

Brain Atlas

The BRAPH 2 Developers

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This is the tutorial to work with the Graphical User Interface (GUI) to manage brain atlases, which is typically the first step that is required to perform a graph analysis in BRAPH 2.0. In this Tutorial, we will explain you how to upload a brain atlas and how to visualize it.

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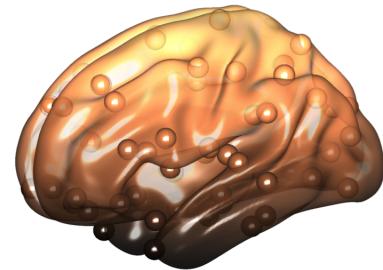


Figure 1: **Brain regions..** Example of a brain surface image with some brain regions generated with BRAPH 2.0.

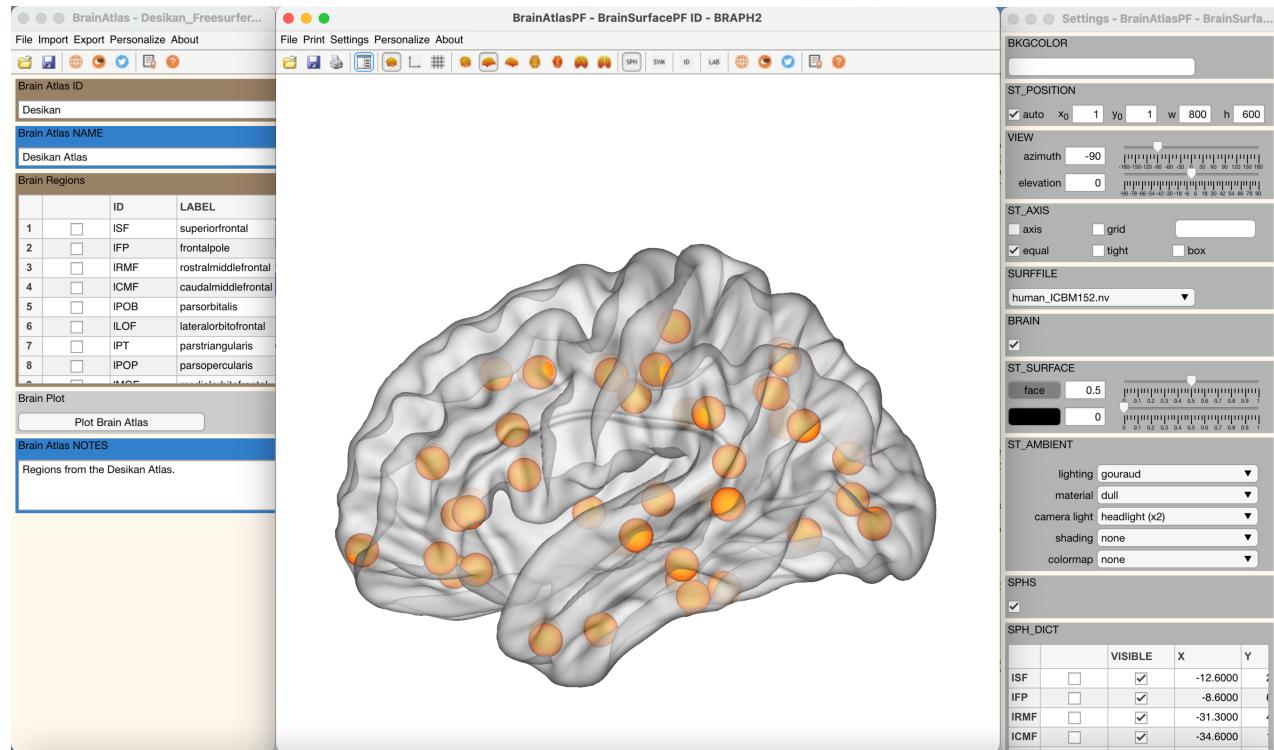


Figure 2: **Brain Atlas GUI..** Full graphical user interface to work with a brain atlas.

