VR Final Project

Sketching in 3D

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Abstract

The main idea of the project is to make possible to create 3D sketches in virtual environment. It could be helpful in fast preliminary asses of some 3D models.

To achieve the fast part we decide to use the hand-drawing input and in our case, it was possible to use the professional tablet Wacom Cintiq21UX that make easy the drawing input. Another input device that we decide to use was the SpaceMouse, this one we use for navigation task as well as for manipulation. It seems to be not ideal decision to use such input for precise manipulation task, but if we take into consideration all tasks that we want to solve by one input devise it fit no so bad. For example, in tasks of controlling rate of the cursor plane during 3D drawing such elastic devices is what we need. For some supplementary input, there are available keyboard commands. Finally, to make comfortable the process of drawing, there is used 2 Monitors - for 2D and 3D image output, so we could draw something on tablet screen and at the same time observe the changes in 3D world, it could serve for quite good stimulus response compatibility.

For this project two drawing metaphor were implemented.

First, is simple drawing on 2D plane and next manipulation on it, for example scaling, rotation and translation to fit it in desirable position. By this method any possible forms can be achieved but for difficult ones it could be not so easy. The process of such drawing include creating lots of 2D planes and composite it. In this mode available selecting of any previous 2D planes for edit the drawing on it or manipulate.

Second, is drawing that so called “3D mode”. The process is resemble the 3D printing metaphor when in each moment of time we draw on 2D plane, but it movable in space, so we can create sequences of lines that not in the one 2D plane but in 3D. The new “3D planes” (or better spaces) could be created. But it is hard for editing. In this project only 2D projection of such “3D planes” is available for editing. Also in this mode any manipulations on such 3D spaces is no implemented.

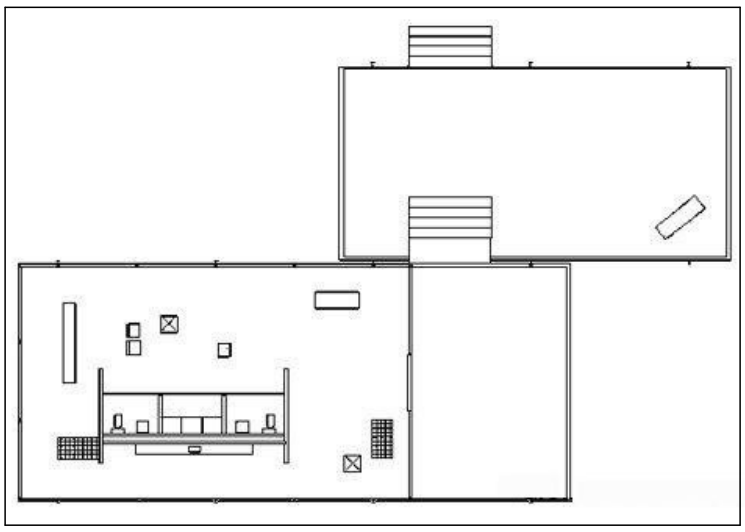
The main challenge was to setup uniform space during the drawing: correct cursor mapping on the tablet screen and correct projection in the main screen onto drawing plane. To easy the step of transformation there was correct plane object added with the same proportions as the tablet screen has. There also was an idea to use the orthogonal projection and setup the camera in such position where the pen exactly maps the same coordinates in screen coordinate space as in plane coordinate system. In such scenario it could be possible draw in relation with already existing planes and drawings. But eventually we choose empty black screen which is separatly existing from the main scene.

There are also some problems with finding intersection between cursor and planes, now it is calculated as distances between centers but not as polygon intersection and it is affects on accuracy of selecting. Also, in case of drawing something less or more complicated, the performance becomes slower, because every line is small box geometry and it is make scene heavy.

