Users' Manual for BrainMap Sleuth 1.0

http://brainmap.org

Angela R. Laird, Ph.D.
Research Imaging Center, UT Health Science Center San Antonio

BrainMap Development Team: Peter T. Fox, M.D.
Jack L. Lancaster, Ph.D.
Angela R. Laird, Ph.D.
Mick Fox, Programmer Analyst
Angela M. Uecker, Programmer Analyst
Sarah M. Thelen, Research Assistant

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1. About Sleuth

BrainMap is an online database of functional neuroimaging results in the form of stereotactic (x,y,z) coordinates. Along with these coordinates, BrainMap also archives each paper's associated meta-data, which includes information on subjects, conditions, experimental paradigms, etc. The software application Sleuth (formerly Search&View) can be downloaded from BrainMap's website, http://brainmap.org, and is used to search the database for experiments of interest and view the relevant search results in a standard (Talairach) brain space.

The ALE meta-analysis software is no longer available in this application. To perform ALE, you will need to download GingerALE from BrainMap's website.

2. Logging In

Once Sleuth has been downloaded and installed on your computer, you must visit our website in order to obtain a username and password: http://brainmap.org/AccountManagement.html.

Next, launch Sleuth and type in your login information in the dialog box that appears. After the initial login, Sleuth will store your username and password so that you will not have to enter it each time. If you prefer to manually login, you can change this setting in the Preferences menu (see Section 6.1).

3. Performing Searches

Sleuth is broken into four main panels: Search, Search Results, Workspace, and Plot.

3.1 Search
To perform a search of the BrainMap database, click on one of the five search buttons ❶,Fig.1 on the left side of the main application window: "Citation", "Subjects", "Conditions", "Experiments, or "Locations". The search criteria are further explained in Section 5. A popup window will appear with a choice of search fields relevant to the button chosen.

Some fields are drop-down boxes, such as Citation Journal or Condition Stimulus Modality, but others are free-entry fields, such as BrainMap ID or Subject Size Range. Select your search criteria, **then click "Add"**, so that your selection appears in the bottom panel of the popup window. It is possible to select multiple search criteria. When you have finished making your search selections, hit "Okay". The popup window will then disappear and you will be taken back to the main application window, where you will find your selected search criteria in the bottom panel, "Search Request" ❷,Fig.1. To refine your search, there is a "Clear" button on the bottom left with a pull-down tab to specify which category you wish to clear ❸,Fig.1. Click on "Start Search" ❹,Fig.1. A popup window will inform you how many papers match your search request. Click on "Okay" and you will be taken on the second panel of Sleuth.
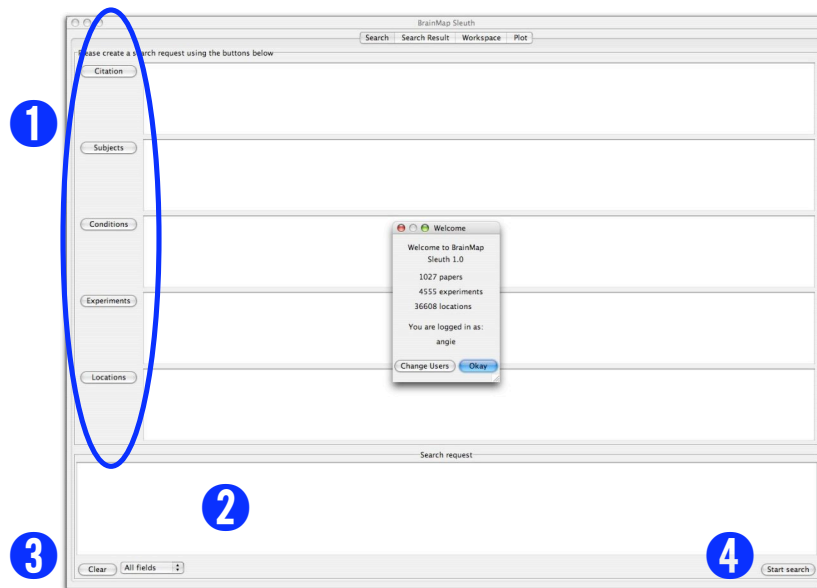

Figure 1. The Search Panel.

3.2 Search Results

Once your search has been completed, a list of all papers matching your criteria will be available for preview in the Search Results panel. This panel is intended to screen your searches by viewing limited information on each paper returned by your search. The top line of this panel ❶,Fig.2 informs you how many papers and experiments match your search criteria. All of the returned papers are listed below ❷,Fig.2 where you may click on whichever paper you wish to preview. To select multiple