Open the GUI

The brain atlas GUI is typically the first step in the BRAPH 2.0 pipelines. You can also do it by typing `braph2`, which will open the Graphical User Interface of the BRAPH 2.0 software, which allows you to select a pipeline containing the steps that you want to apply in your analysis. Once a pipeline has been selected, the first window will allow you to upload the brain atlas, as shown in Figure ?? (1).

To open the GUI and upload the brain atlas, you can also do it from the command line by typing the commands in Code 1.

Code 1: Code to launch the Brain Atlas GUI. This code can be used in the MatLab command line to launch the Brain Atlas GUI.

```

1 ba = BrainAtlas(); ①
2
3 gui = GUIElement('PE', ba); ②
4 gui.get('DRAW') ③
5 gui.get('SHOW') ④

```

① creates a new object `BrainAtlas`.

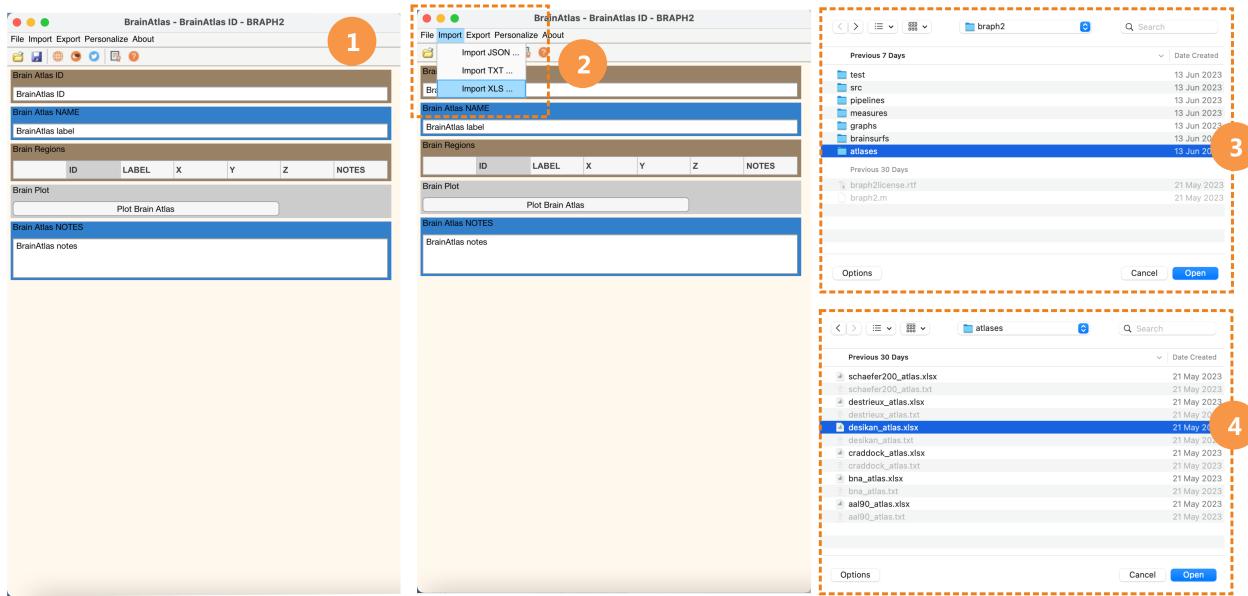
② creates a GUI to upload the brain atlas.

③ draws the GUI.

④ shows the GUI.

Upload the Brain Atlas

In this window that was opened in the previous step (1) you have a menu that you can use to import a brain atlas (2) that you created or has already been prepared for you to use from the atlases folder of BRAPH 2.0 (3). In this example, we are uploading the Desikan atlas (4) Figure ??.



Note that you can change information in this GUI (1) such as the brain atlas ID, the brain atlas name, the brain atlas description (2) as well as the IDs, labels, coordinates and notes of the brain regions.

Figure 3: **Brain Atlas GUI..** Uploading a brain atlas.

