ZOOM PAVILLION

BY RAFAEL LOZANO-HEMMER

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GENERAL IMPORTANT INFORMATION

This short section must be read for proper operation.

ZOOM PAVILION (2015)

BY RAFAEL LOZANO-HEMMER

Technique

Projectors, 13 infrared cameras, 5 computers, 10 IR illuminators, 1 ethernet switch, HDMI and USB extenders and cables.

Description

Zoom Pavilion is an interactive installation consisting of immersive projection on three walls, fed by 12 computerized surveillance systems trained on the public. The piece uses face recognition algorithms to detect the presence of participants and record their spatial relationship within the exhibition space. Zoom Pavilion is at once an experimental platform for self-representation and a giant microscope to connect the public to each other and track their assembly. Independent robotic cameras zoom in to amplify the images of the public with up to 35x magnification: the zooming sequences are disorienting as they change the entire image "landscape" from easily recognizable wide shots of the crowd to abstract close-ups. The whole installation is in a fluid state of camera movement, highlighting different participants and creating a constantly changing animation based on optical amplification and tracking.

Zoom Pavilion marks the first collaboration between artists Rafael Lozano-Hemmer and Krzysztof Wodiczko. It was originally conceived for the Architecture Biennale in Beijing but only realized for Lozano-Hemmer's current solo exhibition in Mexico City's MUAC Museum. These artists' practice often involves transformation of an existing built environment using projection technologies to "augment" the site with alternative histories, connections or public relationships. The term "projection mapping" is now used often to describe techniques that Wodiczko was already deploying over 30 years ago. Meanwhile Lozano-Hemmer's contribution to the field in the past 20 years has been to develop ways to make mapped projections interactive with the general public. This piece emphasizes the temporary construction of connective space in relation to predatory technologies of detection and control.

Operation

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

1. Usually, we set up all computers to automatically turn ON at 8AM and OFF at 2AM with the macOS power scheduler.
2. Depending on the model of projectors used, different methods need to be applied to ensure the projectors are ON before the computers start up. Either the projectors have an internal

scheduler, or the projectors will detect the computer's signal and react accordingly, or a human turns the projectors ON/OFF.

3. The IR lights, the ethernet switch, the USB-Cat5 extender, and all other devices will stay connected to power even if the artwork is OFF.
4. When it is time to start up the artwork, first, the archive wall computer needs to start, then, 2-5 minutes later, the other computer should start.
5. After booting is finished, the macOS desktop should be visible for a few moments.
6. Next, a software called **delayOpen** will start. It takes care of starting all other applications.
7. In some cases, we instal a **watchDog.sh** script that checks if all apps are running (every minute on the minute) and, if the apps are not running, restarts the missing ones. This mechanism might be used to start the apps automatically (instead of **delayOpen**).
8. All walls/computers with cameras attached (except the Archive computer) will run the **mountServer** app, which mounts the archive computer as a remote disk.
9. Then **faceTracker**, **faceTracker2**, **blobCam**, and **blobCam2** will start. Each software occupies a quarter of the screen. If a ceiling projection is part of this exhibition, then only **blobCam** will occupy the full ceiling.
10. When it is time to shut down, the archive wall computer needs to be the last one shutting down, otherwise error messages will notify you that other users are still connected to it.

Maintenance

Ensure that all projectors are working correctly, have the same brightness, and their images are correctly aligned to the projection walls.

Check that the orientation of the USB cameras, the manual focus and zoom of the camera lenses, and the orientation of the IR lights have not changed. Sometimes people touch the equipment, disrupting these components.

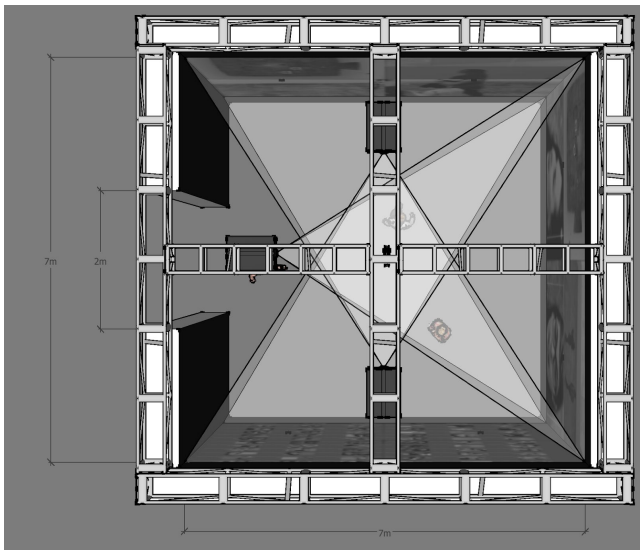
Keep the floor free of objects that the system might mistake for a human: backpacks, pieces of paper, etc. These objects will result in false tracking and false zooming.

