VResin: Instructions and User Guide

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VResin is a tool developed for the research paper:

> Tianyi Xiao*, Kevin Gonyop Kim, Jakub Krukar, Rajasirpi Subramaniyan, Peter Kiefer, Angela Schwering, Martin Raubal. (2024). VResin: Externalizing Spatial Memory into 3D Sketch Maps. *International Journal of Human-Computer Studies*, 103322.

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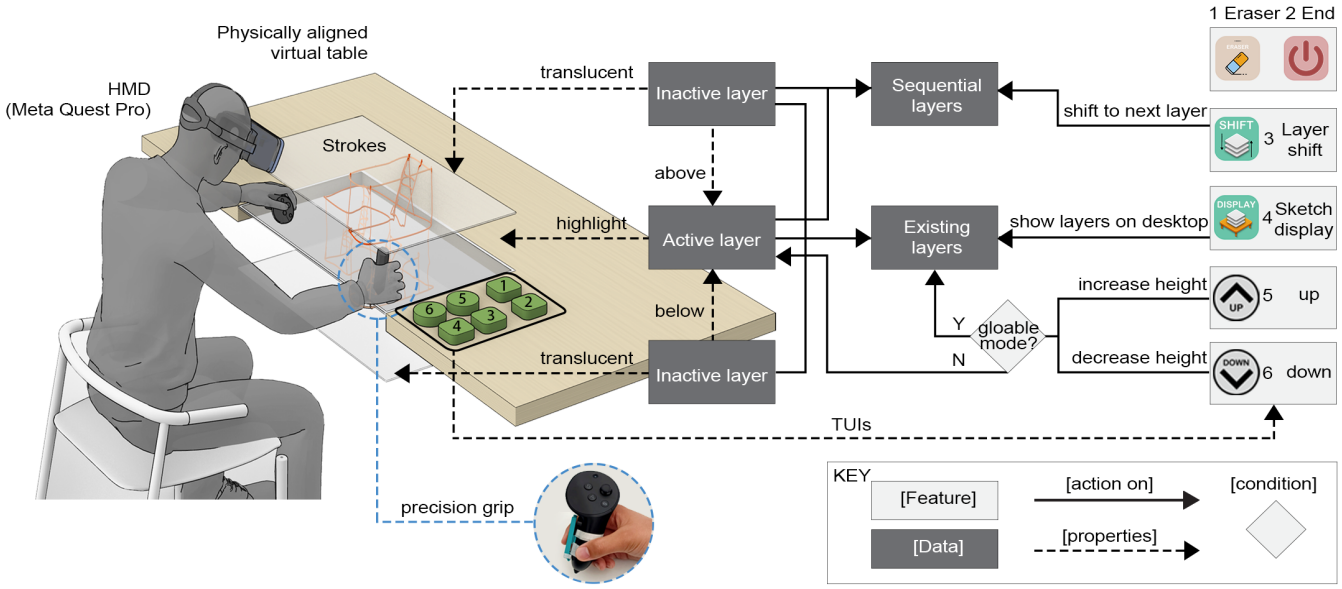
1. Concept Overview

VResin allows users to create 3D sketch maps in a virtual reality environment, externalizing their spatial memory. VResin is suitable for extermalization spatial memory for multi-layer buildings, as it implemented a layered system.

The core architecture is illustrated below:



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2. Setup and Calibration

Before using the tool, you must configure your VR headset and calibrate the workspace.

2.1. VR Headset Configuration

2.1.1 PC Version

1. Connect your VR MND to your PC using a cable.
2. Directly open the `VResin_predefined_layer_version_v1.exe`
3. You can find the streaming assets under path `VResin_predefined_layer_version_v1_Data\StreamingAssets`

2.1.1 APK Version

1. Install `VResin_predefined_layer.apk` on your Meta Quest headset.
2. Run the application at least once. This will automatically create a folder at the following path: `Quest 3S\Internal shared storage\Android\data\com.ETHZurich.VResin_predefined_layer_version_v1\files\`; Or you can manually create those folders and don't need to run the app.
3. Copy the provided `StreamingAssets` folder into the `files` directory created in the previous step.