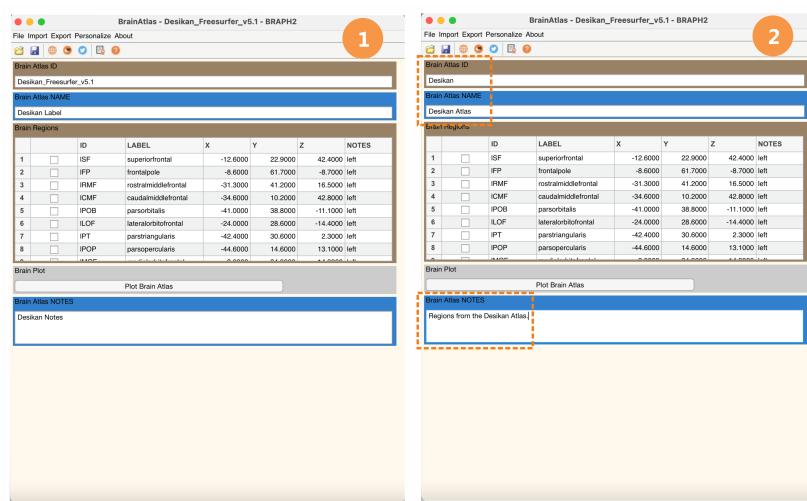
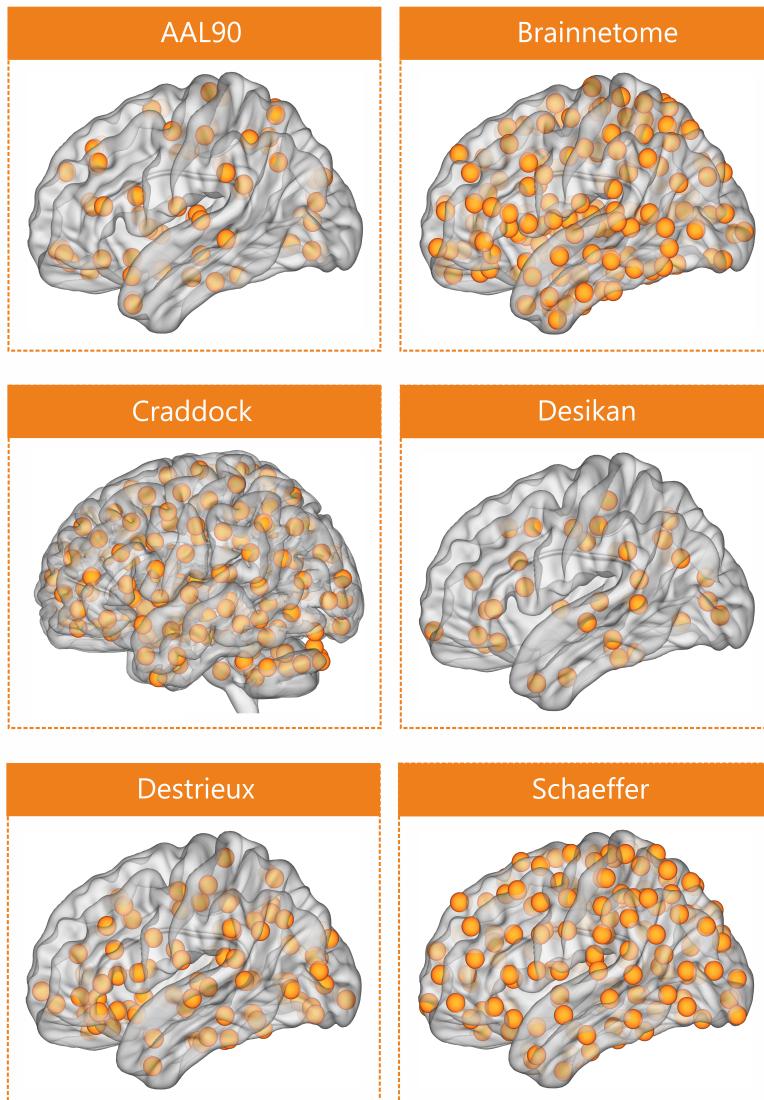


Figure 4: Brain Atlas GUI.. Changing information in the brain atlas GUI.

