3DSM-MVP: Instructions and User Guide

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3DSM-MVP is a tool developed for spatial cognition research. 3DSM-MVP is an open-source tool designed for spatial cognition research in virtual reality. It supports 2D/3D sketching, table calibration, reference images, color selection, eraser, undo/redo, and data export.

Related 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. Paper Link

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@article{xiao2024vresin,
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> Tianyi Xiao, Yizi Chen*, Sailin Zhong, Peter Kiefer, Jakub Krukar, Kevin Gonyop Kim, Lorenz Hurni, Angela Schwering, Martin Raubal. (2025). Sketch2Terrain: AI-Driven Real-Time Terrain Sketch Mapping in Augmented Reality. *In Proc. of the ACM Conference on Human Factors in Computing Systems (CHI 2025)*. Paper Link

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```
@inproceedings{xiao2025sketch2terrain,
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Reality},
  author={Xiao, Tianyi and Chen, Yizi and Zhong, Sailin and Kiefer, Peter and
Krukar, Jakub and Kim, Kevin Gonyop and Hurni, Lorenz and Schwering, Angela and
Raubal, Martin},
  booktitle={Proceedings of the 2025 CHI Conference on Human Factors in Computing
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  pages={1--24},
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}
```
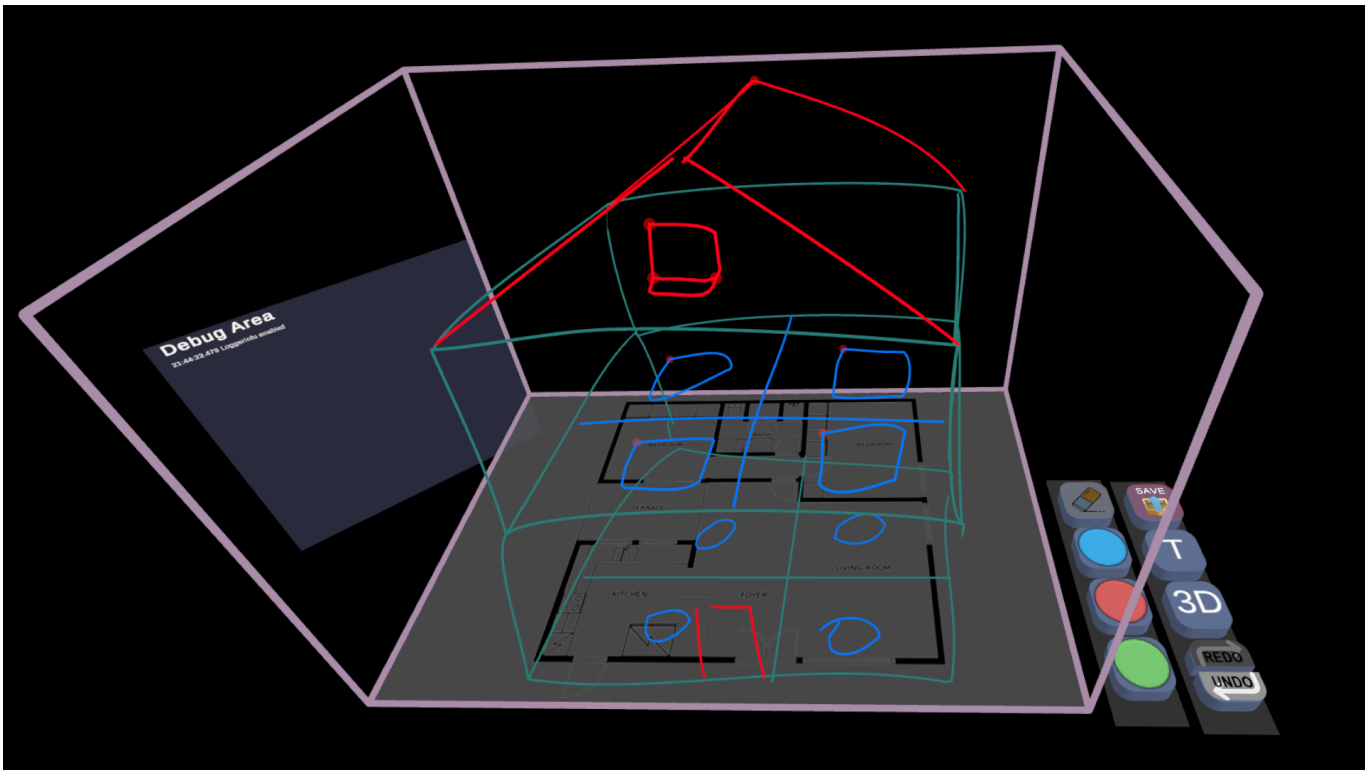

1. Concept Overview

3DSM-MVP provides table calibration, reference images, 2D/3D sketching, color selection (green, blue, red), export, eraser, and redo/undo functions for spatial cognition studies.

