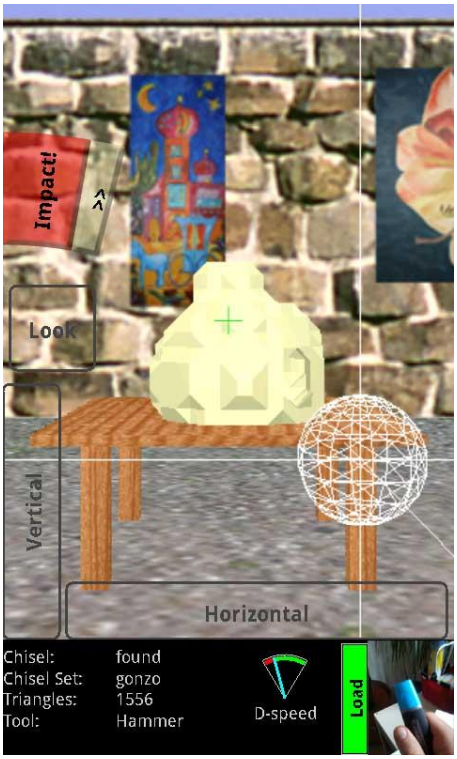
AndroAngelo

Turn Your Smartphone into a virtual studio

User Manual Version 1.0



The AndroAngelo turns Your Android smartphone into a virtual sculptor studio. All you need is the smartphone and a real object like a textmarker representing the chisel in your virtual studio. The AndroAngelo tracks the position of the textmarker using the camera and moves the virtual chisel accordingly to form the virtual sculpture. The block of material is formed (or colorized or extended) with the chisel.

Basic function:
The AndroAngelo creates a virtual sculptor room. This room contains a virtual block of material on a table. Within this room the user can move around and work with a virtual chisel on this block. The movement of the chisel is controlled by tracking the movement of the chisel-representative e.g. a textmarker in front of the smartphone. The position and moves taken from the camera is transferred into the virtual sculpture room.
Beneath the function of removing material from the block AndroAngelo contains also the chisel mode “Create” and “Color” i.e. a mode to create virtual material at the chiselposition and to colorize the parts of the block which were hit by the chisel.
To support and light-situations and multiple objects as a chisel representative, the AndroAngelo contains a function to calibrate the chisel-detection and save the calibration values.
Using the magnetic sensors of the phone the user can look around in the room by turning the phone.

And yes: AndroAngelo is a memory and battery hungry monster.....

Extended version:
The Pro-Version has the following additional functions:

- Saving and loading from multiple files using the OI FIlemanager
- Export the sculpture into the wavefront .obj format
- Pottery mode

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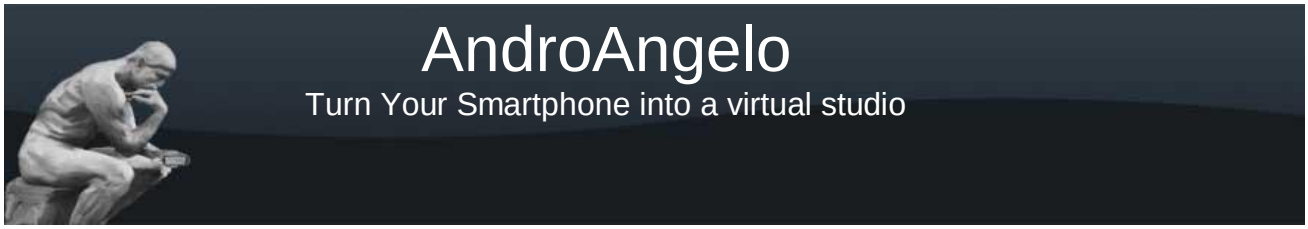


1. QUICK-START

The app has been developed using a Samsung Galaxy i9000. Up to now it is untested on other phones. It requires Android 2.2.