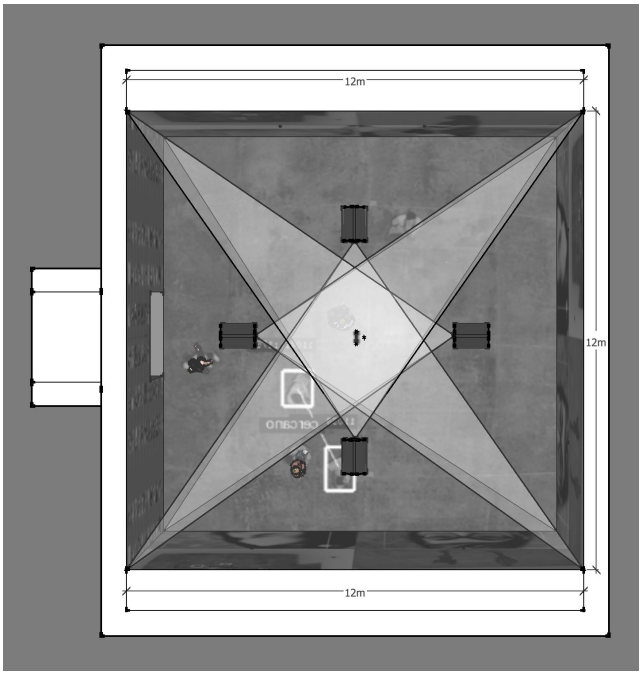
If the walls get dirty, please repaint the affected areas.

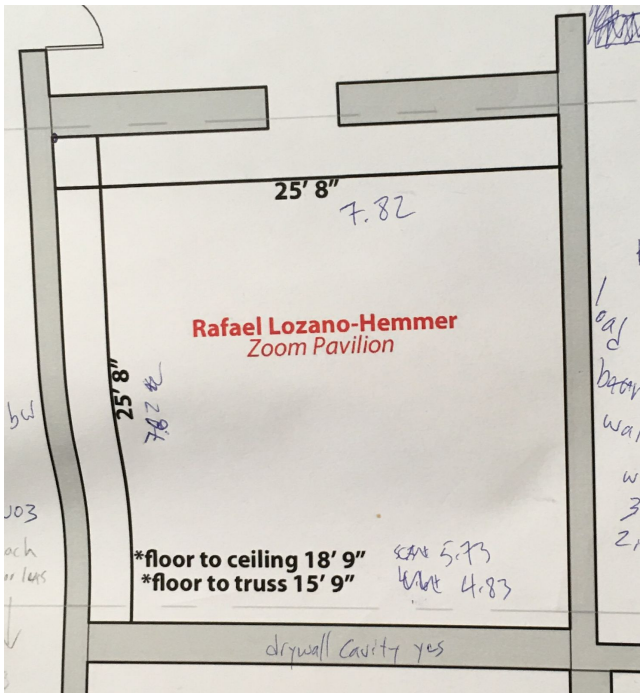
Placement Instructions

The required room for this artwork has four walls, each with the same width and height. On one side of the room, a door measuring 1.5 m x 2.1 m occupies the middle of the wall. Please select a room according to these exact specifications, or build a new one accordingly.

