BIFURCATION, SHADOW OBJECT 2

BY RAFAEL LOZANO-HEMMER

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GENERAL IMPORTANT INFORMATION

This short section must be read for proper operation.

BIFURCATION, SHADOW OBJECT 2 (2012)

BY RAFAEL LOZANO-HEMMER

Technique

Computer, Microsoft Kinect camera, projector, metal, motor, Arduino processor, fumigated wood.

Description

A small Y-shaped branch, similar to a divining rod, hangs suspended from a thread and moves (with the air flow and with a small motor.) A shadow is projected onto the wall behind the branch, allowing you to see the entire tree from which the branch came. Bifurcation is the second installation in the "Shadow Object" series, which was inspired by Octavio Paz and Bioy Casares, among others, who insisted that absence and presence are not opposites.

Note: PLEASE DO NOT TOUCH THE BRANCH (YOU CAN ONLY BLOW ON IT.)

Operation

Please refer to Appendix I - Installation for detailed system information and wiring diagram.

1. Connect the computer, the Kinect, the motor driver, the branch illumination, and the projector to electrical power. Use the supplied power cables.

2. Depending on the version of artwork you have, you will do one of two things. First, a small black box on which to connect a power cable. On that box you will also find a button that is used to turn the artwork ON/OFF.

   If your version does not have this box, you will either use the computer's power button to turn the artwork ON/OFF, or you can set the computer to an automatic power schedule.

3. To turn the piece ON, press the power button on the computer for one second, then release it. Important note: Please do not push the button again as this will shut down the piece. Wait at least two minutes before pressing it again, as the computer might need this long to reboot. After two minutes (or less), you should see the piece.

4. To turn the piece OFF, press the power button on the side of the small box, or the computer button.

Wait about 60 seconds until everything (including the projectors) have finished their shutdown routine. The projector is ready to be used again once the lens door is closed, or once the indicator LEDs on the projector indicate that the cool down process is done.

5. If the piece doesn't start within two minutes, try turning on the piece again. If it still doesn't turn on, then hold the power button all the way down for 10 seconds. Then, wait at least three seconds, then press the power button all the way down for one second, and you should be up and running again.

Maintenance

Please do not clean Kinect camera surfaces with Windex or soap. Use a lint-free cloth and LCD screen liquid cleaner, such as Kensington Screen Guardian found in most computer stores. While cleaning the Kinect, avoid applying too much pressure onto its surface, otherwise the Kinect could swivel and it will mess up the alignment of the artwork.

The metal support structure can be cleaned with regular all-purpose cleaner. Do not use harsh cleaners or rough sponges.

We recommend cleaning the piece at least every two months.

Placement Instructions

The artwork comes in two versions: Version 1 is a metal structure that contains all elements (camera, projector, computer, motor) and Version 2 is comprised of a larger projection, in which the projector can be hung separately.

Version 1:

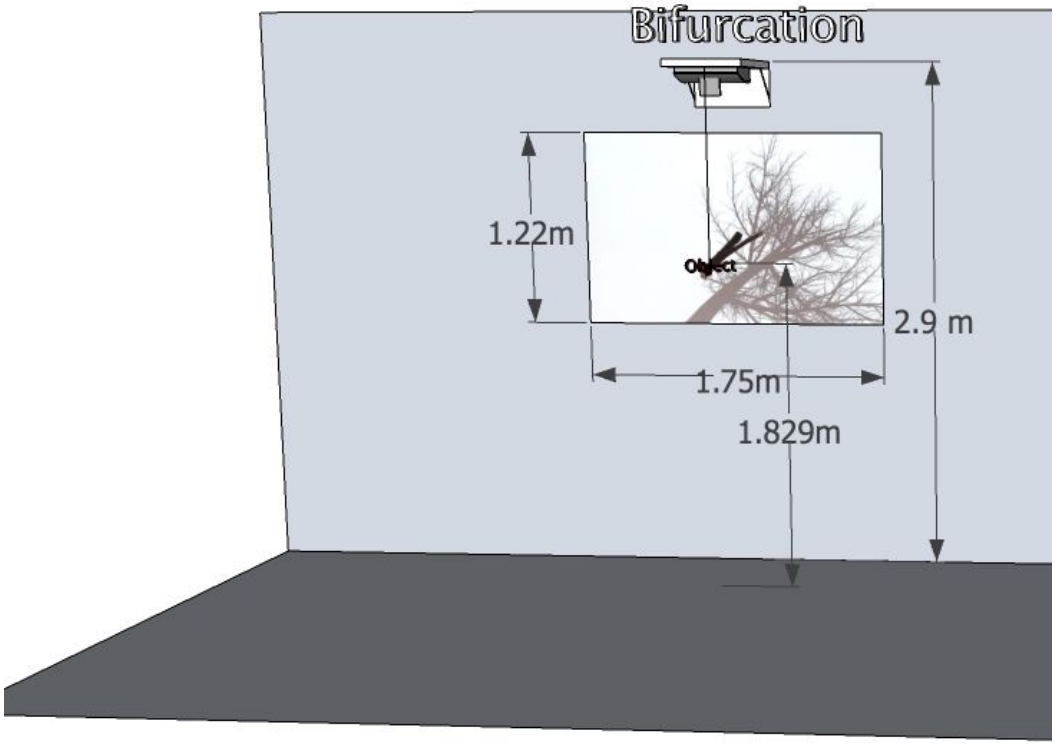
The projector structure should hang parallel to the floor, or perfectly horizontal in order for the projection to look straight.