papers at once, ⌘-click (Mac) or ctrl-click (PC). To the right ❸,Fig.2 you may select what you wish to view about the paper. Limited information can be viewed on Citation, Prose Description, and Experiment Info. The Prose Description summarily describes all conditions involved in the experiments as well as the experiments themselves (typically the name is based on conditions contrasted). Experiment Info lists all experiments, how many subjects were involved in each, and the number of coordinates. The experiments are viewed in green when they match the search criteria and red when they do not. At the bottom is the preview area ❹,Fig.2 where you view the information selected in ❸,Fig.2. To download the papers of interest into your workspace, check the box next the appropriate papers in the Download column ❷,Fig.2 and click "Download Checked"; they will then be available for you under the Workspace tab. Alternatively, you can choose "Download All" to get all papers. As always, there is a "Clear Results" button at the bottom left. Be aware that this clears all results, checked or not.
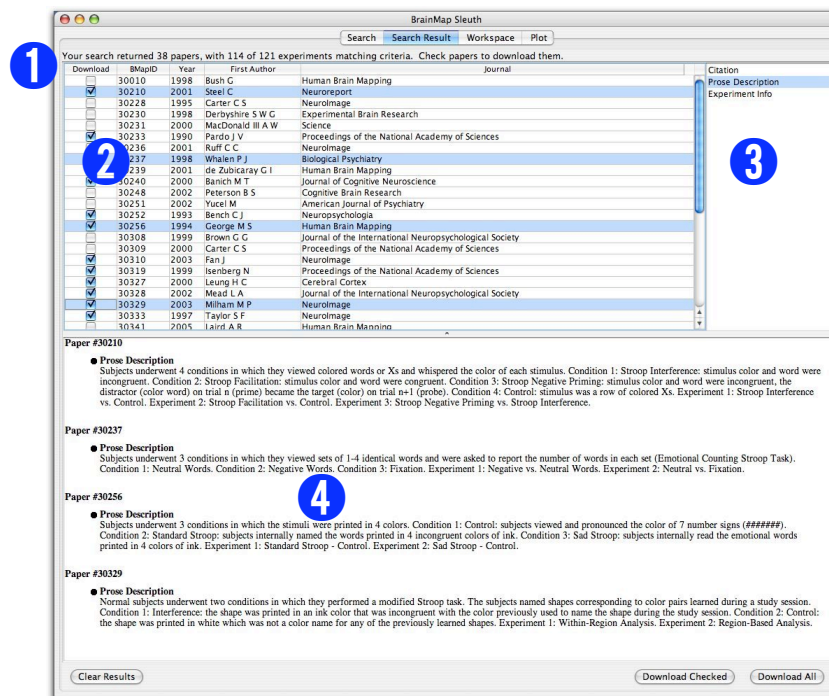

Figure 2. The Search Results Panel.

3.3 Workspace

In this panel you will find complete information on each paper and each experiment. A summary of the workspace is listed on the top line of the

panel ❶,Fig.3: number of papers, experiments, conditions, and locations. The workspace contents and vital statistics are shown in the top portion of the panel ❷,Fig.3. Information listed here includes: BrainMap ID, year of publication, first author, journal, experiment name, behavioral domain, and number of coordinates. Area ❸,Fig.3 allows you to choose what information you wish to view about each experiment, including Citation, Submitter, Prose Description, Subjects, Conditions, Brain Template, Experiments, and Results Synopsis. The information contained in Prose Description and Subjects are exactly the same as that previewed under Search Result. However, the Citation information is now much more detailed, as is the Experiments information. There is much valuable information that can be viewed under Experiments, including: Paradigm Class, Conditions, Contrast, etc., as well as all the coordinates reported (Talairach or MNI), converted Talairach coordinates, the z- or t-scores, and a Talairach Daemon label for each converted coordinate. The Results Synopsis is taken from the pertinent section of the paper's published abstract. All of this selected information may be viewed in the bottom portion of the workspace ❹,Fig.3. You may use ⌘-click (Mac) or ctrl-click (PC) to make multiple selections at once.
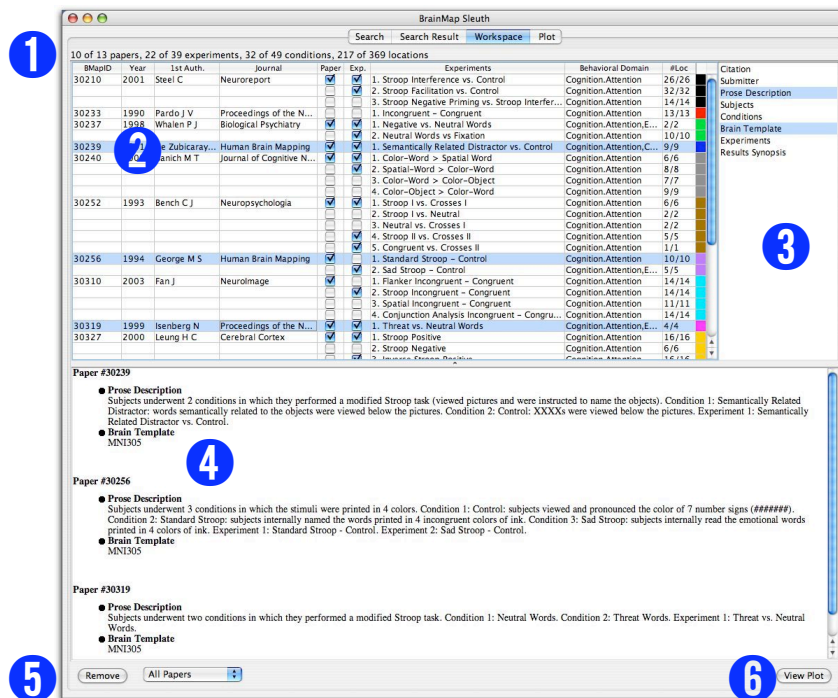

Figure 3. The Workspace Panel.

In the workspace contents ❷,Fig.3, there are two columns marked "Paper" and "Exp". Here, you may decide which experiments you wish to retain and plot or which you wish to discard by checking or unchecking them. By default, every experiment that matches your search criteria is retained. There is a "Remove" option at the bottom left corner ❺,Fig.3 that can be used to remove unplotted (unchecked) papers or all papers in the workspace. Once you are done making your selections here, you may move on to the Plot panel by clicking on "View Plot" at the lower right corner ❻,Fig.3.

