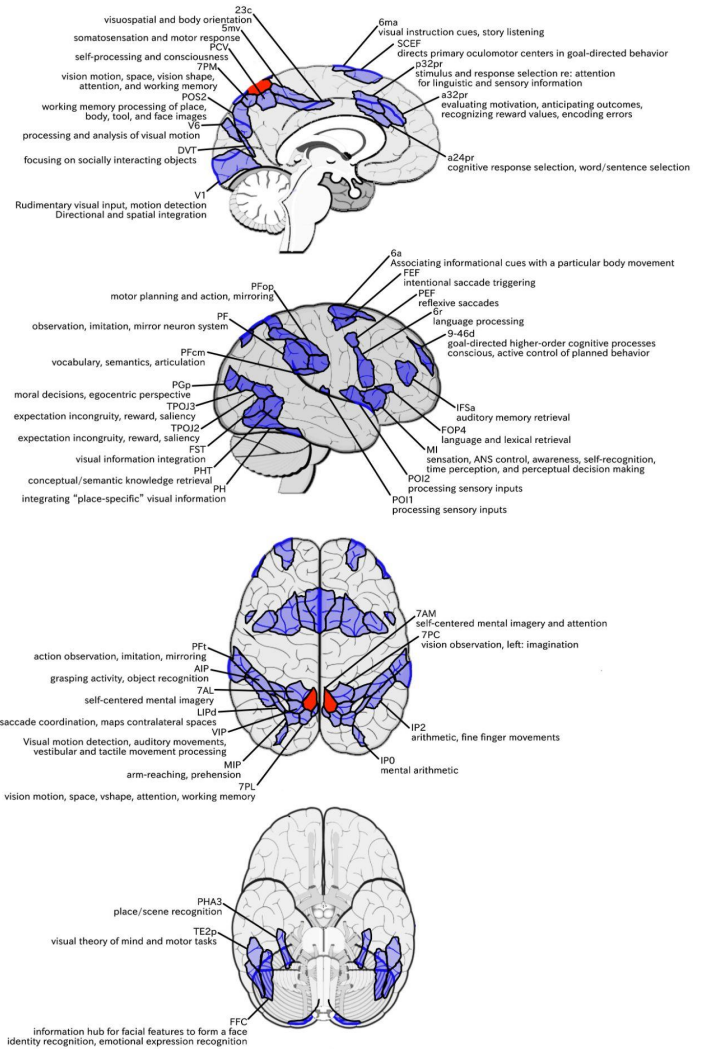
GB9 (PH/PHT/FST)

ST8 (6r/PEF)

GV19 (7PM)

Structurally Connected Acupoints:

GV19 (7PM)



Area 7PL (7 posterior-lateral)

Location:

On the posterior superior surface of the superior parietal lobule

Functions:

- Left hemisphere: vision motion, space, vision shape, attention, and working memory
- Right hemisphere: vision motion, space, vision shape, working memory, motor learning, execution, and attention
- Role in episodic memory retrieval and saccade-related activity

-Compared to 7PM: activated vs deactivated when viewing body images vs a compilation of tool, face and place images; demonstrates greater functional activity in both emotional and social cue tasks

Functional Connectivity:

- Premotor regions: SCEF, FEF, PEF, 6ma, 6a, 6r
- Lateral frontal lobe: IFSa, IFJp, p9-46v, 46, 9-46d
- Medial frontal lobe: p32pr, 5mv, 23c
- Insula opercular region: FOP4
- Temporal lobe: PHA3, PHT, TE2p
- Lateral parietal lobe: 7PC, 7AL, AIP, VIP, MIP, LIPd, LIPv, PFop, PFT, PF, IPS1, IP2, IP0
- Medial parietal lobe: 7AM, 7PM, PCV, DVT
- Medial occipital lobe: V1
- Dorsal visual stream: V6
- Ventral visual stream: FFC
- Lateral occipital lobe: PH, TPOJ2, FST

White matter connections:

Structurally connected to the IFOF, thalamus, MdLF and local parcellations. IFOF connections course through the posterior temporal lobe and extreme/external capsule to superior frontal gyrus parcellations 9p, 8BL, and SFL. The MdLF terminates near the planum temporale at parcellation MBelt. Thalamic connections project inferior through the posterolateral thalamus to the brainstem and superior colliculus.