1.) Download and install the AndroAngelo app on your android smartphone
2.) Start the app
3.) Grab a yellow textmarker and target it with camera of the smartphone. Verify in the preview-frame in the lower right screen that the textmarker is in view of the camera. If you move the textmarker the sphere on the screen – the virtual chisel – should follow your moves.
4.) By moving your fingers on the touchscreen, the position of the virtual artist in the studio is moved. By pressing the “Focus” button, the distance of the chisel is adjusted to the part of the block indicated by the green cross.
5.) If the sphere intersects with the block or comes close to the block the impacted elements will be highlighted.
6.) Pressing the “Action!” button on the upper left section of the screen will make the impact on the highlighted parts of the block effective. Now move around and form the block with the chisel.
7.) Select the color-tool (“>>” -> “Tool” -> “Color” -> blue field) and color parts of the block.
8.) Select the create-tool (“>>” -> “Tool” -> “Create”). Now the shape-boundaries are displayed by dots. Hitting the “Action!” button now creates material within the boundaries of the chisel-sphere.
9.) Select “options” -> “Save Image”, and the current view on the sculpture is stored to the SD card file system. I will be happy to publish sculptures sent to me.

1.1 CALIBRATION QUICK-START

1.) Open the context menu, select “Calibrate chisel”
2.) Move the chiselrep to the center of the preview-display.
3.) Touch the center section of the preview-display, wait until the calibration sequence has finished.
4.) Verify the detection on the screen by moving the chiselrep within the preview frame
5.) Enter a name and hit “Save”
6.) Return to the main-screen.

1.2 DISPLAY OF .OBJ-FILES

On the Android I use 3D Model Viewer. To use it You have to export to the directory “modelview-data”. On the PC I use 3D Viewer.

2. CREDITS/LICENSES

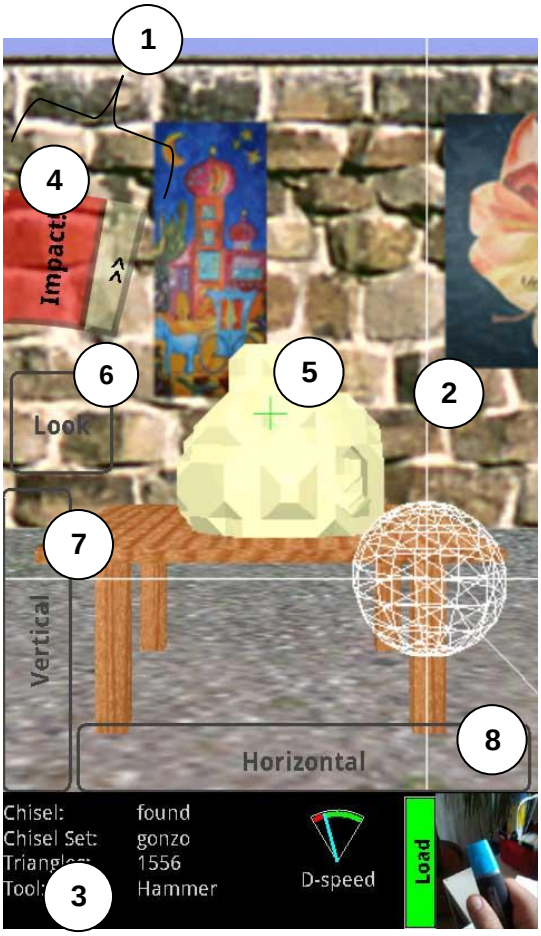
Some icons used has been taken from http://www.androidicons.com/
The OIFileManager call is taken from http://www.openintents.com
Various source-code examples have been taken from http://developer.android.com
Some linear algebra has been taken from the gleem project http://www.gnu.org/s/gleem/

3. THE VIRTUAL STUDIO

The virtual studio is the central activity of the AndroAngelo. Here you can work on the virtual sculptures.