3.4 Plot

In the next panel you can view a plot of all the coordinates in your workspace, color-coded by paper. By default, the orientation is on axial, but can be changed to coronal or sagittal using the appropriate button on the bottom left ❶,Fig.4. To the right of those buttons is a box labeled "Current Location (mm)" ❷,Fig.4. This box reports the coordinate that your mouse hovers over.
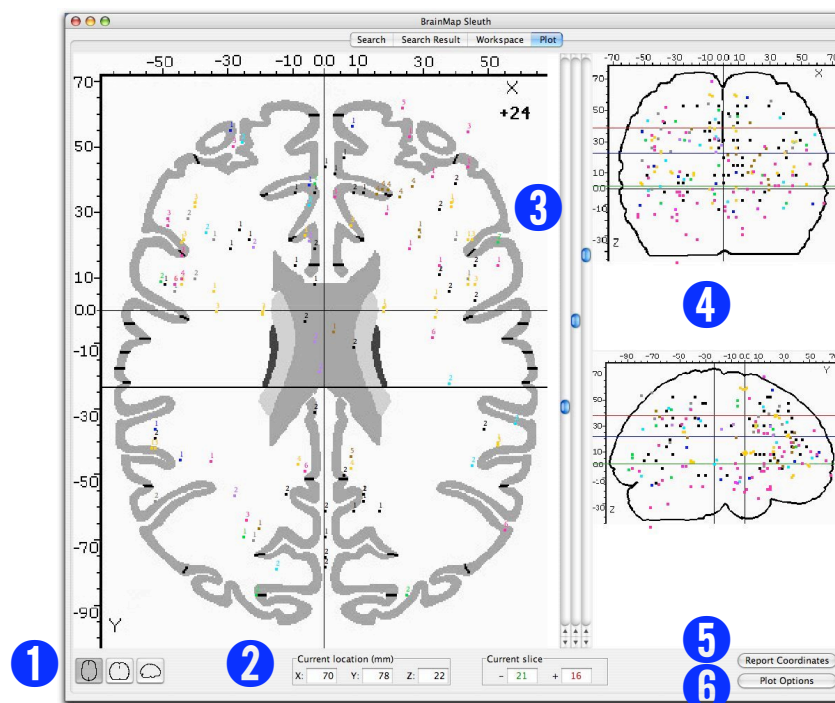

Figure 4. The Plot Panel.

Just to the right of the plot you'll see three scroll bars ❸,Fig.4. The middle scroll bar (blue scroll bar for PCs) adjusts which slice of the brain you wish to view (for example, scrolling when you're viewing axial slices moves you up and down through the slices, and scrolling when you're viewing coronal slices moves you forward and back). The far left and right scroll bars (green and red scroll bar for PCs) adjust the slice thickness. You can either adjust the left (green) and right (red) scroll bars by dragging them, or you may type in the appropriate value under the box labeled "Current Slice".

The two plots on the right side are compressed versions of the two other orientations showing all of the coordinates in the paper ❹,Fig.4. At the bottom right are two buttons that bring up new dialog windows, described below.

4. User Options for Plotting

4.1 Coordinate Reporter

This dialog window ❺,Fig.4 (also Fig.5) reports the x,y,z coordinates and the Talairach Daemon label of whatever location you click on in the Plot panel. In addition, the Coordinate Reporter will tell you the associated BrainMap ID, experiment number, and experiment name that the coordinate is from. If you click on a location in the Plot panel that does not contain a BrainMap coordinate, you will only be shown the Talairach Daemon label of that location, no other information will be returned.
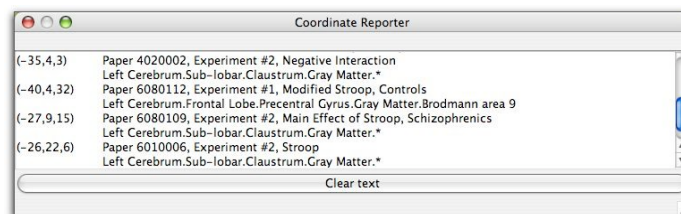

Figure 5. The Coordinate Reporter.

4.2 Plot Options

This dialog window ❻,Fig.4 (also Fig.6) allows you to set options on how the coordinates appear in the Workspace, as well as filter coordinates. Experiments are selected in the top left portion of the window ❶,Fig.6.

The coordinates contained in these experiments are shown below ❷,Fig.6, and you may choose to check or uncheck the coordinates that are plotted. By default all coordinates in an experiment are plotted. To the right of is an Edit Filters button ❸,Fig.6, which allows you to filter the plotted coordinates by regions of interest (ROIs). Below the Edit Filters button is a small section for customizing how the coordinates appear in the workspace, including the color of the coordinates, the shape, the font, and the font size ❹,Fig.6. There is radio button "Apply to whole paper", which if checked, changes the appearance of all experiments from the same paper. This can retain consistency in how the coordinates from the same paper look, but you may wish to uncheck it if you wish you distinguish between the experiments.
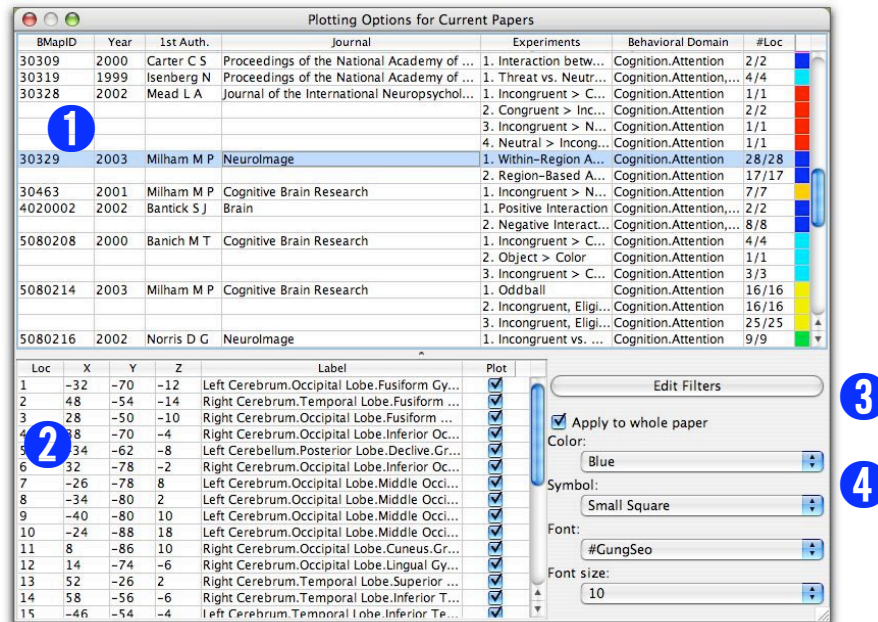

Figure 6. The Plot Options Panel.