2.2. Table Calibration

You need to calibrate the table right after you get into the app. Calibration aligns the virtual table with your physical table, providing tangible feedback for sketching. This is the first action you must perform inside the app.

1. **Start the App**: You will see your physical environment through the headset. The right controller acts as a pen, and the left is the tool controller. (If you are left-handed, swap the controllers).
2. **Set First Point**: Place the pen on the **bottom-left** corner of your physical table and press the "X / Calibrate" button on the left controller. You can release it after pressing.

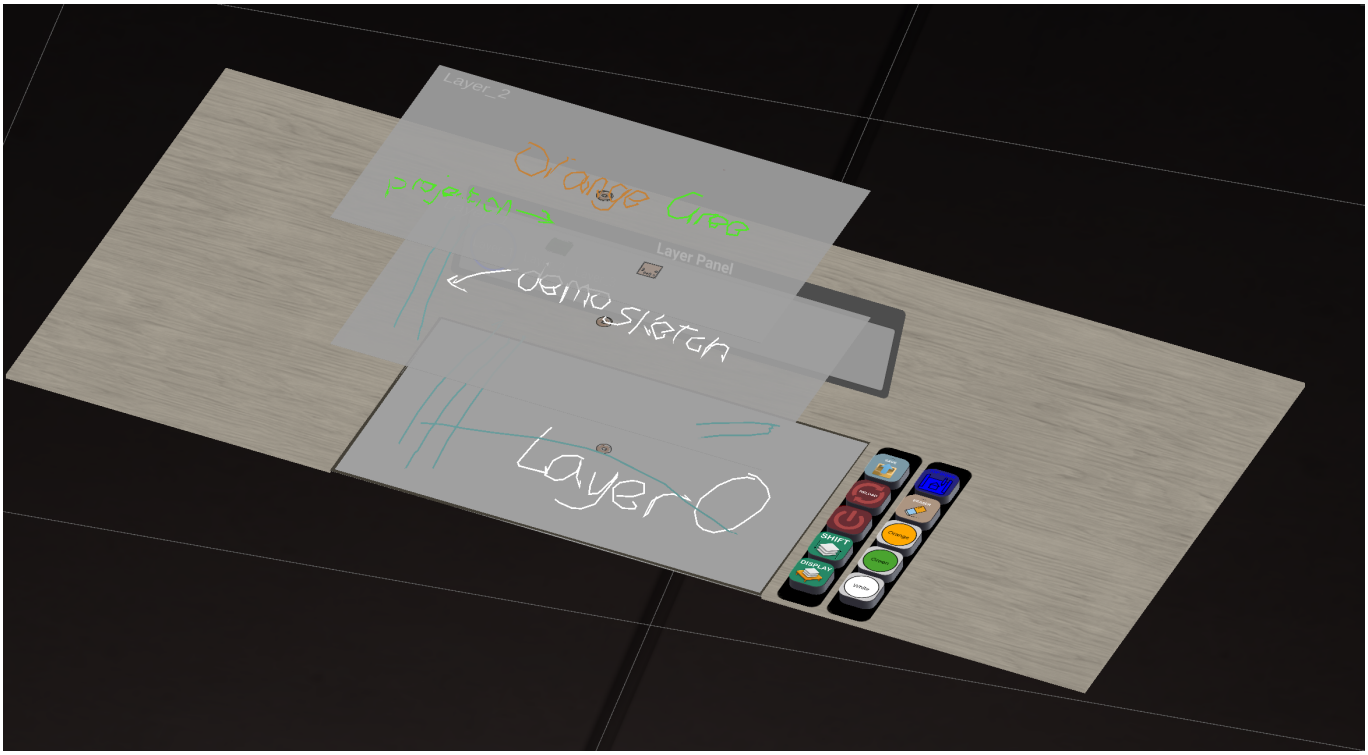
3. **Set Second Point**: Place the pen on the **bottom-right** corner of the table and press the "X / Calibrate" button again.