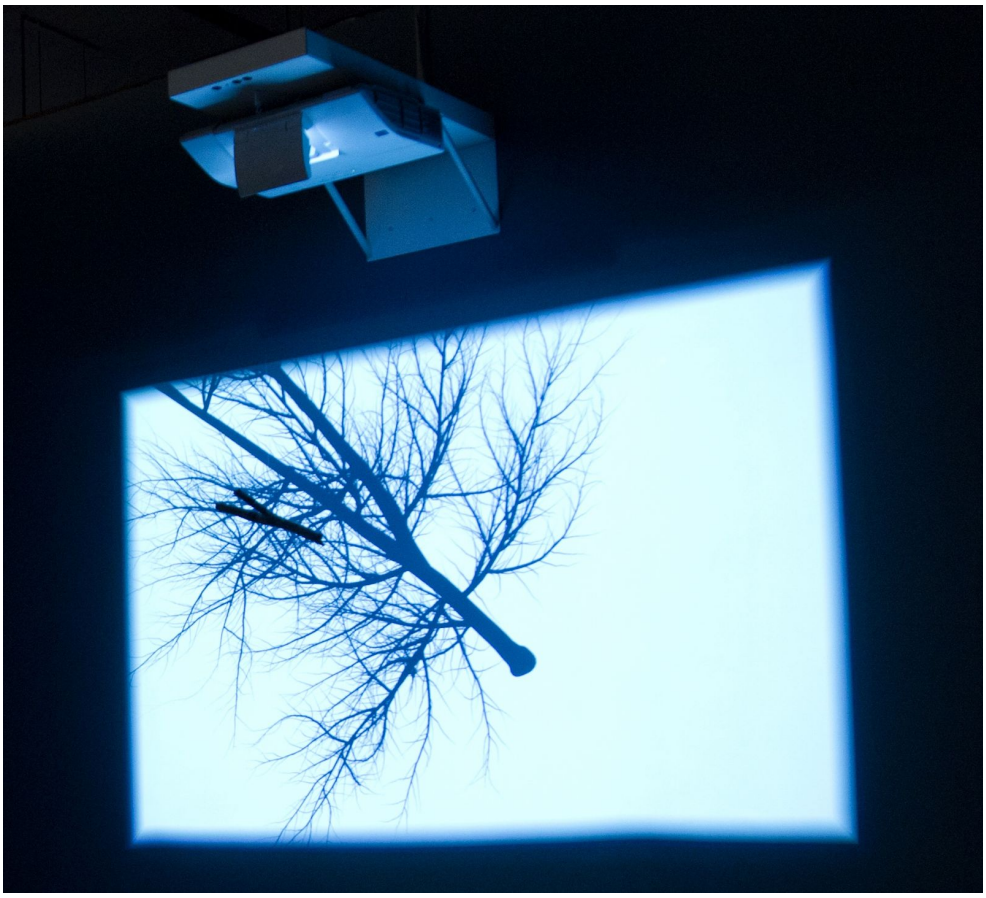
You might have to use the projector's remote control to adjust the keystoning of the image. You can also adjust the projector's tilt by loosening the four screws that attach the projector to the metal structure, on the top side of the structure.

The ceiling height of the exhibition space should be at least 290 cm (114"). Mount the projector structure so that the top of the wall plate is at 290 cm.

Now, attach the tree branch to a nylon string and hang it from the hook. The hook is located close to the camera lenses.

For Version 1, please consult the following images.


Bifurcation
1.22m
Object
2.9 m
1.75m
1.829m



Version 2:

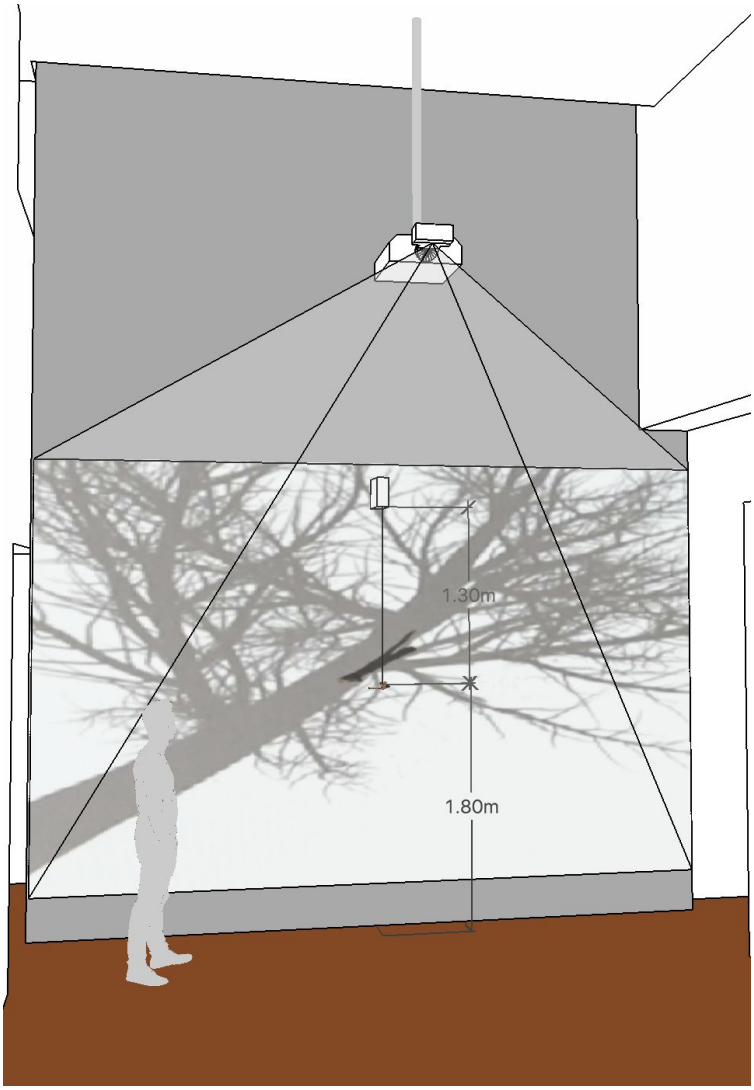
For this version, the projector is mounted separately from the Kinect camera mount. This means that any type of projector can be used and any image size can be achieved.