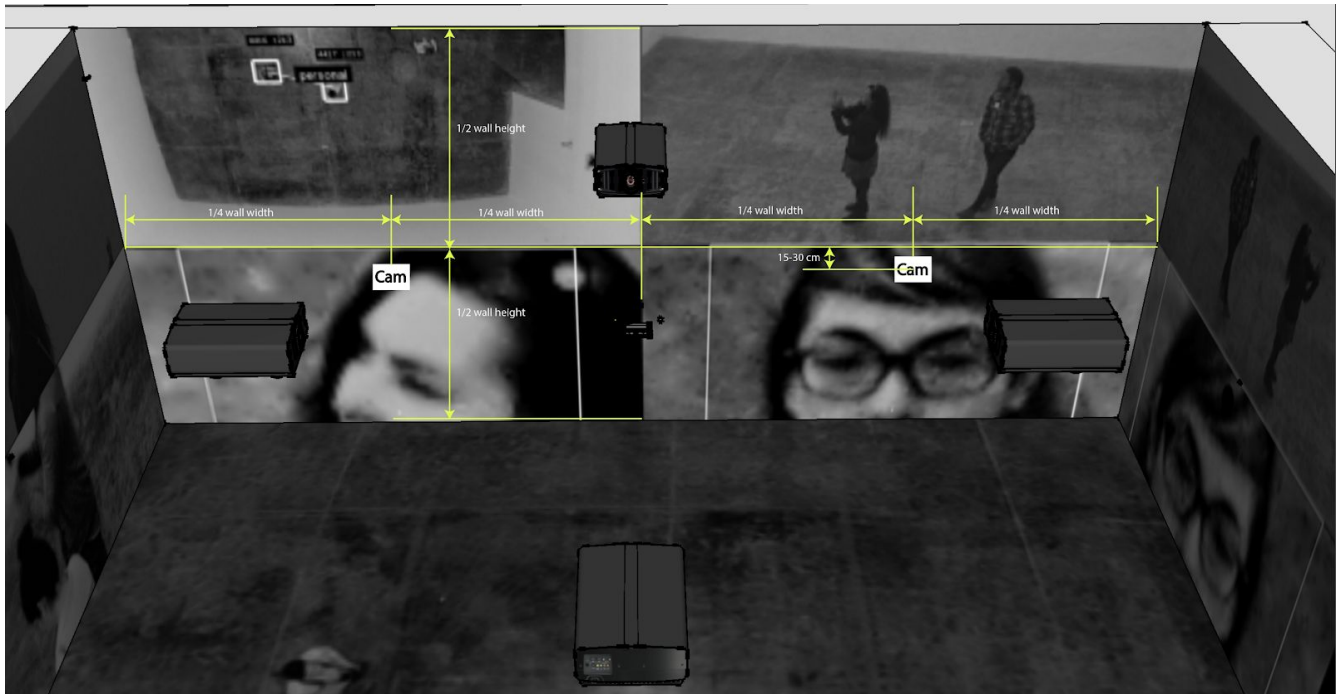
Most projectors have a native aspect ratio of 16:9 or 16:10, therefore the ideal walls for this artwork should have a similar size ratio. It is possible for the software to be adjusted to accommodate any wall height and width ratio, but would require the software to mask out any any light or pixel space, meaning a reduction of image-resolution and image brightness.