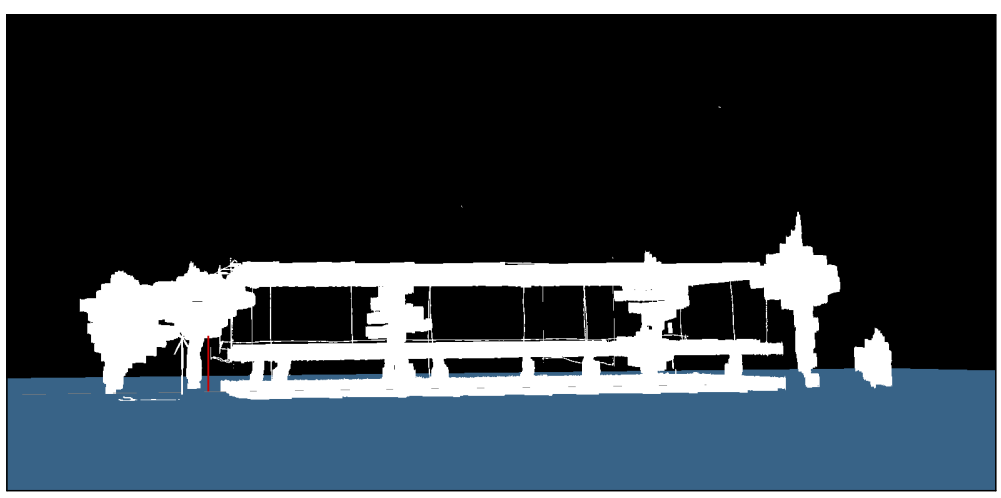
In general, the process of sketching not become as easier as on paper, but it is more live approach to do sketches in 3D. Also in this project there were not attempts to make research on user interfaces in a way to make the process more understandable or logical that also affect on drawing performance.

Example. Drawing process.

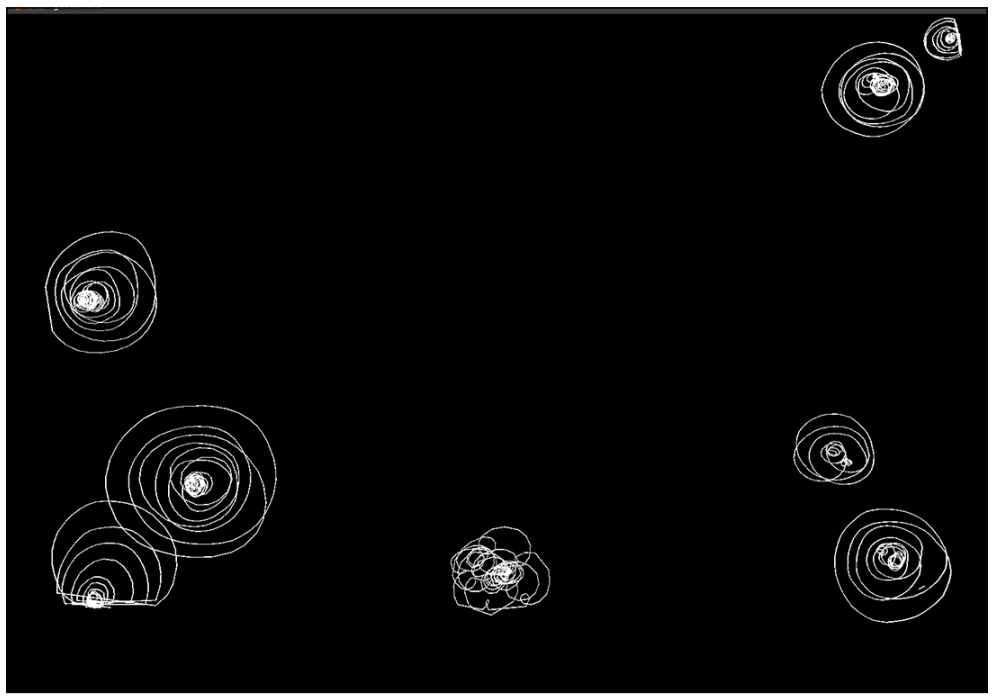
As a simple 3D volume there was chosen Mies van der Rohe's Glass house.