Start the app by hitting the app-icon in the start manager. After the splash screen disappeared, You are in the virtual sculptor studio. The default surrounding is the cellar gallery.
The app is designed to be used with both hands: One hand holding the smartphone in portrait mode and the other to move around the chiselrep in front of the phone.

3.1 BASIC SCREEN



The basic screen is designed use as much of the screen as possible for display of the sculpture and the scenery.

1. The menu for tools and chisel activation is positioned to be used with the thumb. By hitting the double arrow, the submenu expands.
2. The rest of screen accepts touch-moves. Left-Right moves rotate the artist around the sculpture. Up-Down moves move the artist forward and backward.
3. The options menu leads to new/save functions for the sculpture, the selection of a calibration set and the calibration itself.
4. The “Impact!”-button makes the current selected tool effective. Unless the button is touched, the chisel moves around in the scenery, even into the block but does not create any effect. All edges of the block which would be impacted are highlighted.
5. The Focus-Cross indicates to which position the “Focus” function will position the chisel.
6. The “Look” sensor makes the AndorAngelo sensitive to moves of the smartphone in the real world and will transfer the rotation to the look-direction within the studio. The accuracy depends on the quality of magnetic field detection.
7. The “Vertical” Sensor allows to move the virtual artist up and down.
8. The “Horizontal” sensor allows the move the virtual artist left and right.

3.2 MENU STRUCTURE

The AndroAngelo has two menus. All settings dedicated to the work on the sculpture are grouped a radial OnScreen menu. It is designed to be used with the thumb of the hand holding the smartphone. All non-File-interactions or further functions are reachable via the standard options-menu.

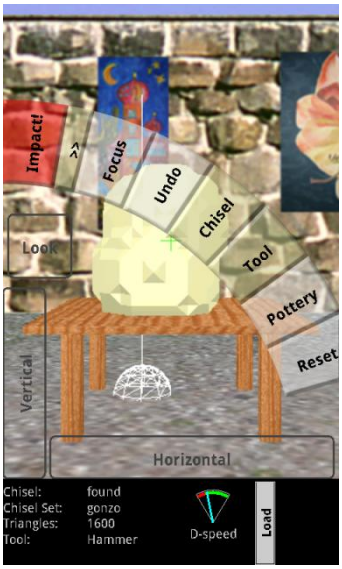
3.3 SCULPTURE-RELATED MENU-ITEMS

3.3.1 “Impact!”

The Action button makes the chisel active. Depending on the selected tool (See section -> 3.3.6.1 Hammer ->3.3.6.2 Color ->3.3.6.3 Create) the tool-impact of the chisel on the space within the chisel-sphere will be applied. Example: If the color-tool is selected all planes of the sculpture within the boundary of the chisel will be colored in the selected color.

3.3.2 “>>”

This button extends the on-screen menu to further menu-items



3.3.3 “Focus”

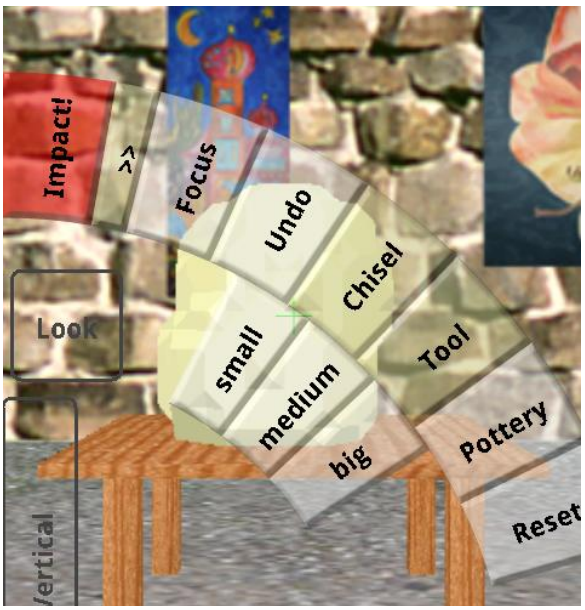
The distance of the chisel is controlled by the detected distance of the chisel-rep to the camera. Since the range of the arms are limited but the virtual atelier is bigger than the range of the artists arms, the distance is always relative. The focus button puts the chisel just in front of the element of the sculpture which is targeted with the green cross at the center of the screen. The focus button also calibrates the near/far movements of the chisel. As a best guess hold the chisel-rep around 20cm in front of the smartphone when hitting the focus button.