The table is now calibrated, and the main user interface will appear.

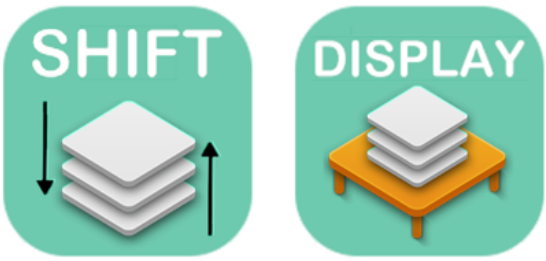
3. Using the Tool

3.1. User Interface (UI)

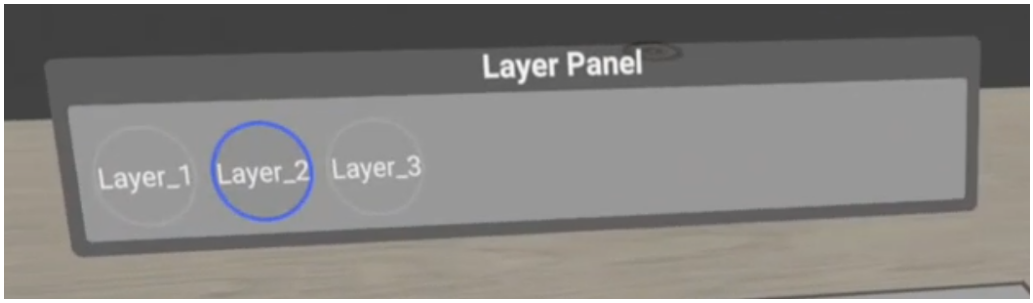
The UI provides several functions for sketching and managing your work. Use the pen to touch a button to activate it.



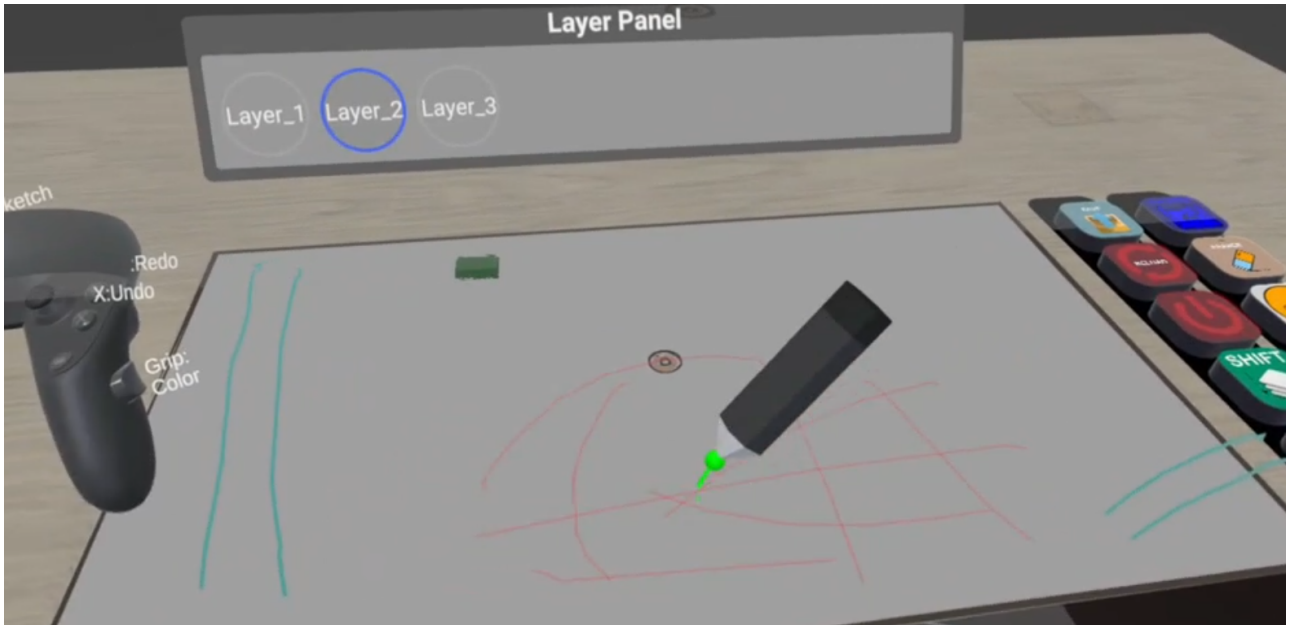
- **System Functions**: Save, Reload, End Session.
- **Layer Control**: Switch between layers or display and highlight all layers simultaneously. Strokes on the `active layer` have full opacity, while strokes on `non-active layers` become semi-transparent.