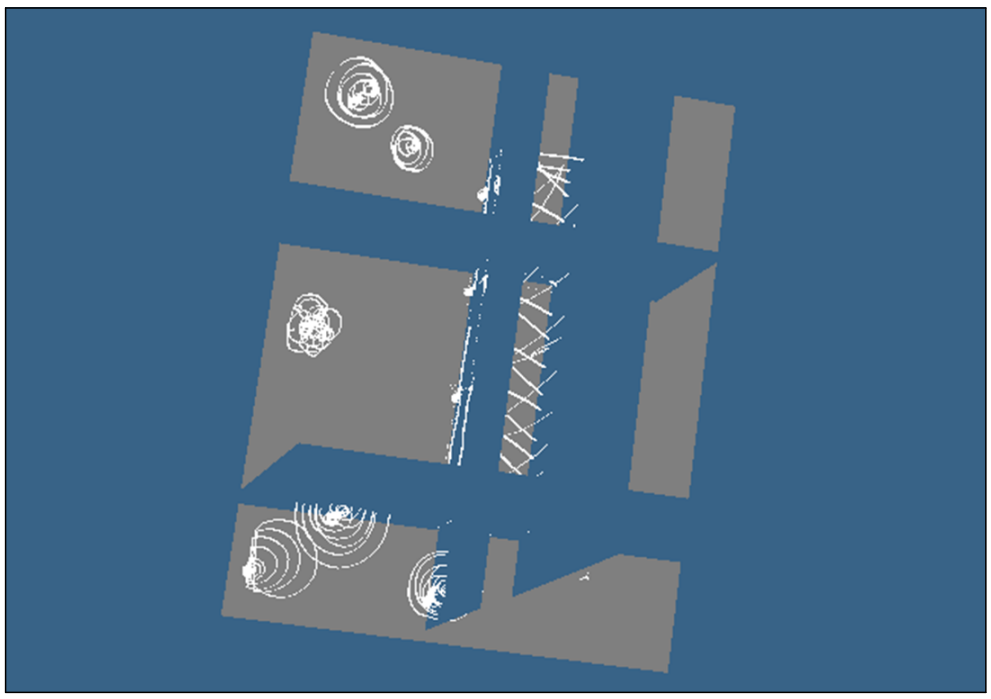
Two main facades were led round on the tablet screen to save all main proportions. Than produced copies of them by the same way and combined in "2D mode". After all, all vertical structures, trees and some hatching were added in "3D mode".