3.3.4 “Undo”

A typical undo-function. The undo function respects the time between interactions. Example: A stroke with the chisel is detected as a sequence of positions of the chisel at the time of detection, which impact is applied to the sculpture. The undo function will revert the entire stroke

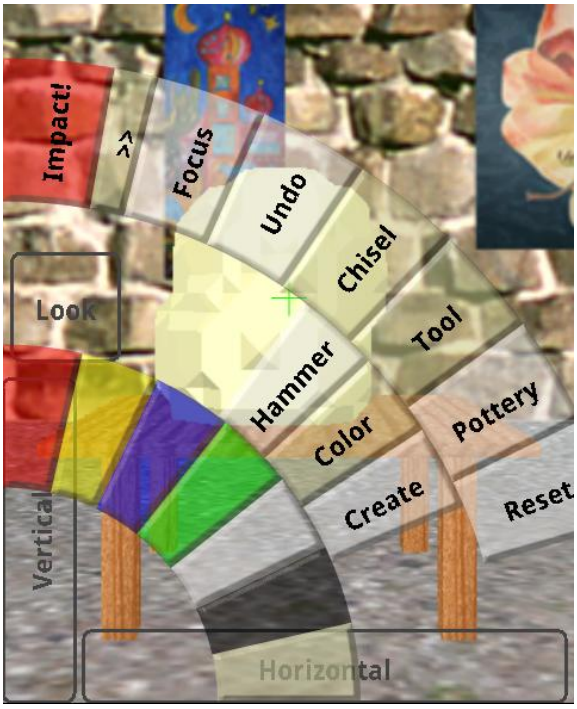
3.3.5 Chisel

The Chisel Menu offers three sizes of the chisel “Big”, Medium” and “small”. The sizes are absolute



3.3.6 Tool

The Tool sub-menu offers the tool selection.



3.3.6.1 Hammer

The Hammer tool modifies the sculpture. When a part of the sculpture is hit, the hammer tool forms this part according to the intersection of the chisel with the part. If the intersection is too big, the part of the sculpture is removed.
The sculpture is constructed of a cloud of points. The renderer identifies, which points are on the surface and creates a mesh of faces on this surfaces. Each point can be moved in certain boundaries and can also be removed.

3.3.6.2 Color

The color tool colorizes all points in the intersection of the chisel with the sculpture. The color tool colors one vertex of the sculpture. The color of one face is controlled by the color of the three vertices defining the face.
The reason is a design-decision which targets on reduction of memory consumption of the app.
The focus of the AndroAngelo is on the geometry of the sculpture. Hence only a small number of colors are offered. In future versions a color-picker might be added.

3.3.6.3 Create

The create-tool is the god mode. There shall be material!
The AndroAngelo thinks of a sculpture as a cube of potential discrete material with a given boundary. Hammering on the material moves or remove a point of material of this cube. The create-tool does the opposite: All potential virtual material becomes virtual material.
All potential points of material manifestation are displayed as dots in the virtual atelier.