Ready Brain Atlases

Currently, we provide several brain atlases that are commonly used in the field of brain connectomics, which can be downloaded from our website (<http://braph.org/software/brain-atlases/>) Figure ??.



- **AAL90** Automated Anatomical Labelling atlas with 90 cortical and subcortical regions.
- **AAL116** Automated Anatomical Labelling atlas with 116 cortical and subcortical regions, including cerebellar areas.
- **BNA** Brainnetome atlas with 246 cortical and subcortical regions.
- **Craddock** Functional atlas with 200 cortical and subcortical regions.
- **Desikan** Anatomical atlas with 68 cortical derived from the FreeSurfer software.
- **Destrieux** Anatomical atlas with 148 cortical derived from the FreeSurfer software.
- **Schaeffer** Functional brain atlas with 200 cortical regions that belong to 7 different resting-state fMRI networks.

Figure 5: **Brain Atlas GUI..** Different brain atlases provided by BRAPH 2.0.
[Add image with full interface.](#)

Create a New Brain Atlas

To prepare a Brain Atlas in BRAAPH 2.0 format, you should create a new excel file (.xls or .xlsx), as shown in Figure ??.

The screenshot shows a Microsoft Excel spreadsheet titled "desikan_atlas". The first four rows contain header information: "Desikan_Freesurfer_v5.1", "Desikan Label", "Desikan Notes", and "BrainMesh_ICBM152.nv". Rows 5 through the end of the table list brain regions with their coordinates and hemisphere. The first column lists region abbreviations like ISF, IFP, IRMF, ICMF, IPOB, ILOF, IPT, IPOP, IMOF, IRAC, ICAC, IINS, IPRC, IPOC, ISUPRA, ISP, IIP, IPARA, IPCG, IIST, IPREC, ICUN, IPERI, ILIN, ILO, ITRANS, IBKS, IST, IMT, IIT, ITIP, IENT, IPHIP, IFUS, rSF, rFP, rCAC, and rCMF. The second column lists region names such as "superiorfrontal", "frontalpole", "rostralmiddlefrontal", "caudalmiddlefrontal", "parsorbitalis", "lateralorbitofrontal", "parstriangularis", "parsopercularis", "medialorbitofrontal", "rostralanteriorcingulate", "caudalanteriorcingulate", "insula", "precentral", "postcentral", "supramarginal", "superiorparietal", "inferiorparietal", "paracentral", "posteriorcingulate", "isthmuscingulate", "precuneus", "cuneus", "pericalcarine", "lingual", "lateraloccipital", "transversetemporal", "bankssts", "superioretemporal", "middletemporal", "inferiotemporal", "temporalpole", "entorhinal", "parahippocampal", "fusiform", "superiorfrontal", "caudalanteriorcingulate", and "caudalmiddlefrontal". The third, fourth, and fifth columns represent X, Y, and Z coordinates respectively, and the sixth column indicates the hemisphere (left or right).