The interface is shown below:



2. Setup and Calibration

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

2.1. VR Headset Configuration

2.1.1 PC Version

1. Connect your VR headset to your PC using a cable.
2. Open **`SketchMapMVP.exe`**.
3. Streaming assets are located at `SketchMapMVP_Data\StreamingAssets`.

2.1.1 APK Version

1. Install **`SketchMapMVP.apk`** on your Meta Quest headset.
2. Run the app once to automatically create the folder:
   `Quest 3S\Internal shared storage\Android\data\com.ETHZurich.SketchMapMVP\files\` (You may also create these folders manually.)
3. Copy the provided **`StreamingAssets`** folder into the `files` directory.

2.2. Table Calibration

Calibrate the table immediately after entering the app. Calibration aligns the virtual table with your physical table, providing tangible feedback for sketching. This is the first step 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. (Swap controllers if left-handed).
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.

3. **Set Second Point**: Move the pen to the **bottom-right** corner and press the "X / Calibrate" button again.

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

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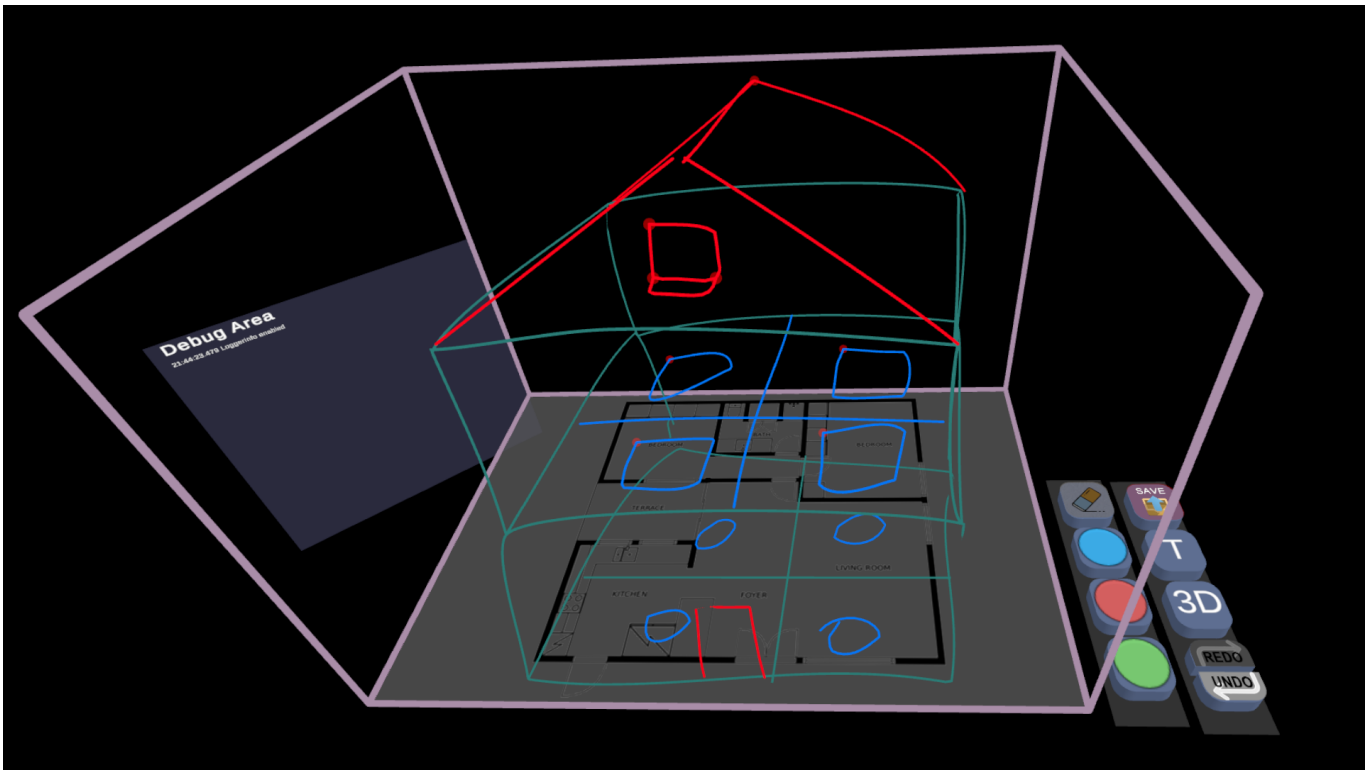
3. Using the Tool

3.1. User Interface (UI)

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



Function list:

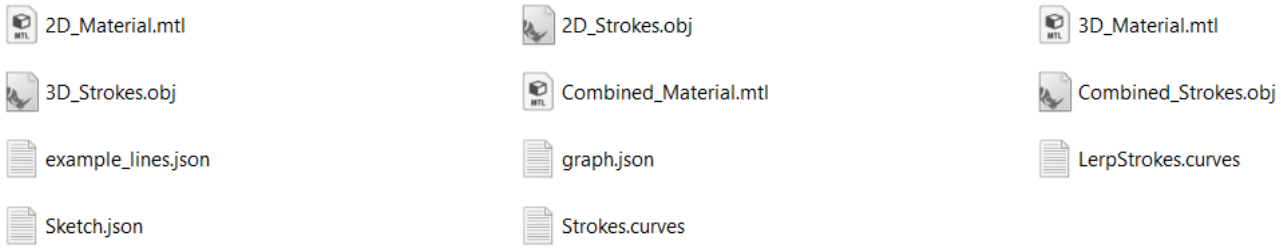
- **System Functions**: Save your work.