5. Search Criteria Options

BrainMap includes a large amount of metadata that completely describes the content and context of a functional neuroimaging experiment. On the left side of the main search panel, there are five Search Buttons that are used to perform a search of the BrainMap database ❶,Fig.1. These searches are broken into five groups based on what type of search is desired: "Citation", "Subjects", "Conditions", "Experiments, or "Locations". A

popup window appears when one of these buttons is selected with detailed search criteria options. Below, these options are described.

5.1 Citation

Citation searches are available on criteria relevant to information on the authors, journal, laboratory, Medline number, BrainMap ID, and date range Fig.7. To add an item to your search query, select the appropriate item or type it in and click the "Add" button to its left. Logic operators are found at the top to refine your search using AND, OR, and NOT (Note: if you search using several fields, such as author, journal, and published keywords, the logic operator AND will always be applied). To clear any search queries, use the pull-down tab to the right of the Clear button, select the appropriate field you wish to clear, and then click the Clear button. Do not close the dialog box using the close button at the upper right; this will not save any changes.
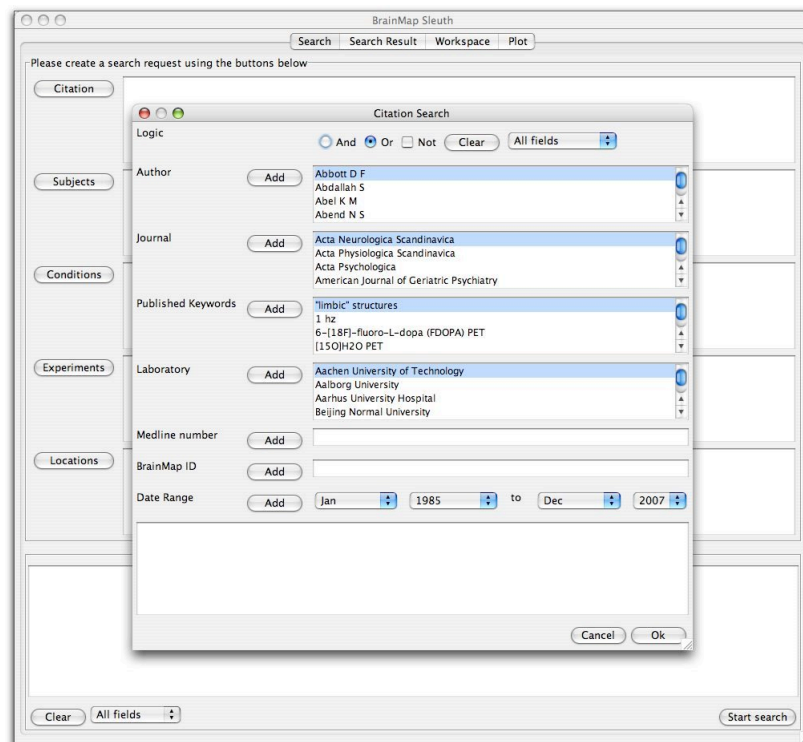

Figure 7. Citation Search Criteria.

5.2 Subjects

Subjects searches are available based on diagnosis, ICD code, handedness, native language, gender, subject size range, and age range

Fig.8. When searching by age range, be aware that the minimum and maximum age you set is not the exact age range of the subjects should you have a particular study in mind. For example, searching by an age range of 12 - 57 can also yield studies whose age range is 28 - 35. Also, when searching by age range or subject size range, you must enter both a minimum and a maximum value. If you have no minimum in mind, feel free to enter 0. If you have no maximum in mind, enter any very large value.

Just as with searching by citation, to add an item to your search query select/type it in and click the appropriate "Add" or "Set" button to its left. The logic operators AND, OR, and NOT are available to refine your search, and clearing any queries is achieved in the same manner as above.
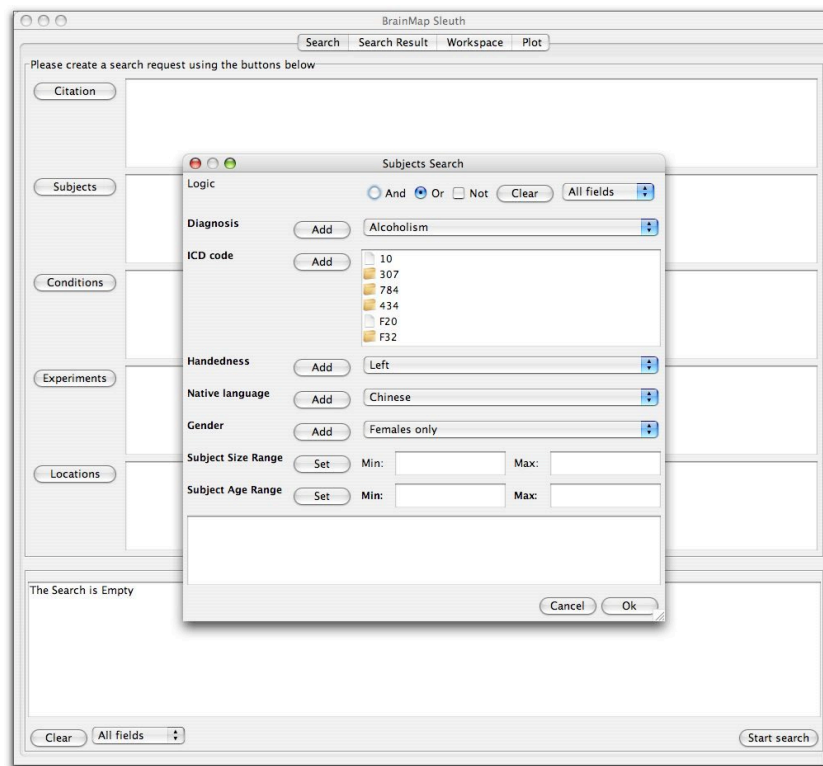

Figure 8. Subjects Search Criteria.