The majority of local short association bundles project posterior to V3A, V7, IP0, MIP, PGp, and IPS1, there are also connections to VIP, 7PL, and 7AM

Traditional Acupoint Correlates:

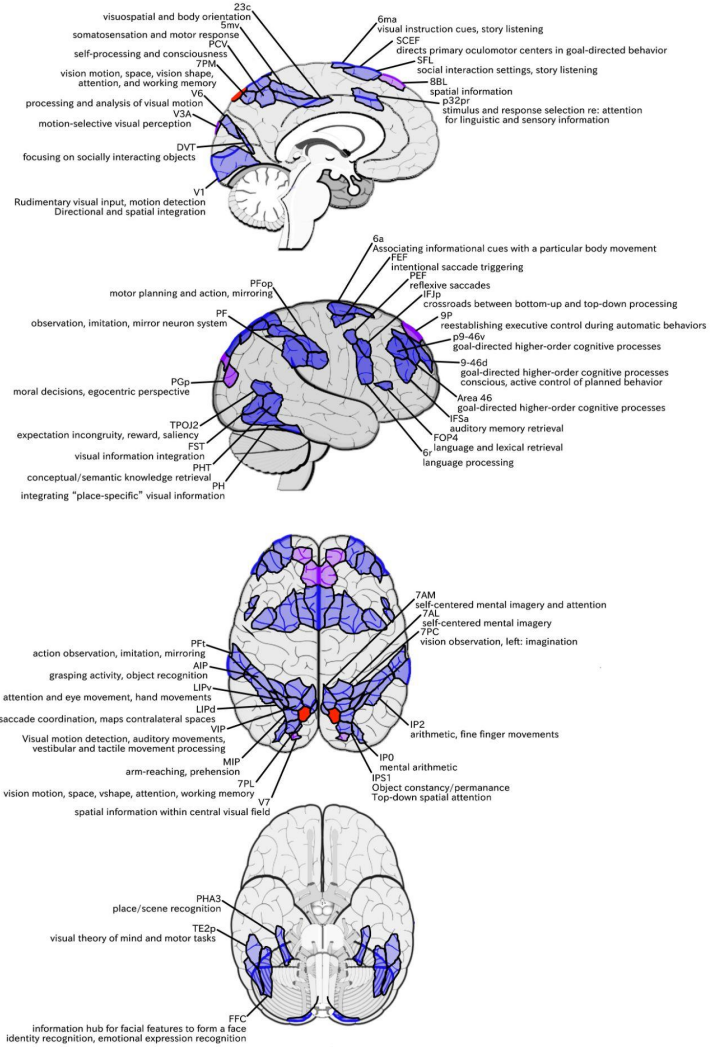
N/A (lateral to GV19)

Functionally Connected Acupoints:

- | | |
|-------------------|------------------|
| BL4 (9-46d/46) | BL6 (6a) |
| BL8 (IP0/IPS1) | GB4 (6r) |
| GB8 (PHT) | GB9 (PH/PHT/FST) |
| GB15 (p9-46v/46) | GB16 (FEF) |
| ST8 (6r/IFJp/PEF) | TW20 (TE2p) |
| GV19 (7PM) | GV21 (SCEF) |

Structurally Connected Acupoints:

- | | | |
|--------------|-------------------|------------|
| BL3 (8BL/9P) | BL8 (IP0/IPS1/V7) | GV21 (SFL) |
|--------------|-------------------|------------|



Area 7PM (7 posterior-medial)

Location:

Occupies the posterior superior parietal lobule at the angle where the convexity surface of the SPL turns inferior to form its interhemispheric surface. 7PM occupies portions of both surfaces

Functions:

- Left hemisphere: vision motion, space, vision shape, attention, and working memory
- Right hemisphere: vision motion, space, vision shape, working memory, motor learning, execution, and attention
- Role in episodic memory retrieval and saccade-related activity

-Compared to 7PL: deactivated vs activated when viewing body images vs a compilation of tool, face and place images; less activated during emotional and social cue tasks

Functional Connectivity:

- Frontal lobe: i6-8, s6-8, 8AD, 8BM, 8C, a10p, p10p, 46, 9-46d, a9-46v, p9-46v, a32pr, 23c, IFJp
- Premotor area: 6a, 6ma
- Temporal lobe: PHA2, PreS, PHT, TE1p
- Lateral parietal lobe: PGp, PGs, PFm, IP0, IP1, IP2, AIP, MIP, LIPd, 7PL
- Medial parietal lobe: 7m, 7AM, PCV, DVT, 31a, POS1, POS2, RSC

White matter connections:

Structurally connected to the contralateral side and thalamus. Some individuals have IFOF connections but these are inconsistent. Contralateral connections course through the corpus callosum to end at 7PM, POS2, and PCV. Thalamic connections project inferior through the posterolateral thalamus to the brainstem and superior colliculus. Local short association bundles connect with POS2, PCV, and 7AM

Traditional Acupoint Correlates:

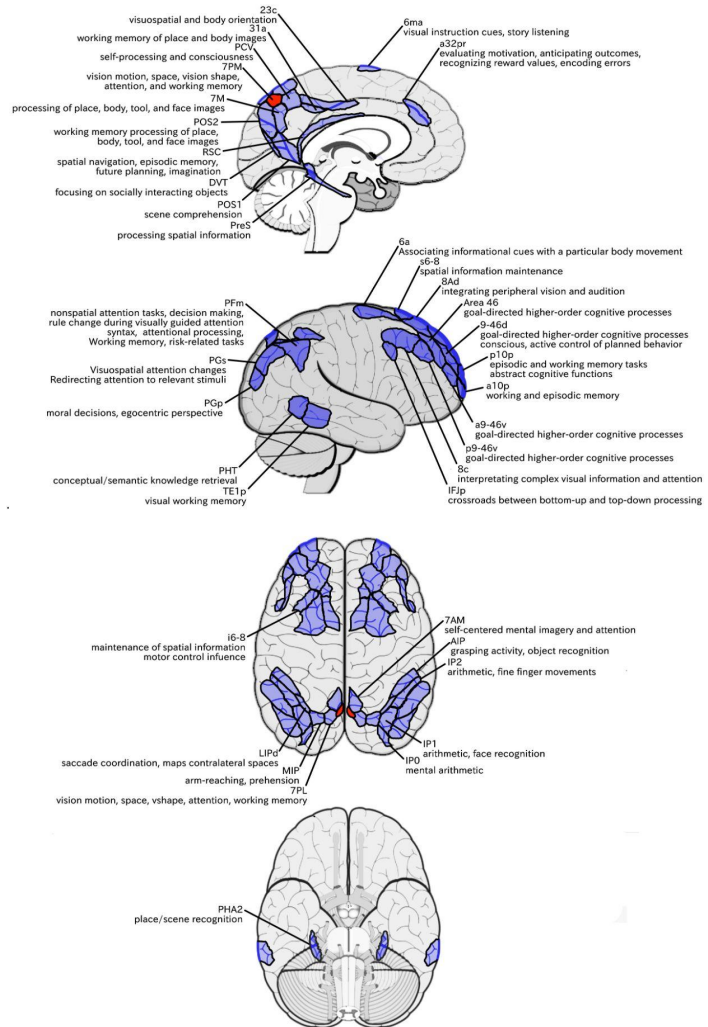
GV19

Functionally Connected Acupoints:

- | | |
|-------------------------|------------------------|
| BL3 (8AD) | BL4 (8AD/9-46d/46) |
| BL5 (8AD/i6-8) | BL6 (6a) |
| BL8 (IP0/IP1) | GB7 (TE1p) |
| GB8 (PHT/TE1p) | GB9 (PHT) |
| GB13 (p9-46v) | GB14 (a10p/p10p) |
| GB15 (8AD/8C/p9-46v/46) | GB18 (AIP/PFm/PGs/IP1) |
| ST8 (IFJp) | |

Structurally Connected Acupoints:

N/A



Area VIP (Ventral Intraparietal)

Location:

On the central portion of the superior surface of the superior parietal lobule. It does not extend to the intraparietal sulcus, though it does approach the interhemispheric fissure

Functions:

- Demonstrates directional selectivity
- Activated by optic flow and assists in encoding direction
- Important for visual motion detection, auditory movements, and vestibular and tactile movement processing

Functional Connectivity:

- Sensory strip: area 1, 2
- Motor strip: 4
- Premotor regions: SCEF, FEF, 6a, 6v
- Insula opercular region: FOP4
- Temporal lobe: PHT
- Lateral parietal lobe: 7PC, 7PL, 7AL, AIP, MIP, LIPv, LIPd, PGp, IP0, IPS1
- Medial parietal lobe: DVT
- Medial occipital lobe: V2, V3, V4
- Dorsal visual stream: V3a, V3b, V7, V6a, V6
- Ventral visual stream: V8, PIT, FFC, VVC, VMV1, VMV2, VMV3
- Lateral occipital lobe: V3cd, V4t, PH, LO1, LO2, LO3, MT, MST, FST

White matter connections:

Structurally connected to the MdLF, IFOF, thalamus, and local parcellations. IFOF connections course through the posterior temporal lobe and extreme/external capsule to superior frontal gyrus parcellations 9p, 8BL, and SFL. MdLF connections project inferior, deep to the parietal lobe to the planum temporale to end at MBelt. Thalamic connections project inferior through the posterolateral thalamus to the brainstem and superior colliculus. Local short association bundles connect with 7AL, 7AM, 7PL, MIP, and LIPv