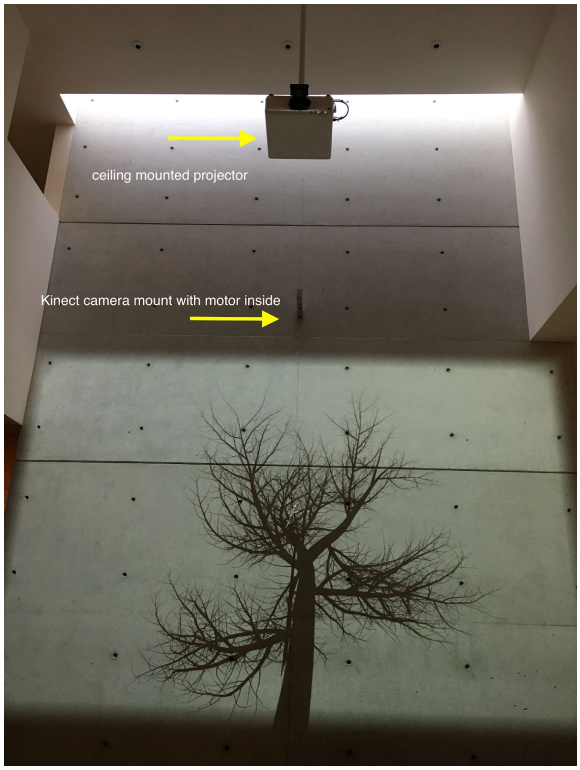
The Kinect camera mount comes with a 10-15 degree wedge which allows it to be installed on an angle. This allows for variation in terms of how far the camera can see into the room.

The Kinect camera mount can be installed inside or outside of the projected image. A small shadow might be cast by the mount depending on how the projector light hits it.

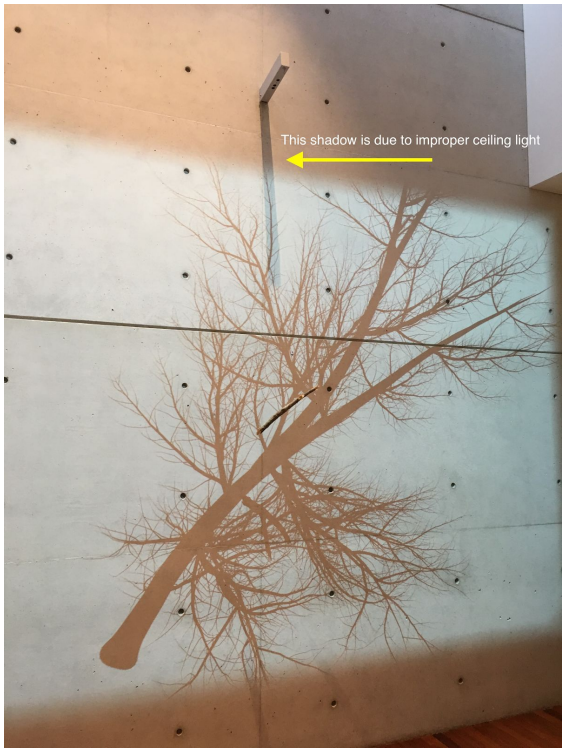
Depending on how far away the computer is installed, a Black Box USB extender might be needed for the Kinect camera USB connection.

For Version 2, please consult the following images.





Camera mounted outside of the image.



Camera mount casting a shadow due to bad lighting.