5.3 Conditions

Condition searches are available based on stimulus modality and type, overt response modality and type, instructions, and external variable Fig.9. To add any item to your search query, simply click on the pull-down tab

and select the item you want, and then click on the Add button to the left of it. The logic operators and Clear button from above still remain. While stimulus modality and type share the same button, you do not necessarily need to specify both. To search just by modality or type, keep the other as "All". Also, there are some types that are generalizations of others. For example, there is a "Pictures" type as well as a "3D Objects" type. While the latter seems to fall under the former, it is recommended that if you do wish to search only for 3D objects, you should only select the latter. It should also be noted that the response modality and type strictly refer to **overt** responses. Covert verb generation, for example, should fall under Response Modality: None; Response Type: None; Instructions: Generate.

Again, to add an item to your search query select/type it in and click the appropriate "Add" or "Set" button to its left. The logic operators AND, OR, and NOT are available to refine your search, and clearing any queries is achieved in the same manner as above.
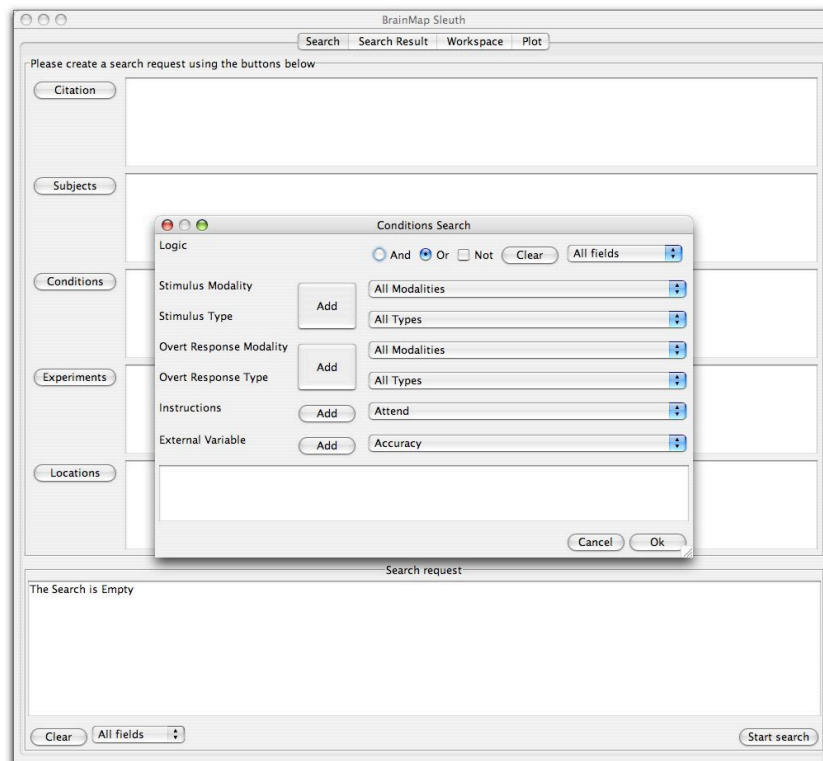

Figure 9. Conditions Search Criteria.

5.4 Experiments

Experiment searches can be performed on criteria related to context, paradigm class, experiment contrast, behavioral domain, and imaging modality Fig.10. Behavioral domain is divided into 6 general categories that can be further divided into subcategories. To view all subcategories, double click on the appropriate category. For example, double clicking on Action yields subcategories including Execution, Imagination, Inhibition, etc. Items with a folder as its icon can be divided even further into more categories, as is the case with Execution. You are not limited to searching by the simplest element, however. If you choose to add any item that can be divided into subcategories, then the search will find all of the subcategories as well.

Again, to add an item to your search query select/type it in and click the appropriate "Add" or "Set" button to its left. The logic operators AND, OR, and NOT are available to refine your search, and clearing any queries is achieved in the same manner as above.
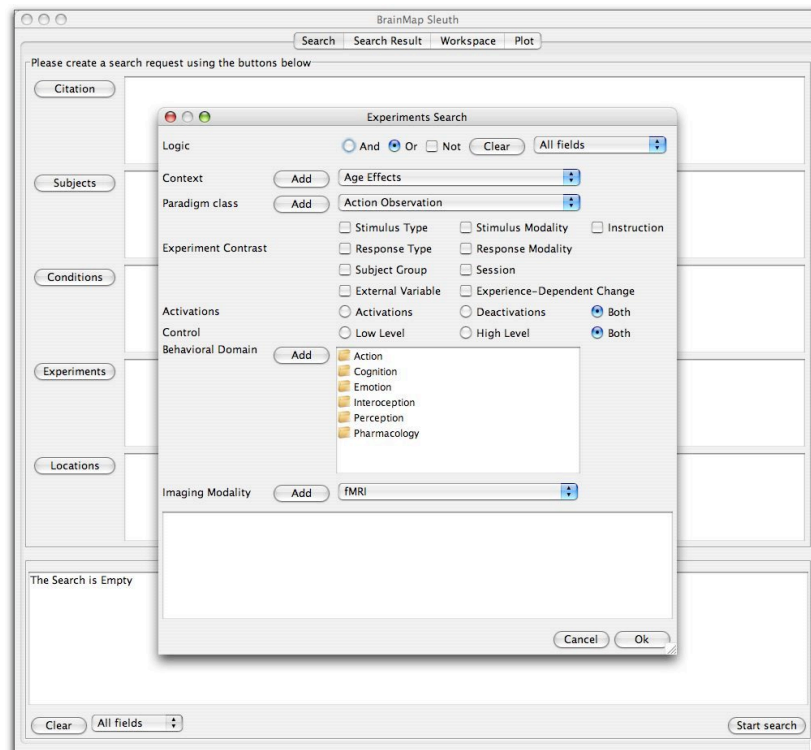

Figure 10. Experiments Search Criteria.