- **Layer Panel**: A `Layer panel` in the middle of the table indicates the currently `active layer`, which is the layer your stroke belongs to.



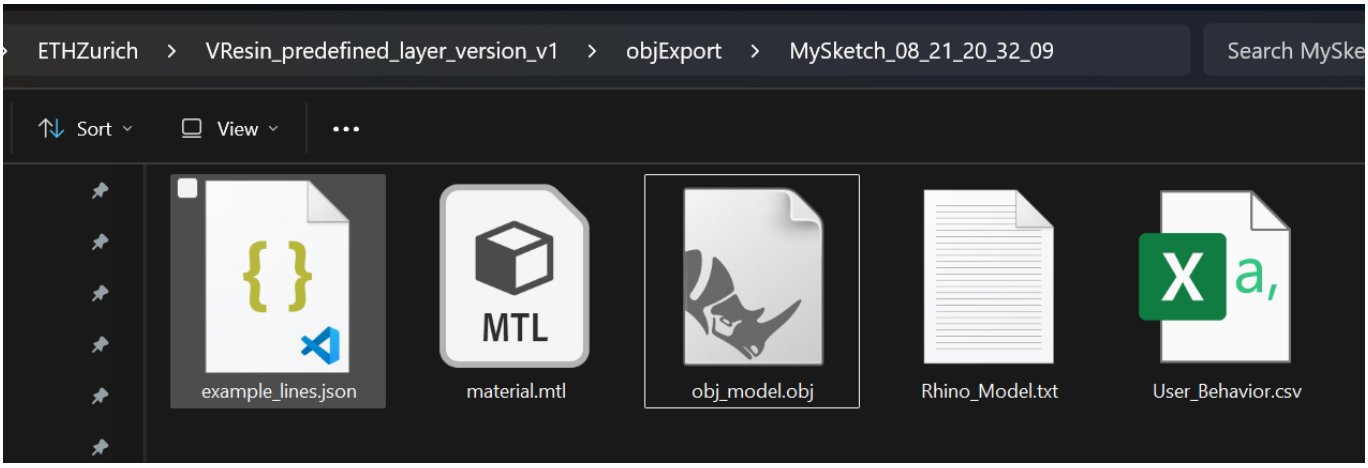
- **Drawing Tools**: Eraser, three predefined colors (orange, green, white).
- **Projection Lines**: Projects strokes from a lower layer onto the tabletop surface as dark red lines for reference.



- **Redo/Undo**: You can press the `Y:Redo/X:Undo` button on the `left controller`.
- **Change Color**: You can press the `Grip:Color` button on the `left controller` or touch the color button on the table.