Final model

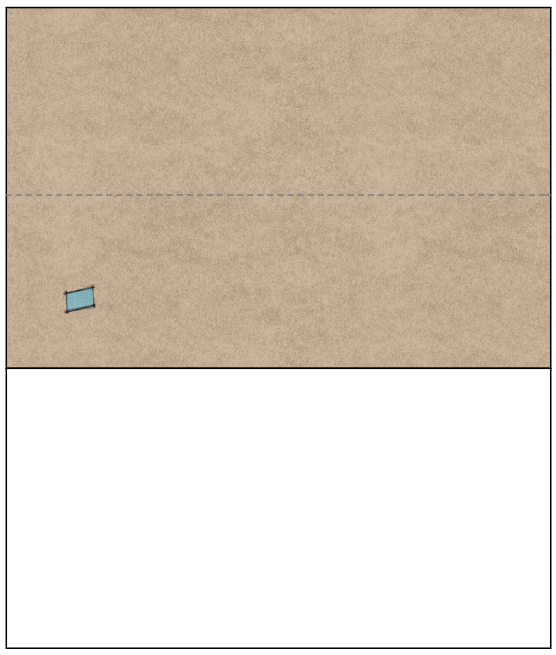


Trees in 3D plane

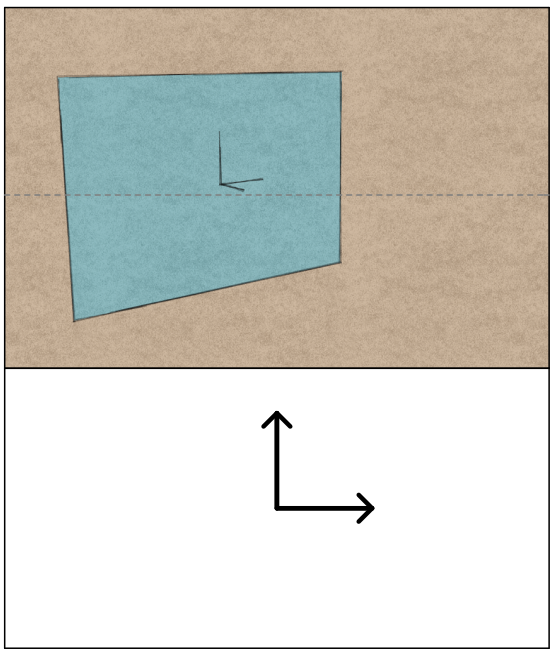


Visible drawing planes

Drawing 2D



Translate/Rotate
Drawing
Select/Intersect
Scale



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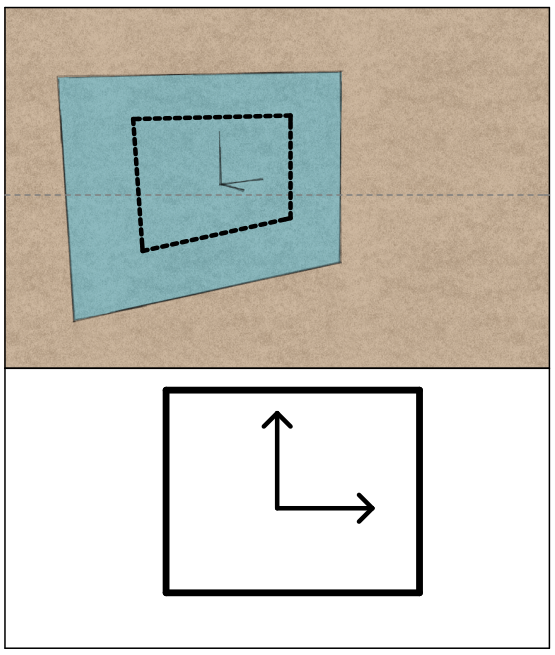

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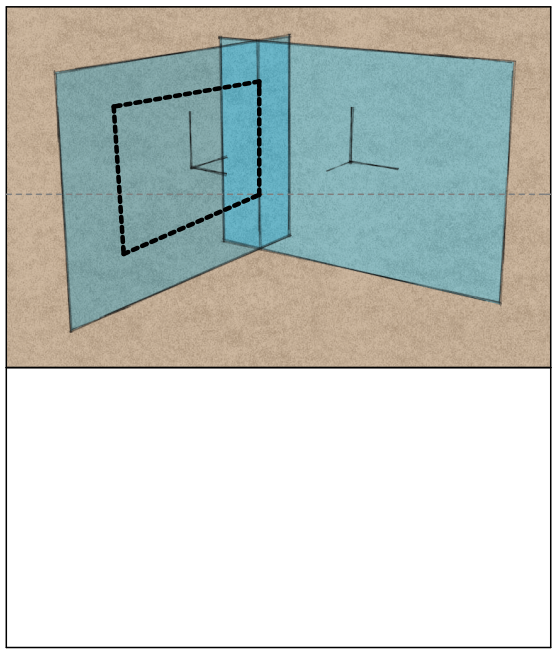

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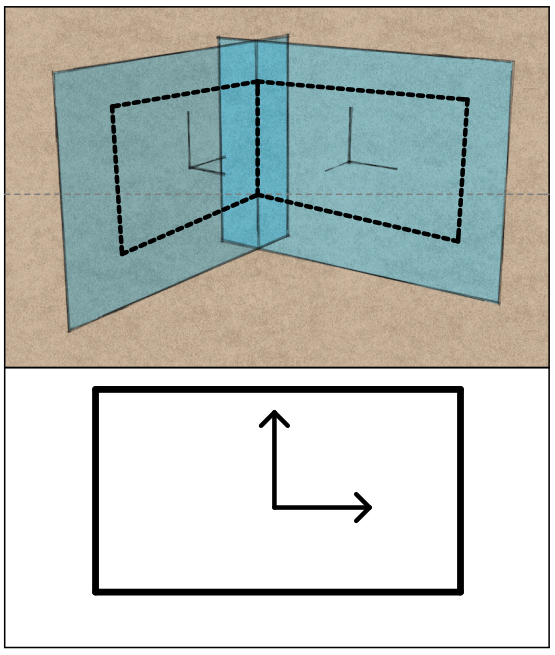