5.5 Locations

The coordinates in BrainMap can be searched either by a user-defined ROI or by Talairach Daemon label. Going down the left side, the first button is "Edit ROIs" ❶,Fig.11, which brings up a new dialog window in which you can add a new ROI, edit an existing ROI, delete an ROI, or check statistics on an ROI (see the next section for complete information on ROIs). This is the same window as the Edit ROIs brought up from the Tools menu. The next button is "Add ROI" ❷,Fig.11, which allows you to add user-defined ROIs to the filter list. The next button below is "Add Label" ❸,Fig.11, which applies a filter based on Talairach Daemon labels used. The labels that use a folder as an icon can be divided into subcategories by double clicking on them, or you can choose to use the entire category as a filter. At the bottom is the list of all search filters in the box labeled "Search Statement" ❹,Fig.11. Note that the filters are always applied using an OR operator. Once you have specified your filters, click "OK" ❺,Fig.11 at the bottom right, and all coordinates that met your filter will be retained, and all other coordinates will be removed. There is a "Clear" ❻,Fig.11 button at the top to clear all criteria.
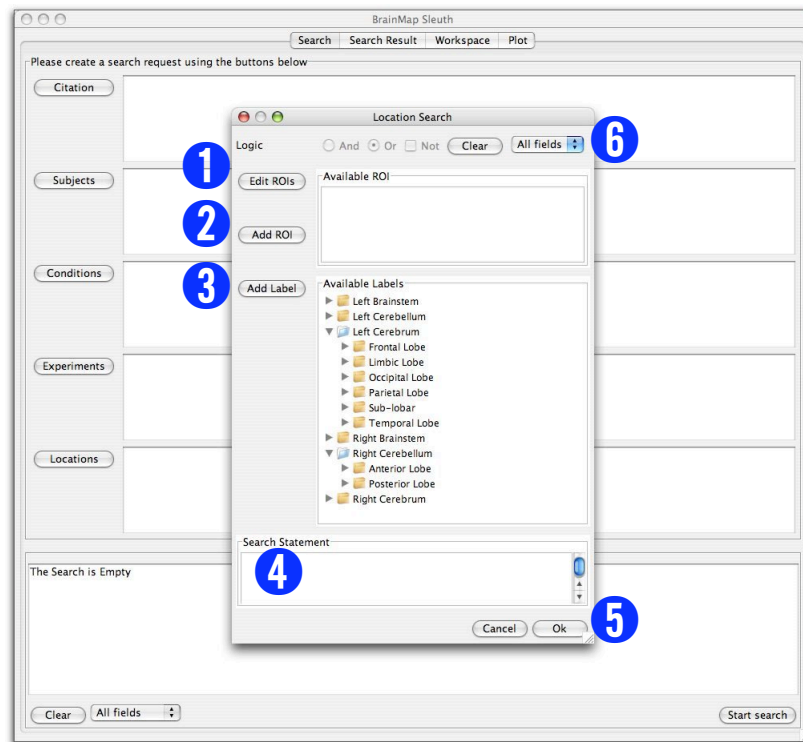

Figure 11. Locations Search Criteria.
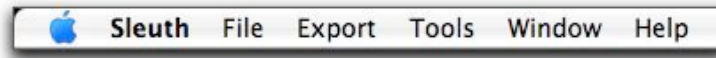
6. Main Menu Items

Figure 12. The Main Application Menu.

6.1 Sleuth

About Sleuth: This menu item contains basic information about Sleuth, such as homepage, version number, and copyright date.

Preferences: This menu item sets certain user preferences, such as remembering your login name and logging in automatically when the application is opened Fig.13. Hotkey: ⌘-, (Mac) or ctrl-, (PC).
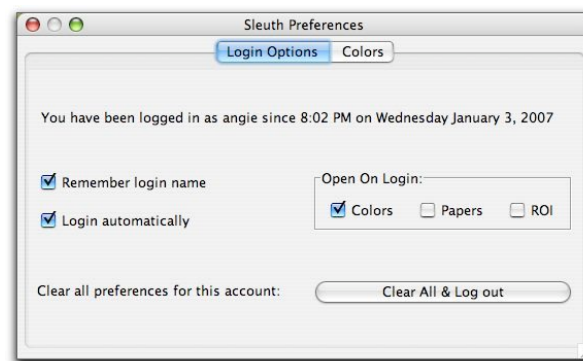

Figure 13. Preferences: Login Options.

There is also a Colors tab under Preferences Fig.14 in which you can edit existing colors or add new colors by specifying RGB values. To change an existing color, select that color from the left ❶,Fig.14, make the desired modifications to the RGB values, and click on "Save this color" ❷,Fig.14. To add a new color, specify the desired RGB values, name the new color, and click "Add this color" ❸,Fig.14. The new color will then appear in the list on the left. The colors in this list are used when plotting coordinates in the Plot panel.
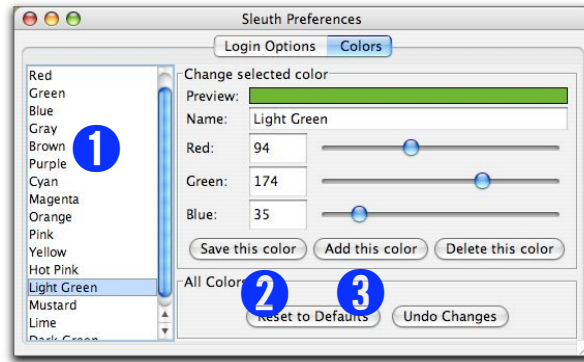
Figure 14. Preferences: Colors.