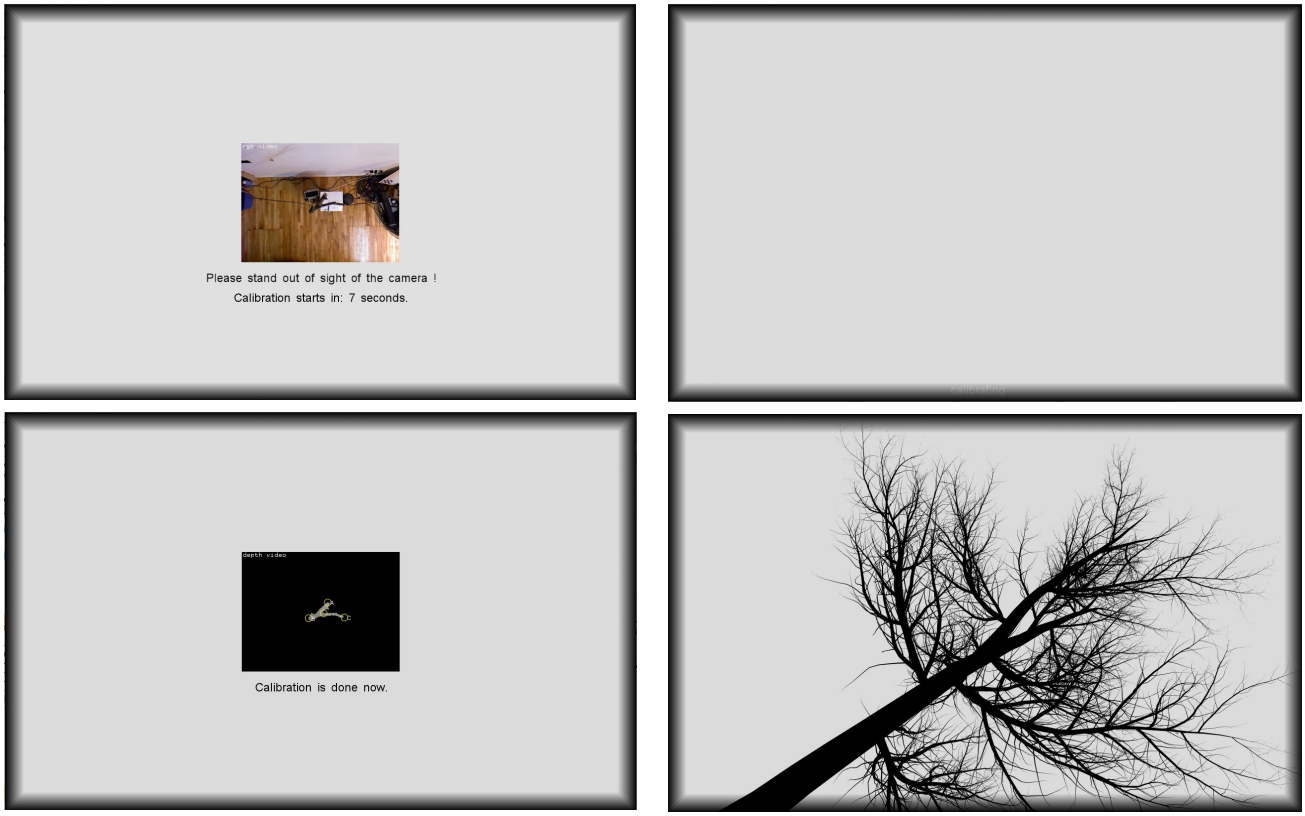
Camera mounted inside of the projection.

DETAILED TECHNICAL INFORMATION

Normal Software Operation

When the software starts up, it goes through a setup routine during which people must stay outside of the camera viewing area.

For a short moment, a live RGB camera view will be visible, then an empty screen (during which point the calibration happens), then a grayscale depth image with the branches tracking graphics, and, finally, the 3D model of the tree.



Now the piece is operational and the 3D tree model will react to the rotational orientation of the wooden branch.

Manual Software Calibration

Double clicking the mouse on the white background or pressing key **g** will make the GUI appear.

To cycle through the GUI elements listed below, press the key **a**.

Calibrate New Branch:

A new calibration of the branch shape and the position is performed only if a new branch is being used, or if the distance between the branch and camera changed, or during the first install.

After the startup routine is done, or once the 3D tree model appears, double click onto the white background or press key **g**, to make the following GUI (graphical user interface) appear.

Find the button labeled “calibrate new branch” and click on it. The GUI and the 3D model will disappear and the video feeds, including a red branch image with a blue skeleton line will appear.

By clicking three time on the screen, as outlined below, you will tell the software which end of the tree branch is A, B and C. The above image shows a red shape, which described the branch. Click inside the red area at each end to indicate the yellow crosshairs.

B is the bottom of the branch, the part that would be closest to the tree trunk. C is the end of the smaller offshoot of the branch. A is the remaining end, the one most likely in line with point B.

Please consult at the branch image in the Appendix for an example of which parts of the branch should be identified as ABC.

After these three clicks, the red branch will start moving according to the movements of the actual, suspending tree branch.

Double click anywhere to make the GUI appear again. If you might have made a mistake while creating the template above, you can click on the “calibrate new branch“ button again. Otherwise, double click on the background to make the GUI disappear.