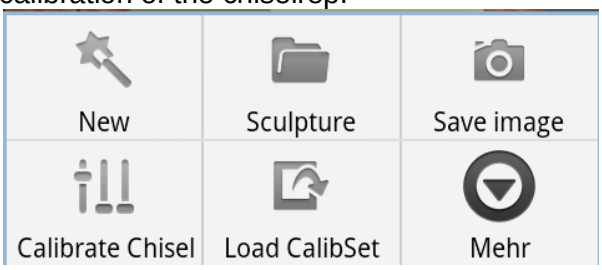
The idea of the overall workflow is to create an empty block and then as a first step create the rough shape of the to be created sculpture. Afterwards the sculpture is refined using the hammer tool. In case of need parts are colorized.

3.3.7 Reset

The reset button resets the position and viewing direction of the virtual artist to the initial values. After intense moves around in the atelier this can be the shortest way of finding again a useful view.

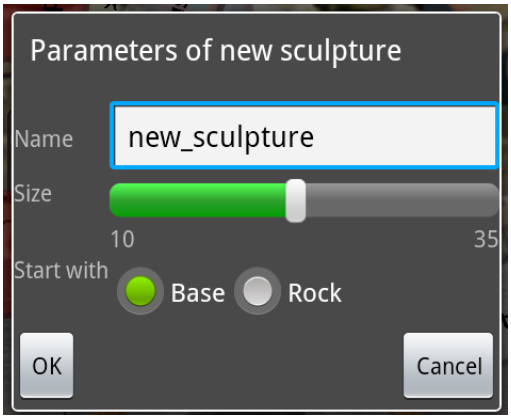
3.4 OPTIONS MENU

The options menu offers basic configurations, the file-management and the navigation to the calibration of the chiselrep.



3.4.1 New

To create a new sculpture define the parameters in the upcoming dialog. A name is optional, but can be added already at the definition-dialog.



By default using the “Base” option a small 4*4*2 block in the center bottom of the sculpture-boundaries is filled with material.
Using the “Rock” radio, the block is random shaped.

Size: Be careful with the size. The limitation of Android apps to 16M limits also the size of sculptures. The AndroAngelo App tried to fit an image-detection and sculpture model into 16M. The size is limited.
Having a sculpture of 20*20*20 elements means 8000 elements in the space to treat.

3.4.2 Sculpture (Load/Save/Export)

Free-Version: The current work is stored or loaded using the file system.
Pro-Version: The current work can be stored in the file-system under an editable name. To perform this, the OI-FileManager (https://market.android.com/details?id=org.openintents.filemanager) is integrated. To use this feature the OI FileManager has to be installed.
Loadings a sculpture uses also the OI FileManager

3.4.3 Save Image

The current view into the atelier is stored under a name in the file-system (/SDCard) as a numbered jpeg file. Until the media-scanner ran, the display of the file from the gallery takes sometimes up to 10 seconds.

For saving the chisel-display is suppressed. Some examples:



3.4.4 Calibrate Chisel

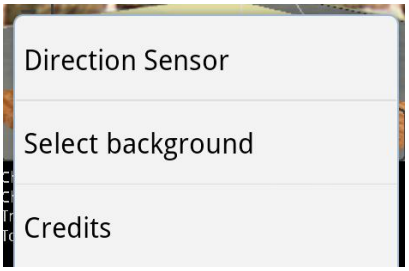
Navigation to the Calibration of the chisel. (See Chapter 4 Calibration)

3.4.5 Load CalibSet

Selection of a predefined Chisel-Detection calibration

3.4.6 More

The more-menu leads to further options



3.4.7 Direction Sensor

The Andro-Angelo is capable of processing the data from the orientation sensor to change the view-direction within the studio.
If the orientation sensor is enabled, the view rotates with the orientation of the device, when the “Look” Button is pressed. Enabling of the Sensor increases the battery hunger of the app.

3.4.8 Select background

Three predefined backgrounds are available.