Quit: This menu item exits you out of Sleuth. Hotkey: ⌘-Q (Mac) or ctrl-Q (PC).

6.2 File

Log out: This menu item logs you out of Sleuth. Hotkey: ⌘-L (Mac) or ctrl-L (PC).

Open: This menu item allows you to open saved workspaces (.xml files), or locations (.txt files of x,y,z coordinates). Alternatively, you can open one of BrainMap's data files in .ent format that are creating using the application Scribe. Hotkey: ⌘-O (Mac) or ctrl-O (PC).

Save Workspace: This menu item saves your workspaces. By default, these workspaces are saved in BrainMap's .work format. However, since these workspace files are saved in .xml format, you may also specify a name with the .xml file extension. Hotkey: ⌘-S (Mac) or ctrl-S (PC).

6.3 Export

Citations (Endnote): This menu item exports the citation information from the papers in your workspace in .txt format, in a style that can be imported into the Endnote reference manager software. When importing these citations into Endnote, use the Import Option of "Endnote Import" with no text translation.

Workspace (Text): This menu item exports the contents of your workspace in .txt format, minus the x,y,z coordinates of activation.

Locations (Text): This menu item exports the locations (Talairach x,y,z coordinates) contained in your workspace in .txt format. Coordinates will be grouped by experiment and labeled by first author name, year, and experiment name. This metadata is commented out in the text file by a "//" so that the file may be correctly read back into the workspace at a later time for ALE meta-analysis purposes.

Locations (Image): This menu item exports the locations (Talairach x,y,z coordinates) contained in your workspace in image format (.nii). This file can be viewed with our anatomical template (colin.nii) that is available on our website (www.brainmap.org/ale/ale.html). In the Locations (Image) file, each voxel that contains a foci from your workspace is assigned a value corresponding to its experiment number. For any voxel in which more than one coordinate appears, we assign a value of n+1, where n equals the total number of experiments in your workspace. For example, if you have 5 experiments in your workspace and choose Export → Locations (Image), then the file that is written will have values that vary from 0 (no coordinates) to 5. If, however, identical coordinates are given in two or more experiments, the voxel corresponding to that coordinate will be assigned a value of 6.

6.4 Tools

ROI Options: This menu item allows you to define a new ROI with a custom name and color. The ROI drawn will always be a rectangular prism, but can be drawn in one of two ways. The default dialog window allows you to enter the minimum and maximum x,y,z values for your desired ROI dimensions Fig.15, left. Alternatively, you can check the box "Use Cube-Shaped ROI" and draw a ROI cube with side lengths you specify (Width), centered at a given coordinate Fig.15, right. In addition, if you would like to enter your ROI in MNI coordinates instead of Talairach coordinates, then check "Convert coordinates from MNI" and choose the software you used for spatial normalization from the drop-down menu so that we implement the correct transformation from MNI to Talairach space (please see Lancaster et al., 2007). Please note that we

no longer use the Brett transform to convert between MNI and Talairach space.
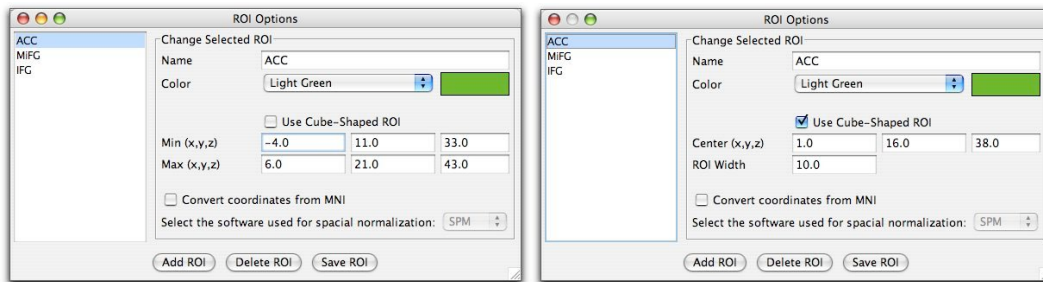

Figure 15. ROI Options: Rectangular (left) and Cubic (right) ROIs.

ROI Statistics: This menu item reports various statistics relevant to all of the ROIs present in the workspace, and the coordinates that are found within those ROIs Fig.16. ROI information includes: ROI name, color, and dimensions. Locations in this ROI are detailed by: BrainMap paper ID, experiment number, x,y,z coordinate values, and Talairach Daemon label.
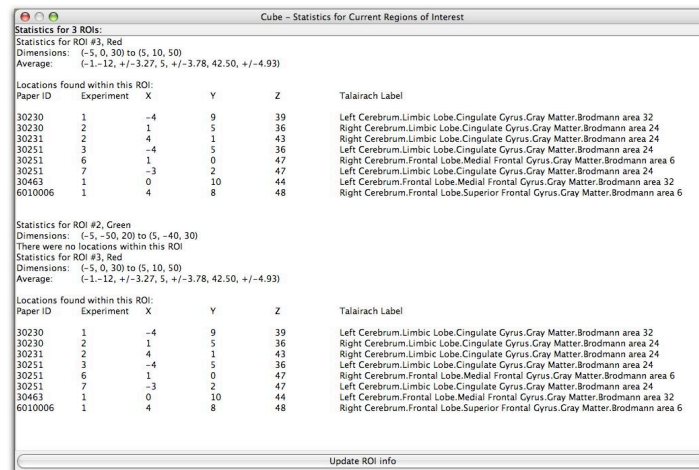

Figure 16. ROI Statistics.