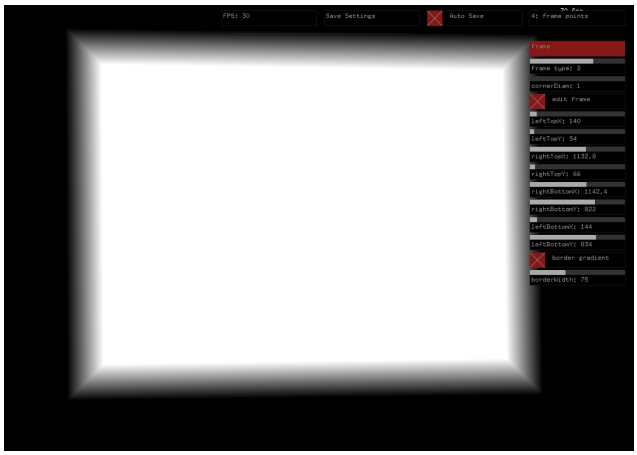
Adjust Tilt of 3D Tree Model:

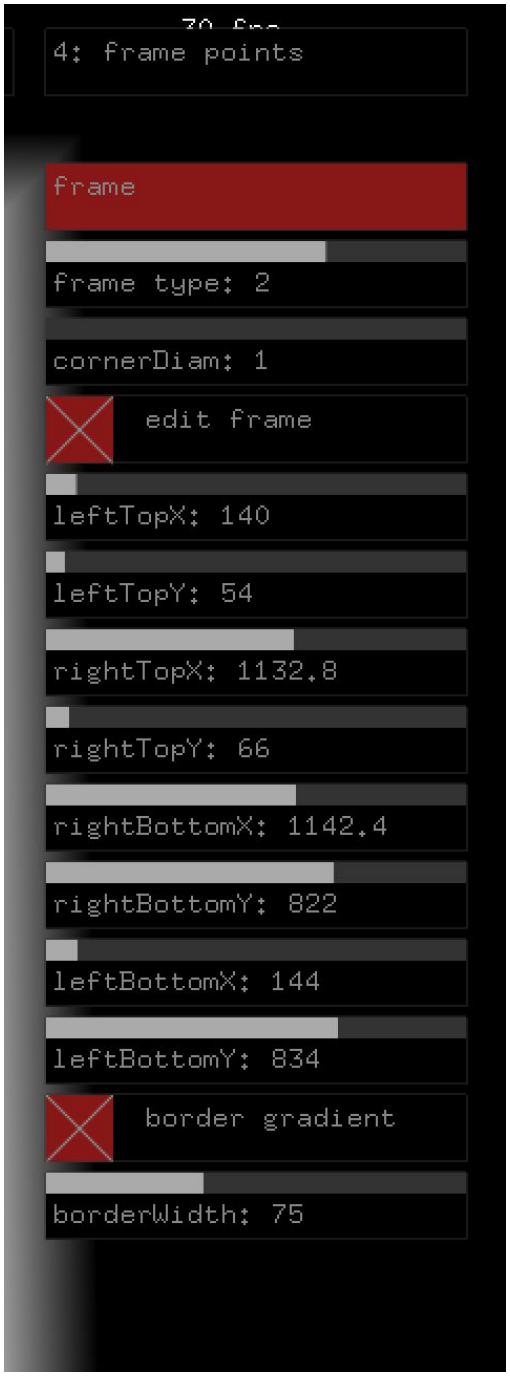
With the GUI visible, you can adjust the tilt of the 3D model using the “tree tilt“ sliders. Best practice is to hover the mouse cursor of the slider and use the arrow keys to fine tune the slider values.

Now, double click on to the background to hide the GUI again.

Black Projection Frame:

The software offers the option of drawing a black frame around the projected image. This creates a gradient between the white background image and the wall. This can also be used to mask out any light that might be spilling onto the projection wall.





Select **frame type 0** to not use any frame or **type 2** to get the gradient shown above.

Select **edit frame** to alter the positions of the frame corners.

Now, you can change the X and Y location of each corner until the projected image is aligned well with the wall.

By selecting **border gradient** and adjusting **borderWidth,** you can whether or not your frame needs a gradient effect and the width of the gradient border.

Make sure to un-select **edit frame** when you are done.

Other GUI Elements Used for Setup:

Some of these GUI elements are only needed when the artwork is initially set up in its location.

Leave **mirror, flip** selected.

use raw: disables all motion smoothing.

DON'T use **load camPos, save camPos.**

modelScale: determines the size of the 3D tree.

tree tilt: determines the horizontal angle of tree.

zOffset_c: determines the rotation around tree's main axis.

min diamTOtempl: tree jumps to raw tracking position if the distance between the template and the real branch is too large.

DON'T use **bUseKalman, process noise, measurement noise.**

lowPass: smoothes tree's rotation.
lowPassZ smoothes tree's tilt and sway.

make template starts a new template calibration.

show model makes the 3D tree visible, but usually all other "show" GUI elements are just for debugging.

bAllowEcoMode allows dimming. The five sliders following this are only used in Version 1 to set the projector's lamp mode.

near + far Threshold establishes the distance from the Kinect that the branch is found.

Selecting **min + max CropY, CropX** shows the video in which to see how cropping limits the Kinect's viewing area. This can be used to exclude the wall and other nearby objects from being seen by the Kinect.

binaryBlur, erode, dilate improve tracking image quality.

bJustCollectZ calculates tilt/sway using only z point values.
diameter calculates tilt/sway in an area around point A,B and C, using all x, y, z points.

Depending on whether your Kinect camera is placed parallel or perpendicular to the projection wall, certain adjustments will need to be made in the software.