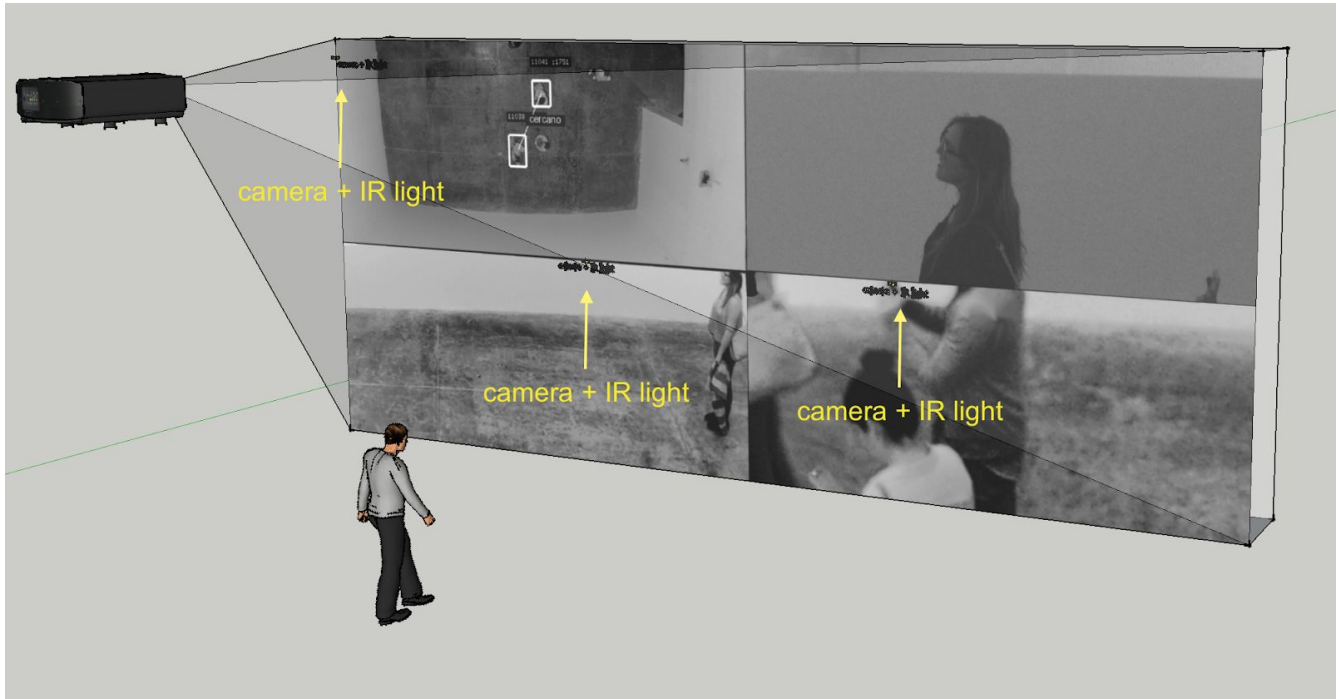






Mount all USB cameras and their IR illuminators on the walls and the ceiling. Place the two lower face tracking cameras and their IR illuminators at one-quarter of the wall width away from the side wall, and about 15-30 cm below the middle of the wall's height. The following images illustrate this.


1/2 wall height
1/4 wall width
1/4 wall width
1/4 wall width
1/4 wall width
15-30 cm
Cam
Cam
1/2 wall height

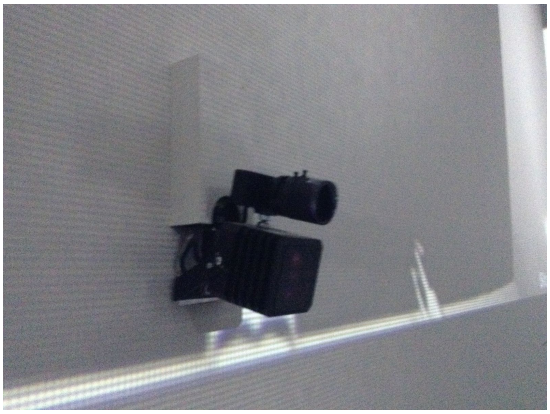

camera + IR light
camera + IR light
camera + IR light

The camera is mounted directly onto the Bosch IR light with a long-set screw, and the IR light is mounted to the wall using its tilt bracket. All cables should be hidden.

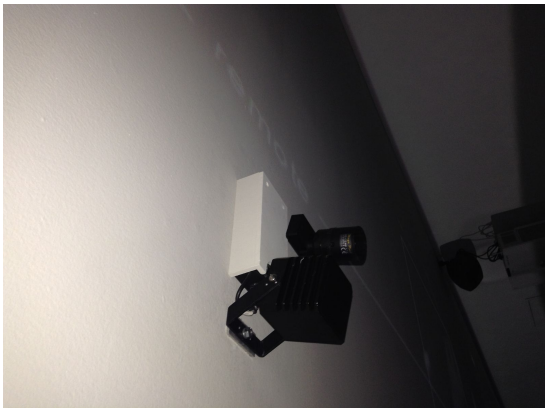
IR light is held onto the metal plate by a single screw.

The camera's set screw has two nuts to prevent rotation.

Connect the cameras to the computers using the USB-Cat5e extenders, then power the IR lights with a 12VDC 1AMP power supply. Use a short USB-A to mini cable to connect the USB camera to the USB extender. The USB extender is best hidden inside the wall or inside a small white box.