- **2D/3D Sketching**: In 2D mode, strokes are projected onto the bottom plane. In 3D mode, you can sketch in a 3D workspace (l:0.6, w:0.4, h:0.4) and draw in mid-air.
- **Text**: Thinner strokes for text annotation.
- **Drawing Tools**: Eraser and three predefined colors (blue, red, green). 

- **Redo/Undo**: Press the `Y:Redo/X:Undo` button on the left controller, or touch the button on the table.

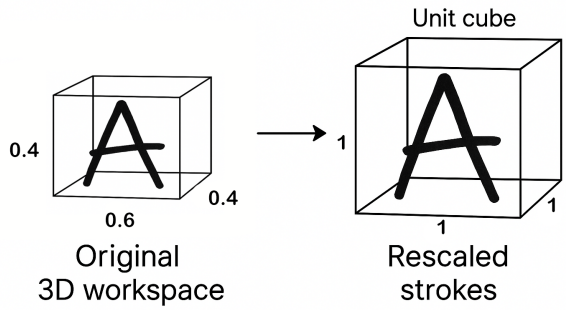
- **Change Color**: Press the `Grip:Color` button on the left controller or touch the color button on the table.

3.2. Saving Sketches and Exporting Data

When you press the **SAVE** button, the tool exports the following files to `\...\files\SketchData~` (Android) or `\...\StreamingAssets\SketchData~` (PC):



- `*.mtl`: Material file.
- `*.obj`: 2D strokes, 3D strokes, and combined strokes (2D + 3D).
- `*example_lines.json`: Copy this file into StreamingAssets and set its name in `StreamingAssets\Scene_paramater.csv` under `Example_Line_Path`. This sketch will be loaded as an example for participants (visualized as dark blue).
- `graph.json`: Stores the graph data structure of the current sketch, including strokes, segments, and nodes describing connectivity.
- `Stroke.curves`: Stores all strokes as polylines, designed for easy import into other systems that use 3D polylines.
- `LerpStroke.curves`: Stroke control points rescaled to fit inside a unit cube (1 × 1 × 1). Original workspace is 0.6 × 0.4 × 0.4 (width × height × depth). Coordinates are mapped proportionally,



preserving shape but normalizing size.

- `Sketch.json`: Log of the entire sketching session, used for remote user study data analysis. Likely not needed for most future use cases.

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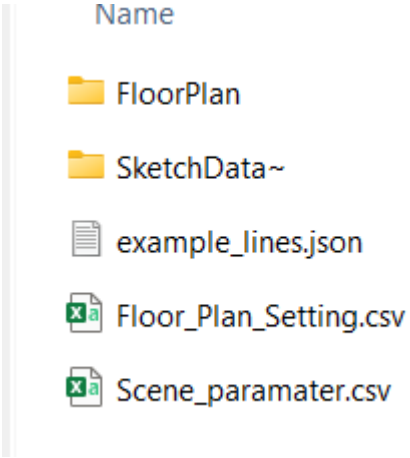
4. Advanced Customization (StreamingAssets)

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`, `example_floor_Plan.png`) into the `StreamingAssets\FloorPlan` folder.
2. Open `Floor_Plan_Setting.csv` and define the scene structure.

Example Your CSV should look like this:

Scene	FilePath
0	example_floor_Plan.png

- `Scene`: Maps conditions to specific floor plans.
- `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.
- `Example_Line_Path`: Path to an `example_lines.json` file. If provided, strokes from this file will be loaded as a blue-colored demo for the user. Leave empty to show nothing. `example_lines.json` should be placed in `StreamingAssets`.

4.3. Showing Example Strokes

To provide participants with a demonstration sketch:

1. Create a sketch 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.