Desikan_Freesurfer_v5.1					
Desikan Label					
Desikan Notes					
BrainMesh_ICBM152.nv					
ISF	superiorfrontal	-12.6	22.9	42.4	left
IFP	frontalpole	-8.6	61.7	-8.7	left
IRMF	rostralmiddlefrontal	-31.3	41.2	16.5	left
ICMF	caudalmiddlefrontal	-34.6	10.2	42.8	left
IPOB	parsorbitalis	-41	38.8	-11.1	left
ILOF	lateralorbitofrontal	-24	28.6	-14.4	left
IPT	parstriangularis	-42.4	30.6	2.3	left
IPOP	parsopercularis	-44.6	14.6	13.1	left
IMOF	medialorbitofrontal	-8	34.9	-14.9	left
IRAC	rostralanteriorcingulate	-6.8	33.9	1.6	left
ICAC	caudalanteriorcingulate	-6.6	18	26.1	left
IINS	insula	-34.2	-4.3	2.2	left
IPRC	precentral	-37.8	-10.7	42.1	left
IPOC	postcentral	-42.3	-23.8	43.6	left
ISUPRA	supramarginal	-50.4	-36.8	31	left
ISP	superiorparietal	-22.8	-60.9	46.3	left
IIP	inferiorparietal	-40	-68.4	27.3	left
IPARA	paracentral	-10	-28.7	56.1	left
IPCG	posteriorcingulate	-7.3	-17.4	35.7	left
IIST	isthmuscingulate	-9.8	-44.8	16.9	left
IPREC	precuneus	-11.6	-57.5	36.7	left
ICUN	cuneus	-8.7	-79.6	18	left
IPERI	pericalcarine	-13.9	-80.6	6	left
ILIN	lingual	-16.5	-66.8	-4.3	left
ILO	lateraloccipital	-29.7	-86.9	-1	left
ITRANS	transversetemporal	-44	-24.2	6	left
IBKS	bankssts	-52.7	-44.5	4.6	left
IST	superioretemporal	-52.1	-17.8	-4.4	left
IMT	middletemporal	-55.6	-31.1	-12.9	left
IIT	inferiotemporal	-48.9	-34.4	-22.2	left
ITP	temporalpole	-32.8	8.4	-34.8	left
IENT	entorhinal	-25.8	-7.6	-31.6	left
IPHIP	parahippocampal	-24.7	-31.2	-17.4	left
IFUS	fusiform	-35.7	-43.3	-19.7	left
rSF	superiorfrontal	13.4	24.7	42	right
rFP	frontalpole	10.3	61.1	-10	right
rCAC	caudalanteriorcingulate	7.3	18.7	26.3	right
rCMF	caudalmiddlefrontal	34.9	11.8	43	right

Start by writing the following information in the first 4 rows:

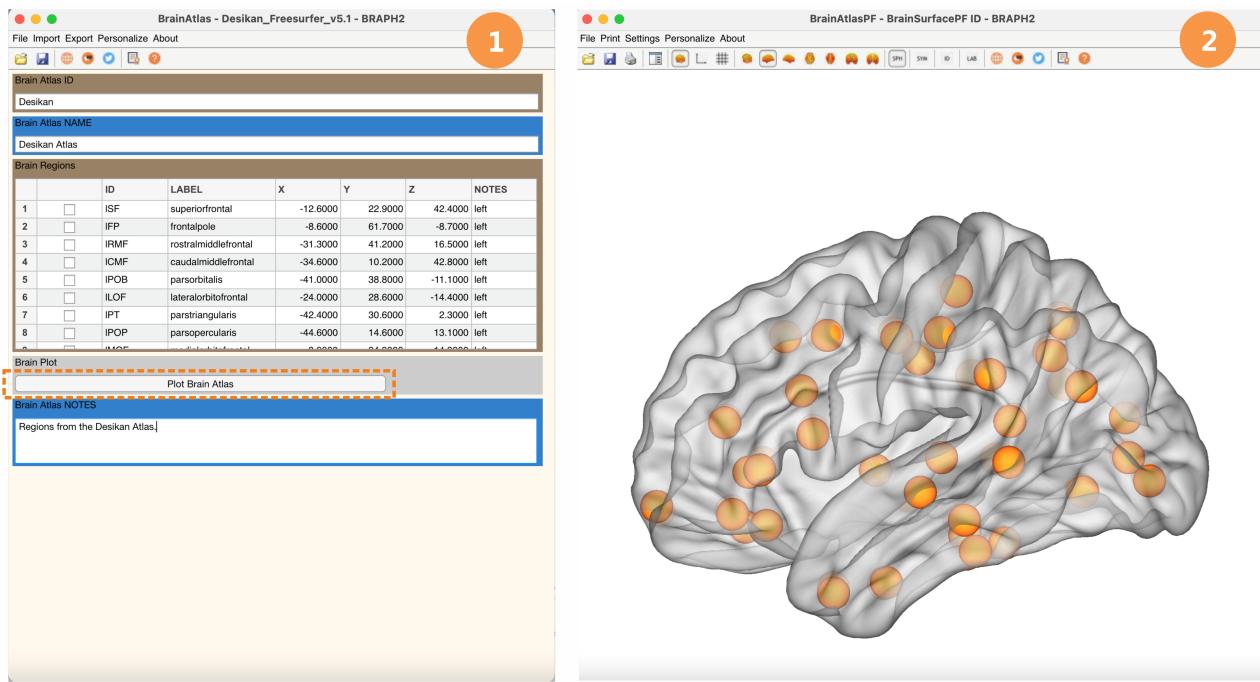
- Brain Atlas ID (row 1, column 1). For example: Desikan FreeSurfer v5.1
- Brain Atlas LABEL (row 2, column 1). For example: Desikan Labels
- Brain Atlas NOTES (row 3, column 1). For example: Desikan Nodes
- Brain Surface Name (row 4, column 1). For example: Brain-MeshICBM152.nv