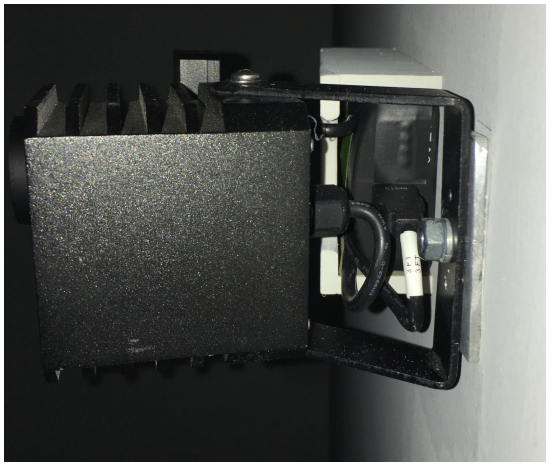
White box behind camera with USB extender



Box is open at bottom for cable access

White box beside corner camera

White box beside corner camera



LEDs on USB extender are covered

All the cameras corresponding to the same wall are connected to the same computer. This means, for example, that the left wall projector is connected to the two lowest-mounted face-tracking cameras, the camera in the top left corner, and one of the ceiling cameras.

After the software calibrations are done, do not change which USB port each camera is plugged into. Otherwise, the system will no longer know which camera image refers to which quarter of the screen. See the appendix for wiring diagrams.

Install the projectors for the wall projections (or for the ceiling, in some cases.) You might want to use a HDBaseT HDMI over Cat6 extender.

Each computer is connected to one projector (except for the ceiling projection, which can be connected to two projectors.)

The left, front, and right walls each have a corner camera and an IR illuminator installed in their left corners. A small adjustable articulating mounting arm is attached using a small metal plate to the wall. Make sure that the wall each camera is mounted to corresponds to the one that this specific camera's image is projected on to. This helps to establish a better understanding of which camera is delivering which image.

Installed as close to the middle of the ceiling as possible, three or four USB cameras are mounted right beside a larger IR illuminator. The camera lenses might need to be very wide, like a fisheye lens, to be able to see the full room. Later on, a lens calibration will be performed to un-distort the fisheye effect.

USB extenders are right behind or near each camera

Ceiling cameras, IR illuminator, and USB extenders in the middle of the ceiling

Ensure that the IR illuminator is not casting a light onto the fisheye lenses. Ideally, the IR illuminator is hung a bit higher than the cameras.

These cameras need to be orientated in such a way that the room entrance is on the correct side of the camera image. Later, using the software mirror and flip options, we will ensure that the viewers see themselves correctly placed in the camera image. (You can use Quicktime or any other video-viewing software to help see the camera's field of view.)

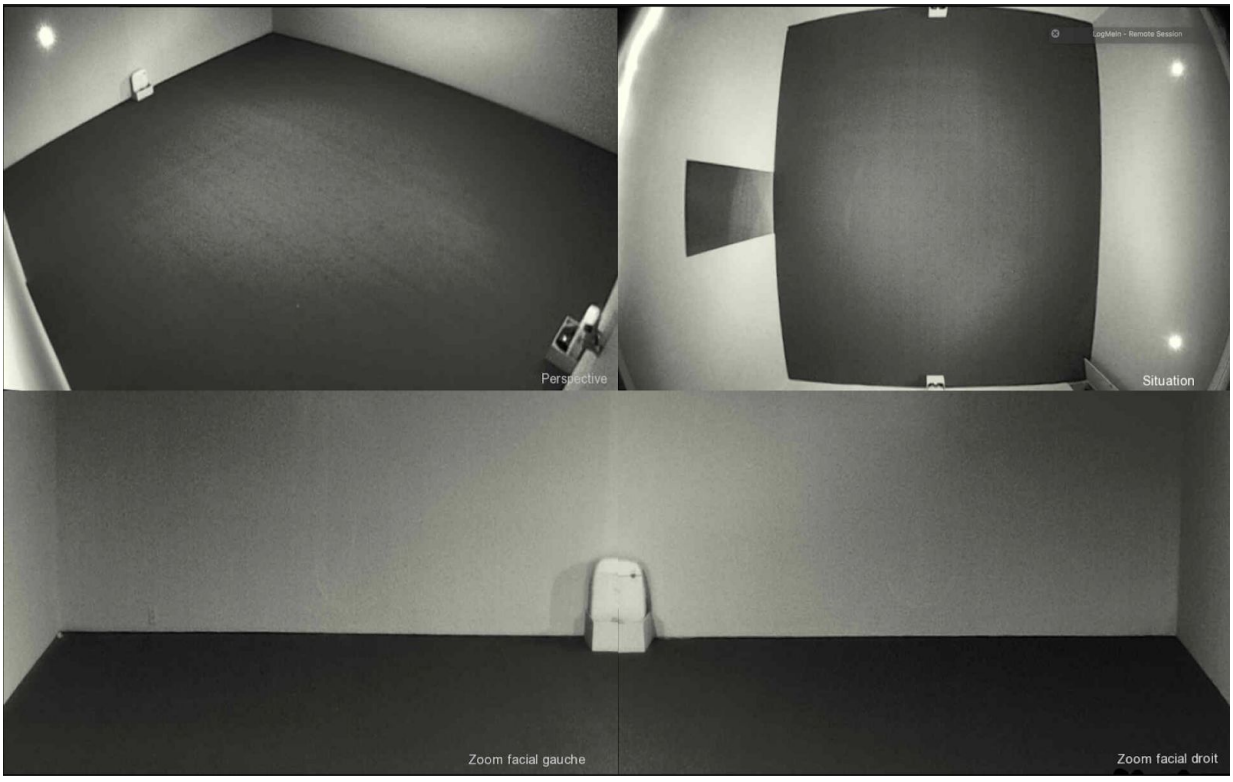
Please use the following images of each wall as a reference to help determine the amount of manual zoom and view angle that need to be set for each camera.