DON'T touch **offsetX,Y,Z**. It will set the position of the 3D tree in relation to the centre of the 3D world.

iMainCamera cycles through different views of the 3D tree, showing how our 3D camera is looking at the tree. The blue lines indicate the camera's viewing cone.

bUseMouse is used for debugging. It moves the 3D world when the mouse is dragged. (Only if **iMainCamera = 0.**)

reset grabCam resets the 3D scene.

cam_tilt, pan, roll sets the orientation of the 3D camera in relation to the centre of the 3D world. These settings need to be adjusted to reflect the orientation of the Kinect in relation to projection wall.

camX, Y, Z sets the position of the 3D camera in relation to the centre of the 3D world.

camFarClip determines that any part of the 3D tree located further away from the 3D camera will be hidden.

Leave **modelAlpha** at 255.

Leave **wireAlpha** at 0.

DON'T touch **xyMotionScaler**.

Remote Access to Artwork's Computer

There is a software installed on the computer running this artwork that allows the studio to connect remotely to the artwork. This feature is helpful when you require assistance from the studio, as we can remotely connect to it, do a quick inspection, and do a debugging session of your components, if needed. In order to enable this feature, the computer has to be connected to the internet at all times. Depending on the computer's operating system (Windows 7/8/10, OSX), the procedure to set the computer online will vary. Please look online for tutorials, if necessary.

Preliminary Troubleshooting Steps

After pressing the button, nothing seems to happen.

Do you hear any sound coming from the computer? If so, the computer is running and the projector should display the piece shortly. If not, check that the projector is powered and try to turn it on with a remote control. Also, check that the projector's source is set to the same port where the cable is plugged in—HDMI, VGA, DVI, etc.

The piece doesn't react when the wooden branch is rotating.

Ensure that the Kinect is well connected to power and to the computer. You might be able to see a light inside the Kinect lenses.

The projected 3D shadow is not reacting or is not visible.

Connect a USB mouse and keyboard to the USB ports on the small box. Press the ESC button to exit the software. Find the app's icon in the dock and restart the app.

The motor that rotates the tree branch is too loud.

There is a cable that runs from the motor to a small black box. This box also has two USB cables entering it. One USB cable connects the box to the computer and the other connects to the projector. Disconnect the USB that runs to the projector. This will shut off the power to the motor.

Upon startup of the app, the RGB video feed is black.

This means that the Kinect camera was not initialized correctly. The software is programmed to automatically try to reconnect to the Kinect camera. If this was successful, you should see the RGB video. If not, use the "restart" button in the GUI to restart the softwares, or shut the computer down and restart it.

The branch fell off.

Use a new fishing wire and feed it through the needle that is attached to the branch. Make sure that the distance between branch and Kinect camera mount is the same as before.

Troubleshooting Assistance

Prior to contacting the Antimodular Studio with a problem about your artwork, please ensure that you went through the preliminary troubleshooting steps outlined in the previous section.

The troubleshooting process will vary depending on the problem. In order to make the process easier, it is recommended that you collect and send the following information to the studio:

- Date and time when the problem first happened;
- Description of the problem;
- Actions taken so far and conclusions;
- Detailed photographs (or videos) displaying the problem;
- Detailed photographs (or videos) of the suspected faulty component;
- Detailed photographs (or videos) of the whole artwork and its surroundings;
- Personnel involved.

Support (Contact Us)

If you would like support for the piece, please feel free to call Lozano-Hemmer's studio in Canada:

Antimodular Research
4060 St-Laurent, studio 107
Montréal Québec H2W 1Y9 Canada
Tel 1-514-597-0917
Fax 1-514-597-2092
info@antimodular.com
www.antimodular.com

APPENDIX I - INSTALLATION

Description of Components

This artwork requires the following components:

Computer, Apple Mac Mini, i5, 2.1 Ghz, 4GB RAM

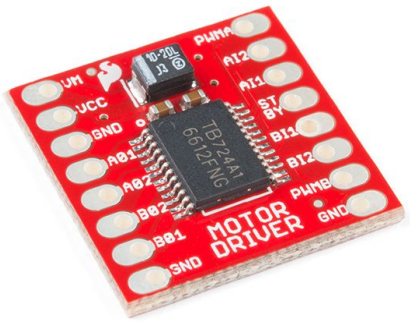
Microsoft Kinect 360 camera

USB 2.0 over Cat5 extender for Kinect - Computer connection, Black Box IC280A-R2 (only needed for Version 2)

25D mm brushed DC motor, 499:1 ratio

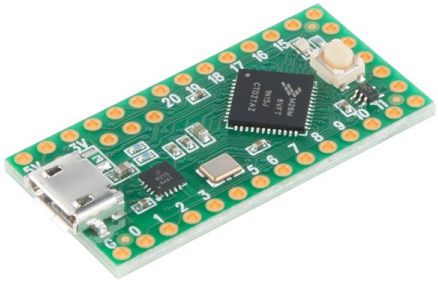
1000:1 Micro DC motor

Metal geared motor, 5 Volt DC, 11-55 RPM



TB6612FNG DC driver from Sparkfun.com

Arduino Uno



Teensy LC

Motor driver TB6612FNG controlled by Arduino or Teensy

Warm white LED illumination - Gantom Precision Z Spot, 1W 12VDC
(only used in Version 2.)