Then, from row 5, you should include the IDs of the regions of your atlas (1st column), the Labels of the regions of your atlas (2nd column), the X, Y and Z coordinates (3rd, 4th and 5th columns) and the brain hemisphere or any notes you would like to add (6th column).

Figure 6: Brain Atlas GUI.. Full graphical user interface to work with brain atlases.

Plot the Brain Atlas

Once you are satisfied you can plot your brain atlas (1), which will open a brain surface that contains the nodes corresponding to brain regions (2) Figure ??.

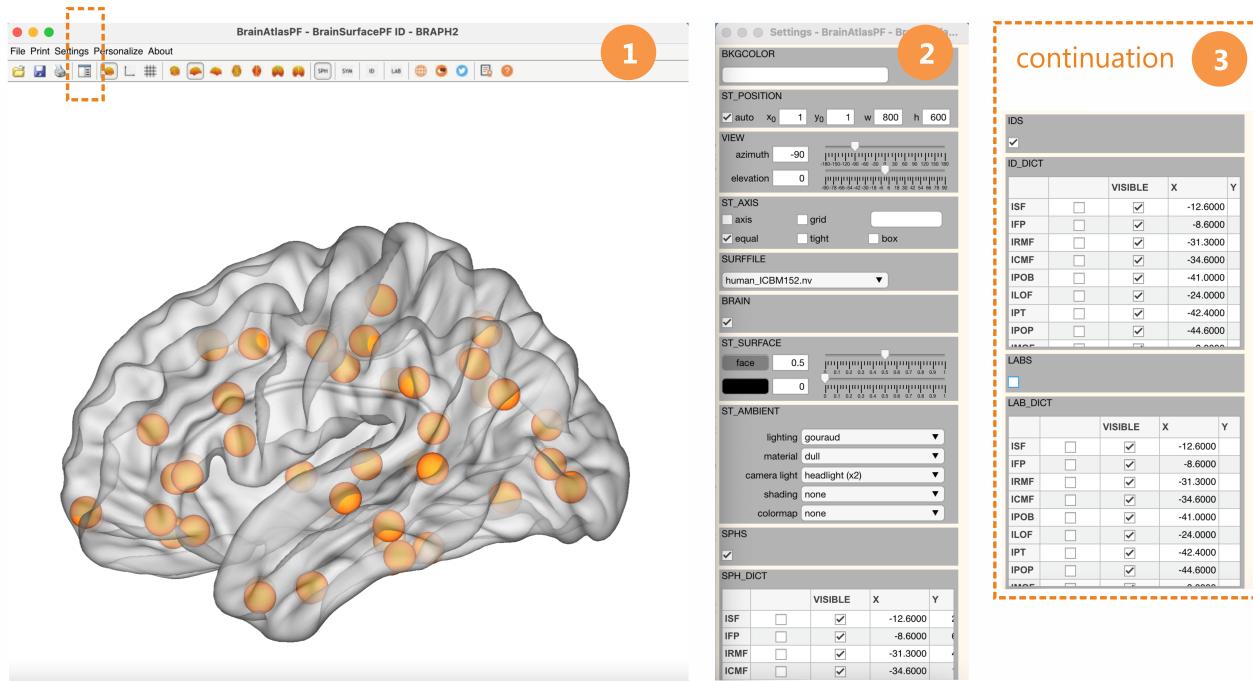


This new window has a large menu that allows you to change the visualization of the atlas. We suggest you try the different options to understand how they change the figure. Importantly, within this menu there is one option called Settings Brain Surface (1) which, when selected, will open another window, as can be seen below Figure ??.