4. CALIBRATION

The fun of using the AndroAngelo is directly linked to the quality of the detection of the chisel-movement. For the detection of the chisel movement the image-stream from the camera is examined to track the moves of the “Real-world-object-representing-the-chisel” or “chiselrep”. (it is something like the motion controller of the PS3 or the detection of the sensor bar IR-light from the WII-Mote)

Due to the limited resources on the smartphone a quite basic image-detection is implemented:

1. The color from the rgb is transferred into the hsv-Color Model (http://en.wikipedia.org/wiki/HSL_and_HSV)
2. All points are filtered to a certain h-value (color value) with a configurable tolerance. (The saturation and value parts are ignored.)
3. Noise is filtered
4. The largest cluster is assumed to be the detected chisel-rep.

By default the chisel-detection is configured to the usage of a yellow textmarker as chiselrep in a neon-lighted indoor room.
The following rules should be respected for selection of a chiselrep:

- The color of the chisel-rep should differ from the background
- The color of the chisel-rep should differ from hand holding the chisel-rep
- The size should be 3-10cm in diameter. The image taken from the camera should show significant changes in diameter according to the distance but should allow significant left-right moves within the camera image.
- The chiselrep should have a matt finish

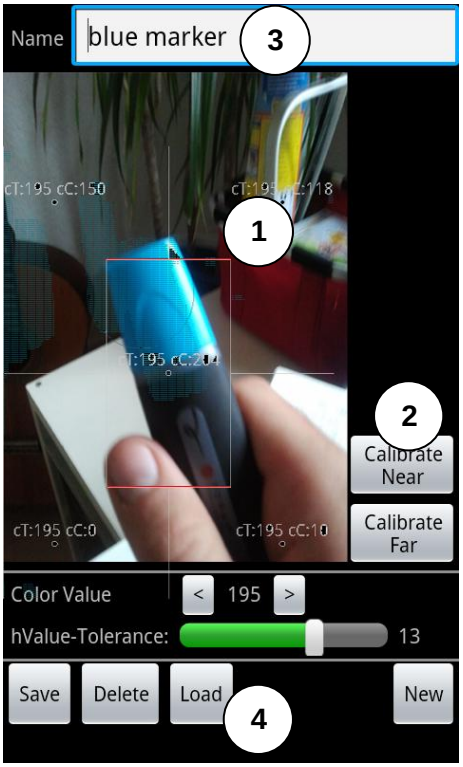
These objects have been tested with reasonable success:

- The fist, as long as the rest of the arm is in a sweater or jacket
- A lid of a thermos jug
- A White-Board-marker (using the colored top as chiselrep)
- A painted table tennis ball

To adapt the image-detection to the currently used chiselrep, the AndroAngelo has to be calibrated to the currently used chiselrep. The calibration can be accessed by using the menu-item “Calibrate Chisel” from the option menu of the main-screen.

4.1 CALIBRATION SCREEN

The main element of the calibration screen is the preview-display of the camera. The result of the image-detection is put as an overlay onto the image. This allows to identify directly problems of the chisel-detection.



(1) Preview-Display
The detection can be calibrated in 5 sections of the image to various color values. The reason behind this is that the camera of the smartphone has the tendency to have a red “touch” in the center of the screen i.e. pixels in the center have a bigger part of red color. This is especially in diffuse light situations applicable.
By touching on the region, the color value for this region is calibrated to the color at the small calibration circle. To make it more robust, the average of the color value at the target is measured for a given period. This is displayed at the calibration section.
To control the color-detection the identified color is displayed directly at the calibration point.
The sequence of the calibration is to start with the center. A calibration of the center overwrites all calibrations in the outer sections. A further calibration of the outer sections is only needed under special conditions.

(2) CalibNear/CalibFar:
The movement of the chisel on the z-Axis (distance) is calculated by the ratio between the detected circle in the near (10cm) and far (range of the arm ca. 60cm). The near/far radius are calibrated by the two buttons.

(3) Name
To allow the usage of various chiselreps in varius situations, the calibration can be saved under a specified name. To save the name is entered in the name field and then saved using the save-button.

(4) Load/Delete/New
As usual

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