Logitech wireless RF keyboard

Projector Hitachi cp-aw251n with remote HL02772

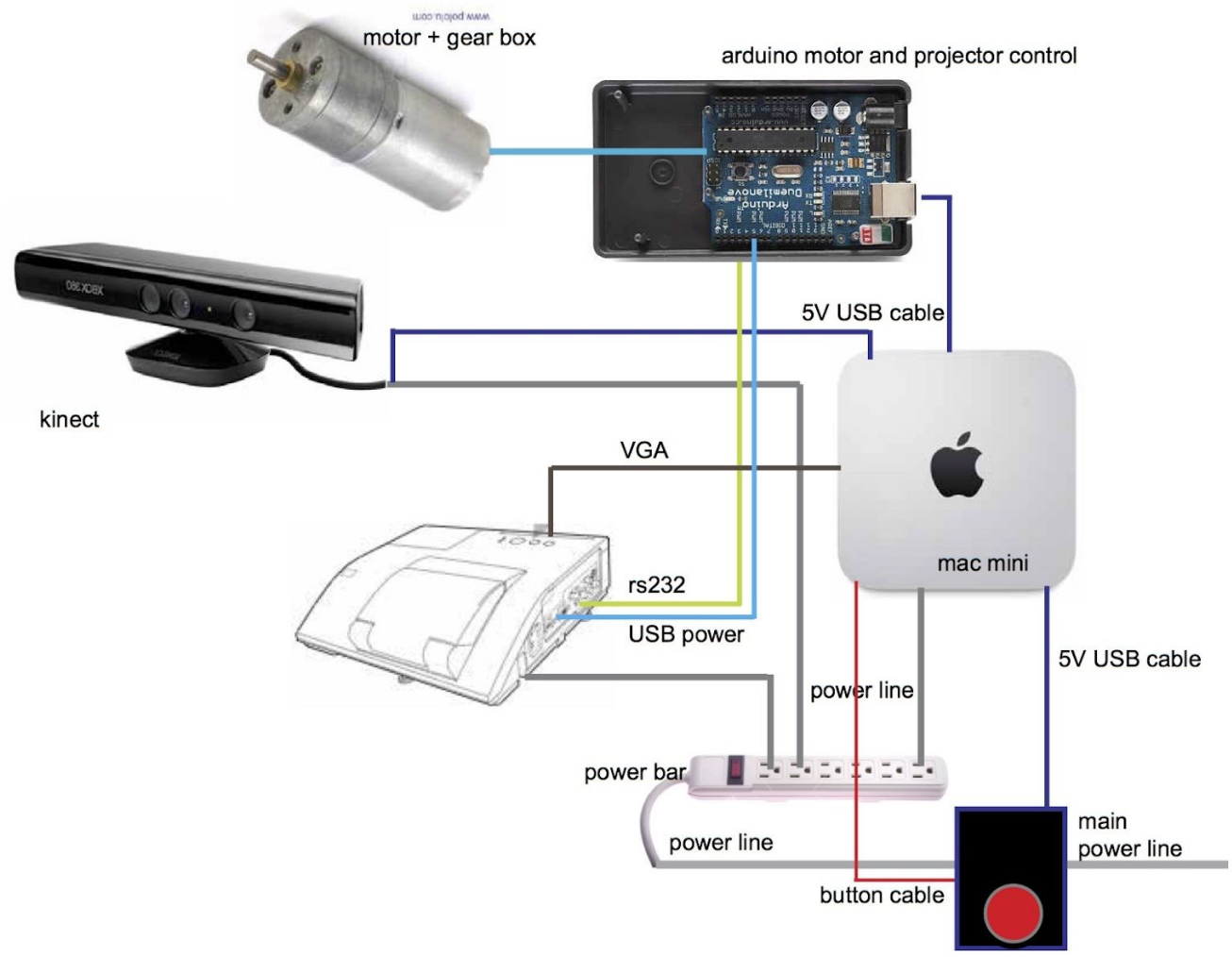
Projector-computer control for Hitachi based on rs232 level shifter, digikey 28560D-ND
(or any other projector for Version 2)