This window allows you to change different options, which are important to create a final figure with all the nodes included in your analysis, which is often included within the 1st figure of a manuscript.

Most things in this panel are intuitive and again we suggest that you try different options until you achieve the visualization you want. Some things that might not be intuitive is the difference between spheres and symbols (the first one is the geometrical structure of a node, whereas the second is just a dot inside the sphere that denotes the presence of a region).

Figure 7: **Brain Atlas GUI..** Plotting the nodes of a brain atlas on a 3D brain surface.



If you wish to change the size of the spheres of all nodes, you need to right click and select other nodes in the first column, change the size of one node and right click to select "apply to selection".

The same applies if you want to change the colour of all nodes in the FACECOLOR column. Here the colors correspond to the hex-adecimal form of RGB colors, which can be found online.

There are many possibilities for visualization. Here is just one example:

Figure 8: **Brain Atlas GUI..** Changing the visualization of the brain atlas.

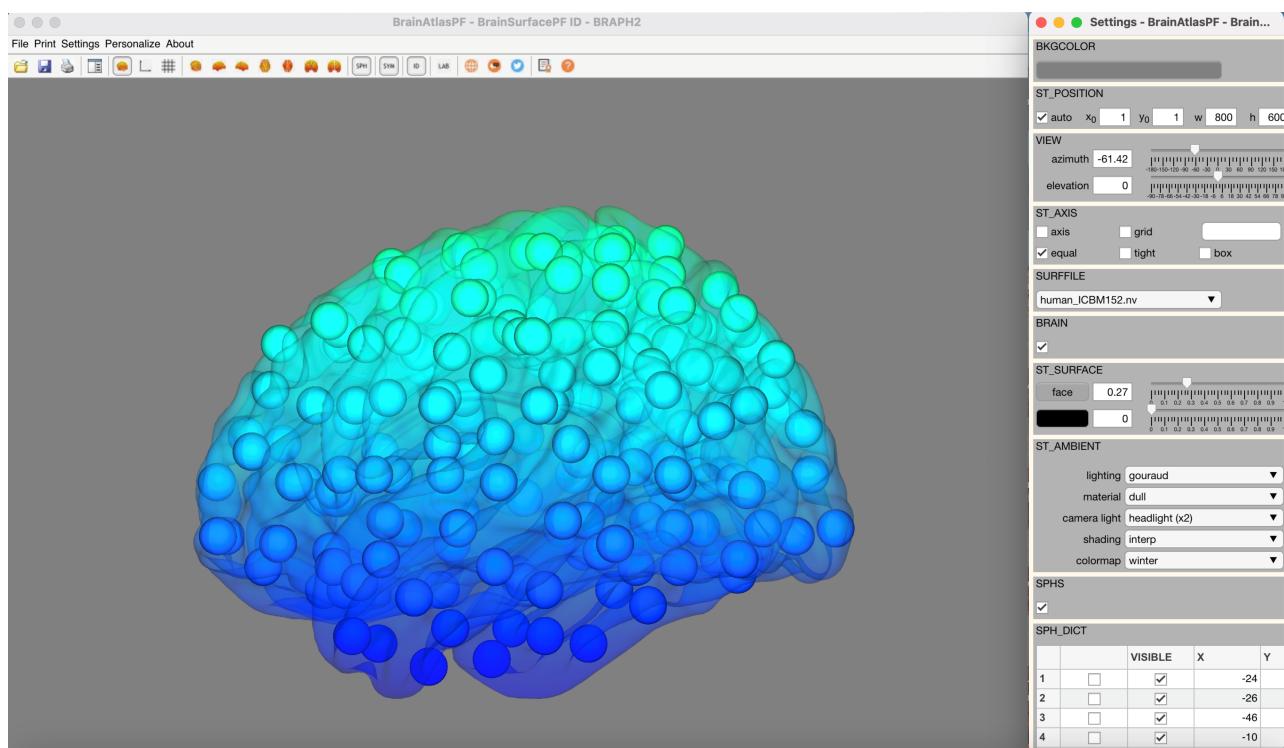


Figure 9: **Brain Atlas GUI..** One example of a visualization of the brain atlas.

Export the Figure

To export and save a figure, you can select print from the brain atlas GUI and select one of the various options we provide Figure ??.

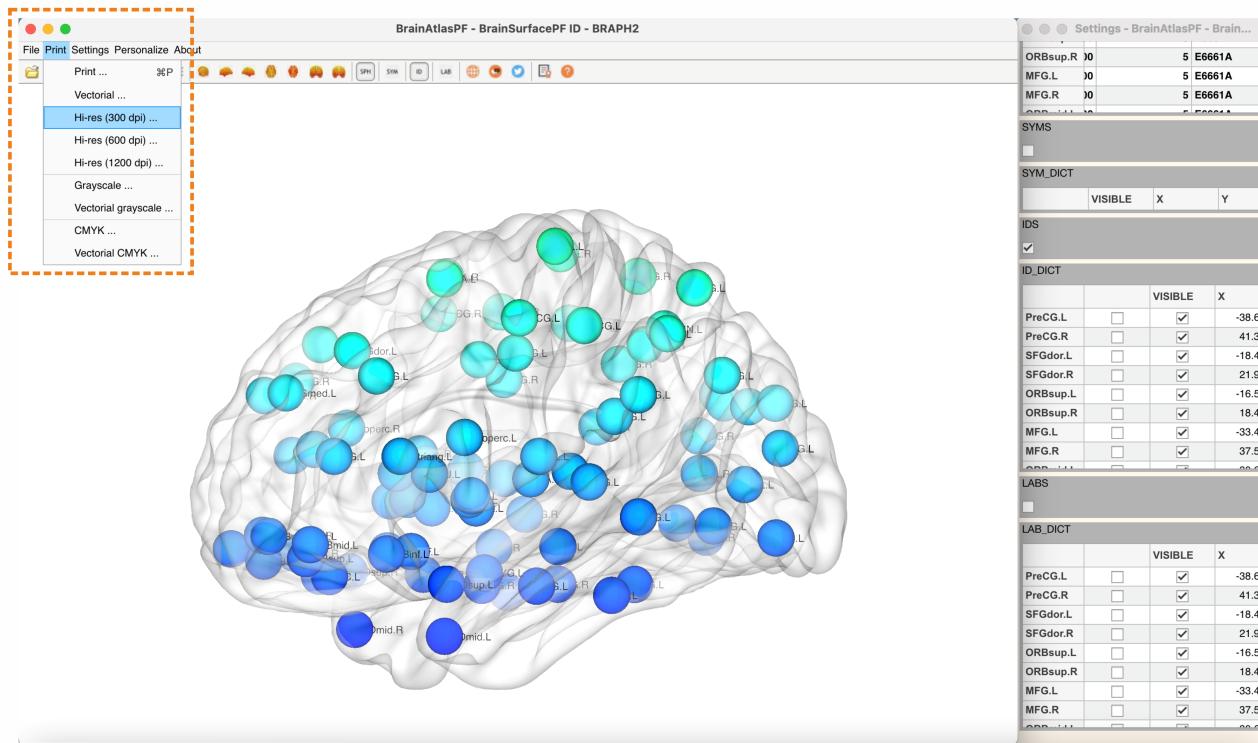


Figure 10: **Brain Atlas GUI.** How to save a figure in BRAAPH 2.0.