Traditional Acupoint Correlates:

N/A (anterior and lateral to GV19)

Functionally Connected Acupoints:

- | | |
|-----------------------|-----------------|
| BL6 (6a) | BL7 (2/7AL/7PC) |
| BL8 (IP0/IPS1/V3b/V7) | GB8 (PHT) |
| GB9 (PH/PHT/FST) | GB16 (FEF) |
| GB17 (1/2/4) | GB18 (AIP/LIPv) |
| ST8 (6v) | GV18 (V2) |
| GV20 (1/4) | GV21 (SCEF) |

Structurally Connected Acupoints:

- | | |
|--------------|------------|
| BL3 (8BL/9P) | BL7 (7AL) |
| GB18 (LIPv) | GV21 (SFL) |
| GV22 (8BL) | |

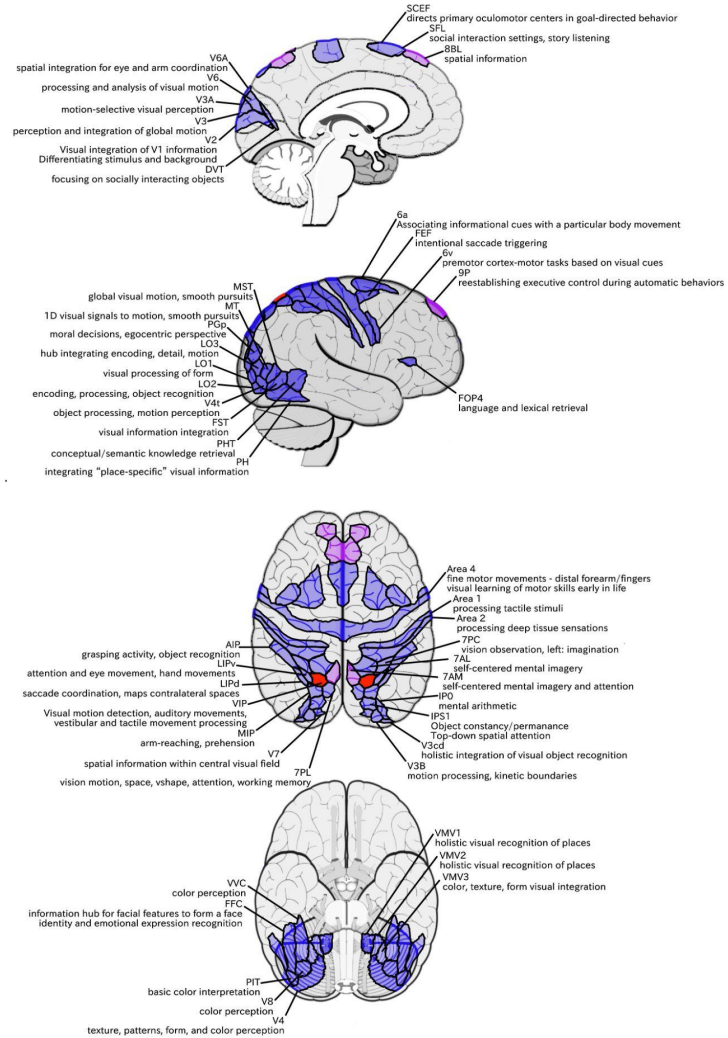


Table 1 Traditional Acupuncture Point Associations With The Lateral Parietal Lobe

Acupoint	Cortical Parcellation Correlation
BL3	8Ad, 8BL, 9P
BL4	8Ad, 8AV, 9-46d, Area 46
BL5	8Ad, 8Av, i6-8
BL6	6a, 6d
BL7	Area 2, 7AL, 7PC
BL8	IP0, IP1, IPS1, V3b, V7
GB4	Area 43, 6r
GB5	A1, A4, A5, POI2, TA2
GB6	STSda, STSdp, STSva, STSvp, TE1a, TE1m
GB7	TE1m, TE1p, TE2a, TE2p
GB8	PHT, TE1p
GB9	PH, PHT, FST
GB13	p9-46v
GB14	a10p, a47r, p10p
GB15	8AD, 8AV, 8C, p9-46v, Area 46
GB16	55b, FEF
GB17	Area 1, 2, 3a, 3b, 4
GB18	AIP, Lipv, PFm, PGs, IP1
ST8	6r, 6v, IFJp, PEF
TW20	TE2p
TW22	TE2a
GV18	V1, V2
GV19	7PM, V6a
GV20	Area 1, 3a, 3b, 4, 5m
GV21	SCEF, SFL
GV22	8BL
GV23	9m, 10d
GV24	10d
Yintang	10v

Conflict of Interest Statement

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.