Active USB extension cable for all other long USB connections

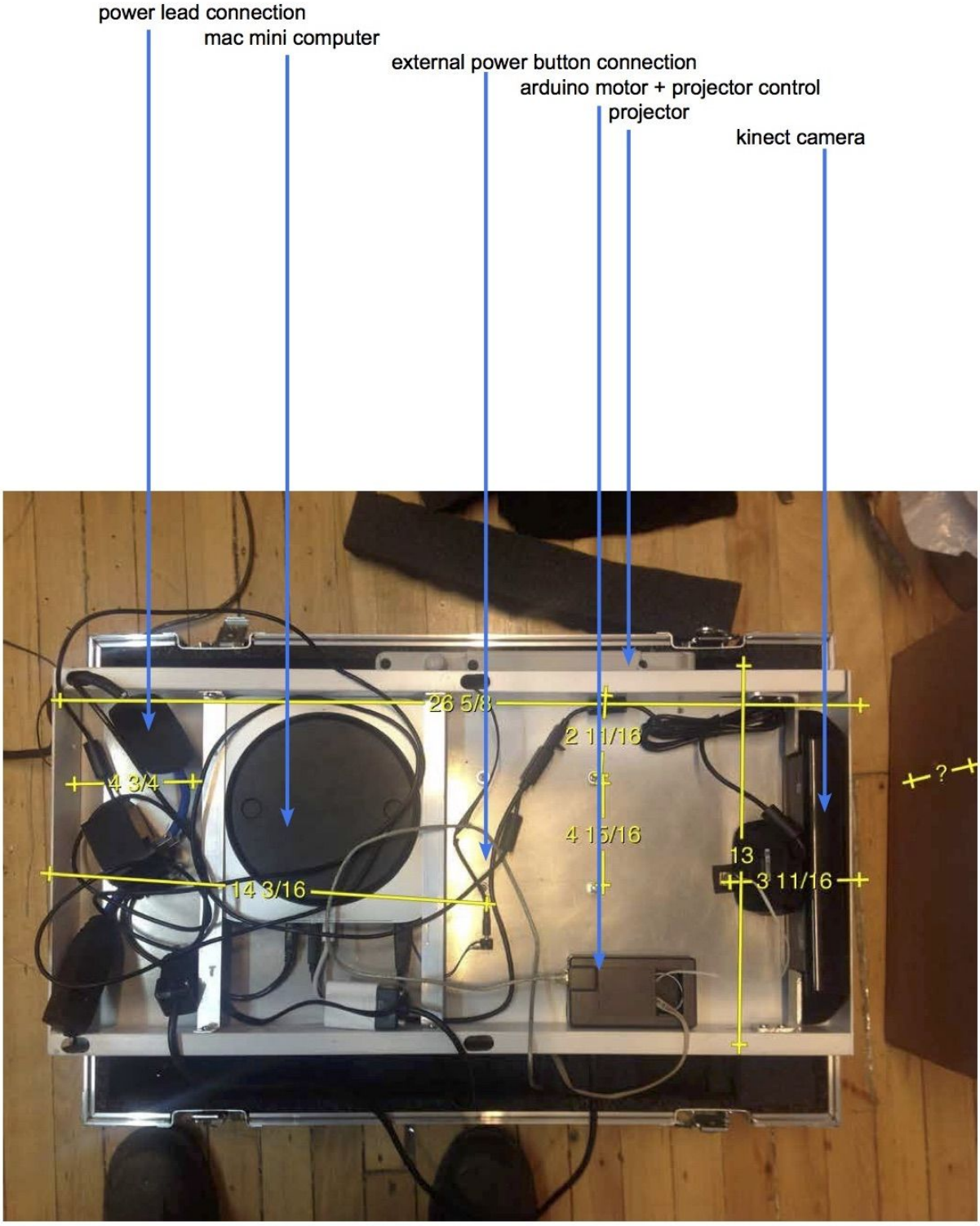
Fumigated tree branch: *The preferred shape of the branch: a relatively straight A-B axis and a shorter off-branch to C.*

Wiring Diagrams and Connections

In order for the piece to run properly, the computer should be connected according to the following diagrams.



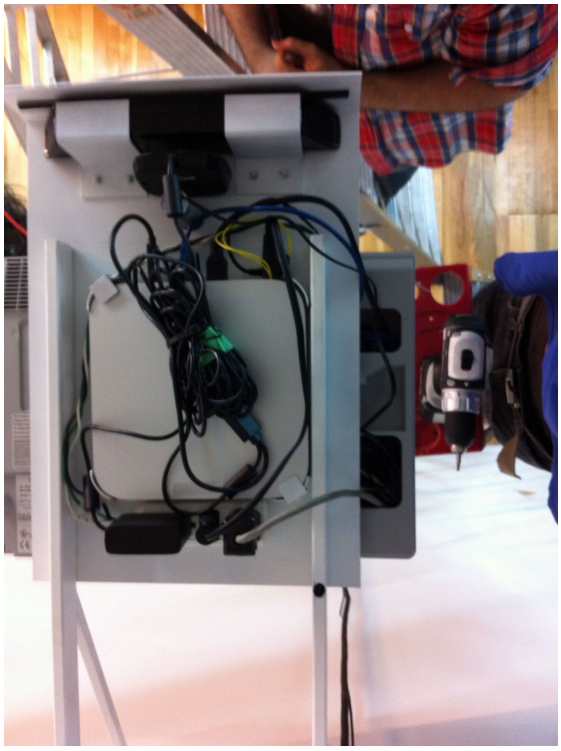
General setup of all the equipment for Version 1



Wiring of Version 1 with all the equipment integrated onto one bracket.

Close-Up Photos Of Mounting

The following are images of the all-integrated mounting version.



All equipment is mounted onto the bracket.

Six screws hold the bracket in place.

Image of how a needle is fixed onto the centre of the branch, for proper balance.

APPENDIX II - TECHNICAL DATA SHEETS

Microsoft Kinect 360

Color Camera	640 x 480 32-bit colour at 30 frames/second
Depth Camera	320 x 240 16-bit depth at 30 frames/second
Minimum Depth Distance	1.2 m
Maximum Depth Distance	3.5 m
Horizontal Field of View	57 degrees
Vertical Field of View	43 degrees
USB Standard	2.0