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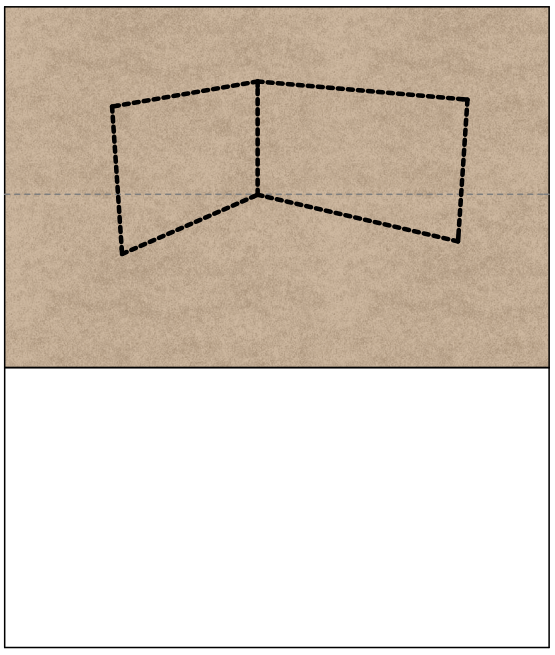

Translate/Rotate
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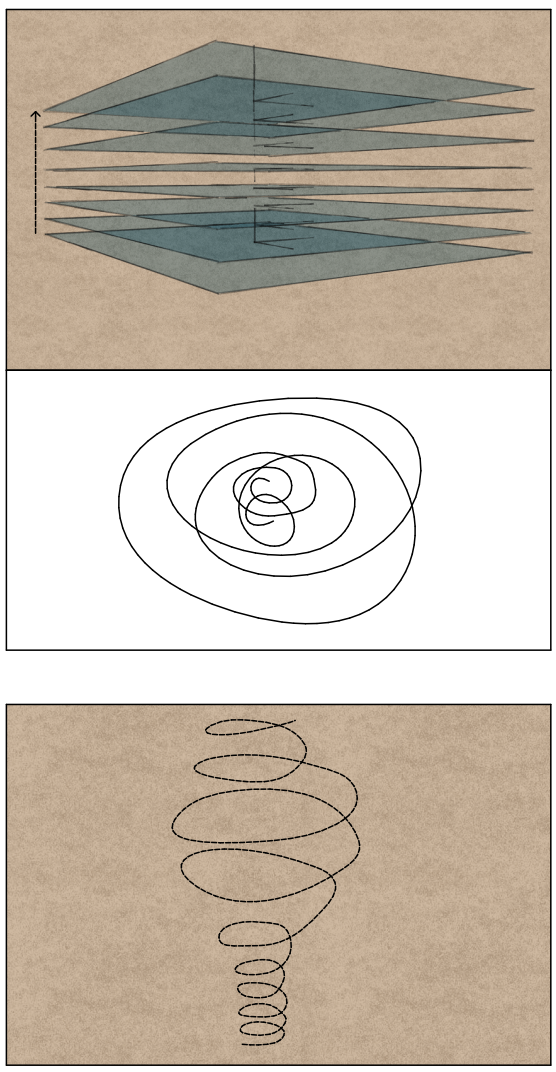
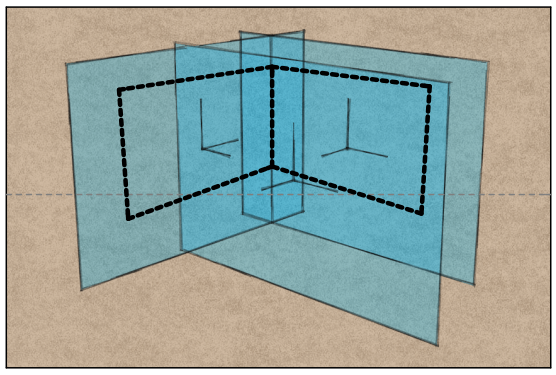
Scale

Drawing 3D



Translate/Rotate
Drawing
Select/Intersect
Scale

Edit



Translate/Rotate
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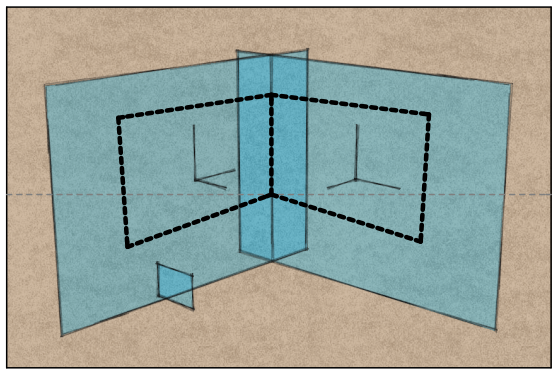
Drawing