Behavioral Histogram: This menu item computes a histogram that details the behavioral domain profile of the current workspace Fig.17. On the left is a local histogram, which applies to all the experiments in the workspace. On the right is a global histogram, which applies to all the papers in the BrainMap database.
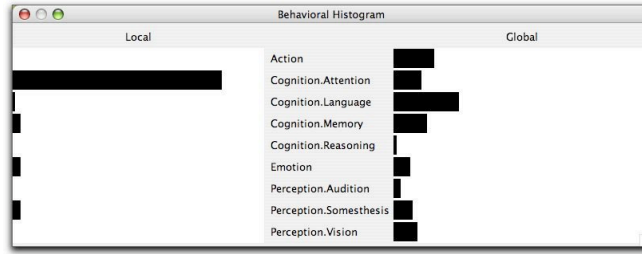
Figure 17. Behavioral Histogram.

<u>Database Statistics</u>: This menu item shows how many papers, experiments, and coordinates are currently in the database Fig.18.
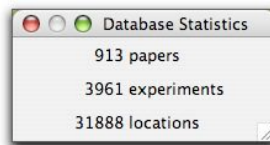

Figure 18. BrainMap Database Statistics.

6.5 Window

Each item in this menu tab takes you to the appropriate panel of Sleuth (Search, Search Result, Workspace, or Plot).

    Hotkey: Search = ⌘-1 (Mac) or ctrl-1 (PC)
                Search Results = ⌘-2 (Mac) or ctrl-2 (PC)
                Workspace = ⌘-3 (Mac) or ctrl-3 (PC)
                Plot = ⌘-4 (Mac) or ctrl-4 (PC)

6.6 Help

<u>Debugging Info</u>: This menu item contains Sleuth configuration information in case troubleshooting is necessary.

<u>Check for Updates</u>: This menu item searches the web for Sleuth updates.

<u>Show Manual</u>: This menu item will show the current manual for Sleuth (this document). An internet connection is necessary for this menu option.

Show Read Me: This menu item will show the current readme file for Sleuth. The readme file contains information about installation and version changes. An internet connection is necessary for this menu option.

Show License: This menu item will show the current license information for Sleuth. An internet connection is necessary for this menu option.

7. Troubleshooting

7.1 I downloaded Sleuth and obtained a BrainMap username and password, but when I double-click on the application I get an error that says I cannot connect to the database.

This can indicate one of two things. First, the BrainMap web server may be down for maintenance. Alternatively, there may be a firewall blocking communication to the BrainMap web server. If your problems are caused by a firewall issue, you will see this error:

java.io.IOException: Server returned HTTP response code: 500 for URL: http://biad02.uthscsa.edu:9000/sv/servlet/performSql3.GetSearchResult2

The BrainMap web server uses port 80 and port 9000 for all Sleuth communications. If a successful connection to BrainMap has been made previously, then please contact BrainMap technical support to check the web server. Otherwise, your firewall issue can be solved by contacting your network administrator to make sure port 80 and port 9000 are open to http traffic from host www.brainmap.org.

7.2 I am interested in performing an ALE meta-analysis for my research. However, many of the papers I'd like to use aren't in the database. What should I do?

You, as a BrainMap user, are eligible to enter papers into our database. If you'd like to perform an ALE meta-analysis in GingerALE, then we definitely recommend that you add your missing papers to BrainMap. To do this you'll have to download our input software application, Scribe: http://brainmap.org/scribe.html and use that software to enter in information about each paper. Also on that webpage you'll find the user's manual for Scribe and several example .ent files (BrainMap database entry

files). You can submit any functional neuroimaging paper that's of interest to you – the only requirement is that it publish brain activations as stereotactic (x,y,z) coordinates.

Once you have a paper ready to submit, please email the .ent file and a .pdf of the paper to the BrainMap Research Assistant, Sarah Thelen, at thelens@uthscsa.edu.

7.3 Previously, I created and saved a workspace. Today, when I loaded that file I received an error:

> "Please re-save this workspace. The database has recently been updated. Please check your workspace for errors and re-save the file."

Can you explain this error?

Occasionally, we find errors in BrainMap entry files. When we find an error, we correct it and reinsert the whole paper into the database. If you've included a file such as this in one of your saved workspaces, you'll receive this error the next time you open that workspace. Your workspace has been revised such that the corrected paper now has all experiments checked, regardless of how it was previously saved in the workspace. Scroll down your workspace and look for any paper(s) with all experiments checked. Then, uncheck any experiments from that paper that you do not want included in the workspace and re-save your workspace to an .xml or .work file.

7.4.a Does BrainMap authorize the reproductions of screen captures from Sleuth to be used in publications?

Yes, we allow screen captures to be published of Sleuth Workspaces or Plots. When doing so, please give BrainMap credit and cite the following paper:

Laird AR, Lancaster JL, Fox PT. (2005). BrainMap: The social evolution of a functional neuroimaging database. Neuroinformatics 3, 65-78.

7.4.b I need to perform an analysis of coordinate data (x,y,z). Can you send me a text or .xml file of the contents of the BrainMap database?

BrainMap is a registered trademark of the University of Texas. All software and **curated** data contained in or used by the BrainMap database are copyrighted by the University of Texas. BrainMap software and data are available for use, free of charge, for educational and scientific, non-commercial purposes. The BrainMap coding scheme and its taxonomy of experimental design are available for use without restriction. If BrainMap's data, software, or coding strategies are used in scientific publications, we request that one or more relevant publications of the development team be cited, as described above. The BrainMap development team welcomes collaborations. We will provide guidance and assistance in the execution of meta-analyses, upon request. We encourage collaborations that develop new tools for meta-analysis or use BrainMap data to develop or validate other neuroinformatics tools and strategies. We do allow other databases and image-analysis environments to query BrainMap's data, but only with prior permission and as a joint development effort. BrainMap data may not be extracted for inclusion in other databases or redistributed in any manner, without prior written permission.