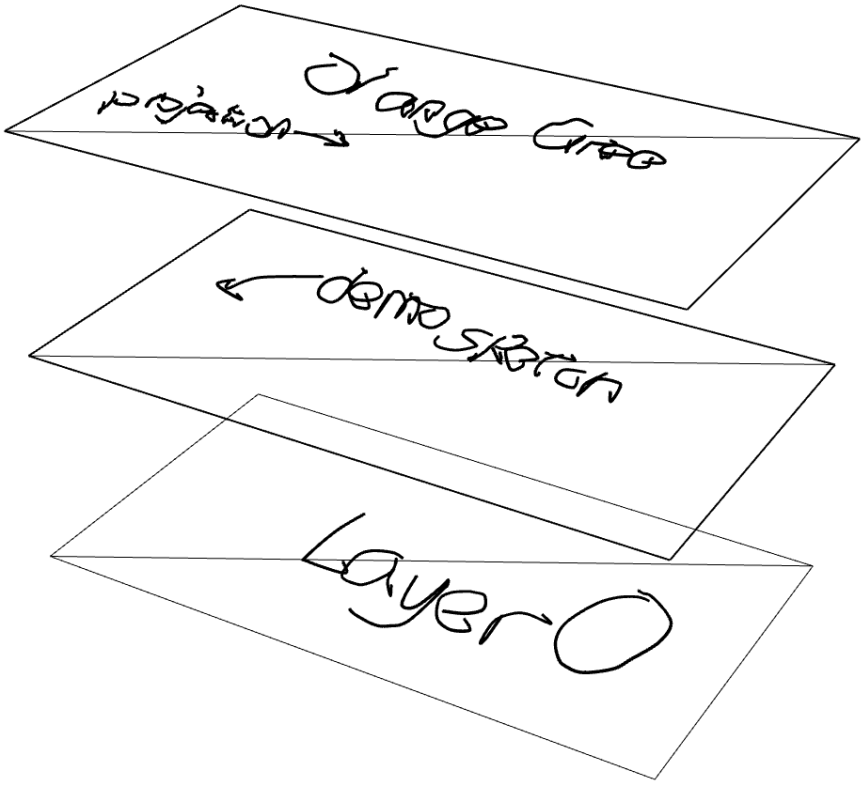
3.2. Saving Sketches and Exporting Data

When you press the **SAVE** button, the tool exports the following files to `\...\files\objExport` for the Android version while under `\...\StreamingAssets\objExport` for the PC version:



- `example_lines.json`: Contains the stroke data. This can be used as a demo or template for other users (see Customization section).

- `obj_model.obj`: A 3D model of your sketch, viewable in software like Rhino.



- `Rhino_Model.txt`: Raw data for rebuilding strokes in Grasshopper (C# component).
- `User_Behavior.csv`: Logs user activity, including completion time, stroke timestamps, and button interactions.

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4. Advanced Customization (StreamingAssets)

The `StreamingAssets` folder allows you to customize experimental parameters without modifying the code.

4.1. Customizing Floor Plans

You can load your own floor plans for sketching.

1. Place your floor plan images (e.g., `floor_0.png`, `floor_1.png`) into the `StreamingAssets\FloorPlan` folder.
2. Open `Floor_Plan_Setting.csv` and define the scene structure.

Example 1: One building with 3 floors. Your CSV should look like this:

	A	B	C
1	Scene	Layer	FilePath
2	0	0	floor_0.png
3	0	1	floor_1.png
4	0	2	floor_2.png

Example 2: Two buildings (scenes), one with 3 floors and another with 2. Your CSV should look like this:

	A	B	C
1	Scene	Layer	FilePath
2	0	0	floor_0.png
3	0	1	floor_1.png
4	0	2	floor_2.png
5	1	0	floor_B_0.png
6	1	1	floor_B_1.png

- `Scene`: Maps conditions to specific floor plans.
- `Layer`: Defines the vertical order (0 is the lowest).
- `FilePath`: Must match the filename in the `FloorPlan` folder.

4.2. Customizing Scene Parameters

Open `Scene_paramater.csv` to configure the experimental session:

- `Current_scene`: Defines which scene (from `Floor_Plan_Setting.csv`) to load.
- `DefaultFloorHeight`: Sets the vertical gap between layers (e.g., 0.25 = 25cm).
- `Example_line_absolute_path`: Path to an `example_lines.json` file. If a path is provided, the strokes from this file will be loaded as a blue-colored demo for the user. Leave it empty to show nothing.

4.3. Showing Example Strokes

To provide participants with a demonstration sketch:

1. Create a sketch yourself using the tool.
2. Press **SAVE**.
3. Find the generated `example_lines.json` in the `objExport` folder.
4. Copy this file into the `StreamingAssets` folder.
5. Update `Scene_paramater.csv` to point `Example_line_absolute_path` to this file.