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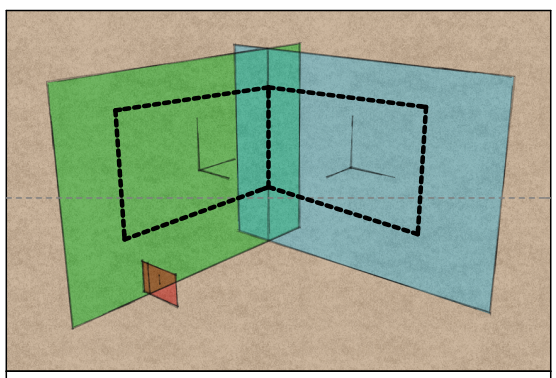

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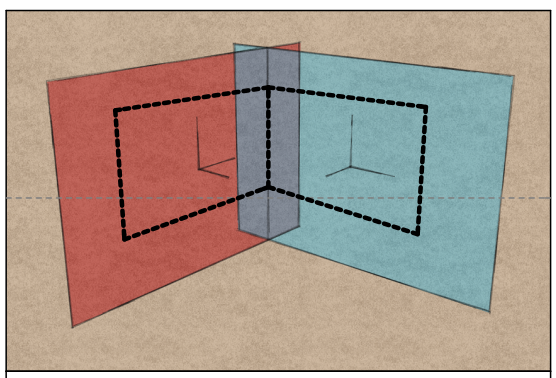

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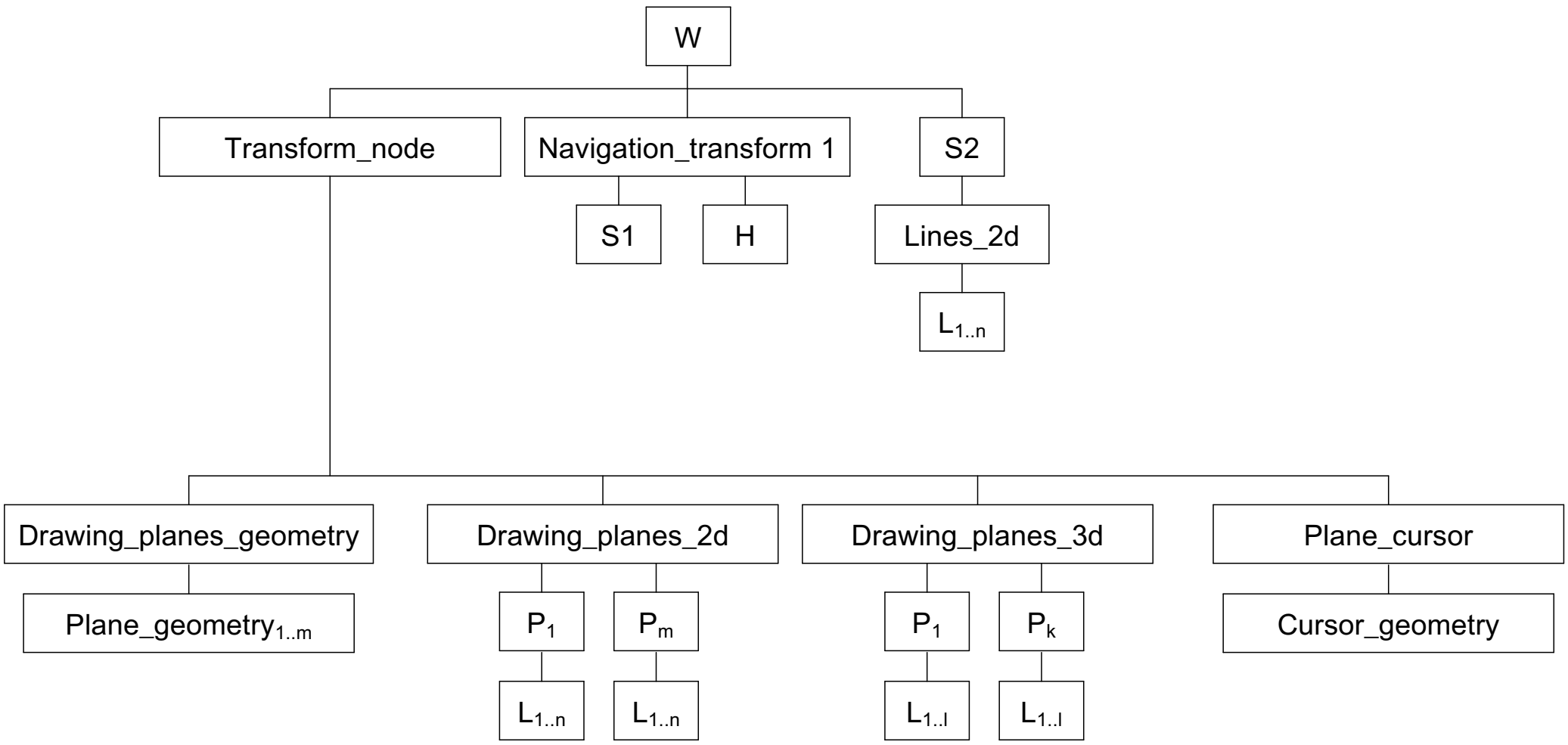
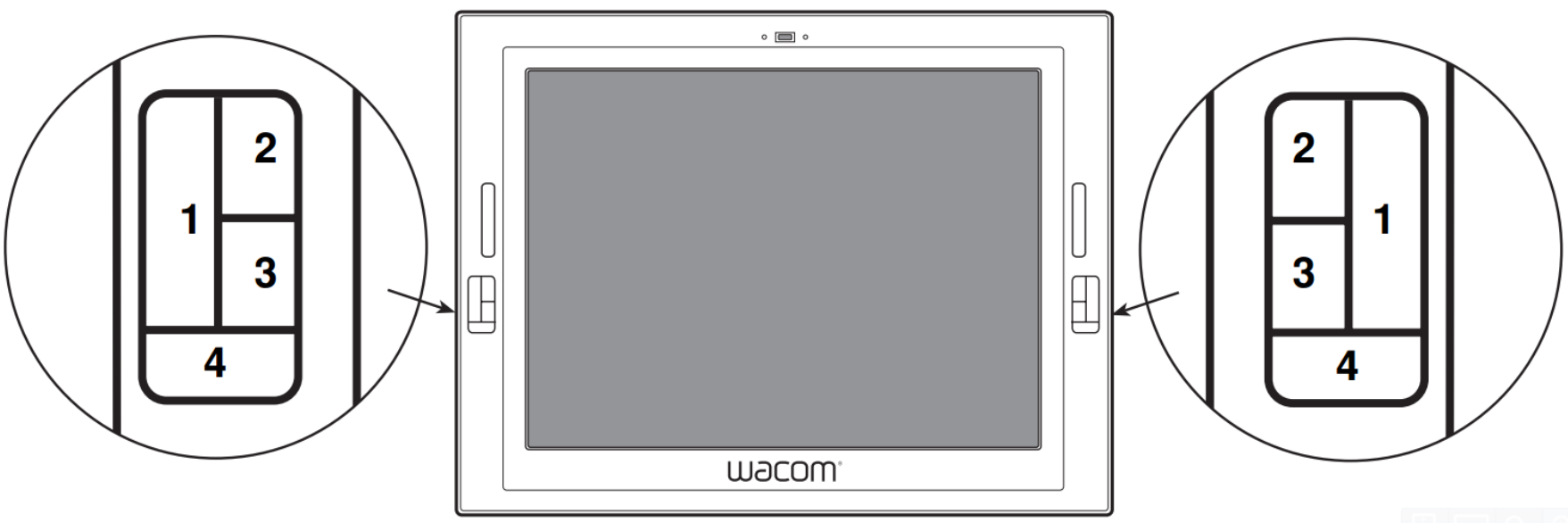
Drawing

Scenegraph



Control structure



1L - Switch between 2D/3D drawing mode
2L - Change camera position
3L - Change cursor position
4L - Scale cursor (2d mode)
4L - Create new 3d plane (3d mode)

2R - Switch visibility of drawing planes
3R - Snap cursor to drawing select plane
4R - Switch to active plane manipulation mode

Space - Switch cursor motion
Arr_Up - Rotate 90° around X-axis
Arr_Down - Snap cursor to the ground
Arr_Left - Rotate 90° around Y-axis
Arr_Right - Create new 3d plane (3d mode)