For example:

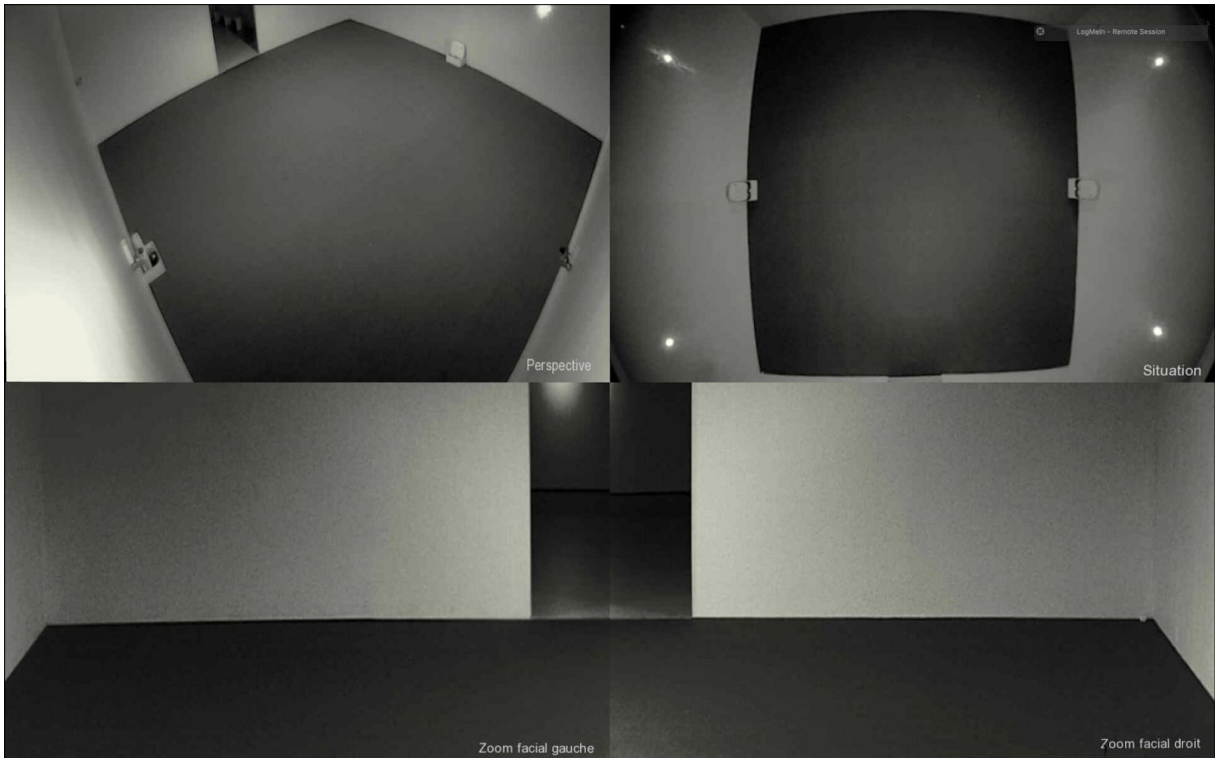
The ceiling-mounted cameras need to be able to see the entire space, including part of the doorway;

The corner-mounted cameras should all have a similar viewing area and possibly see the doorway and the other three corners;

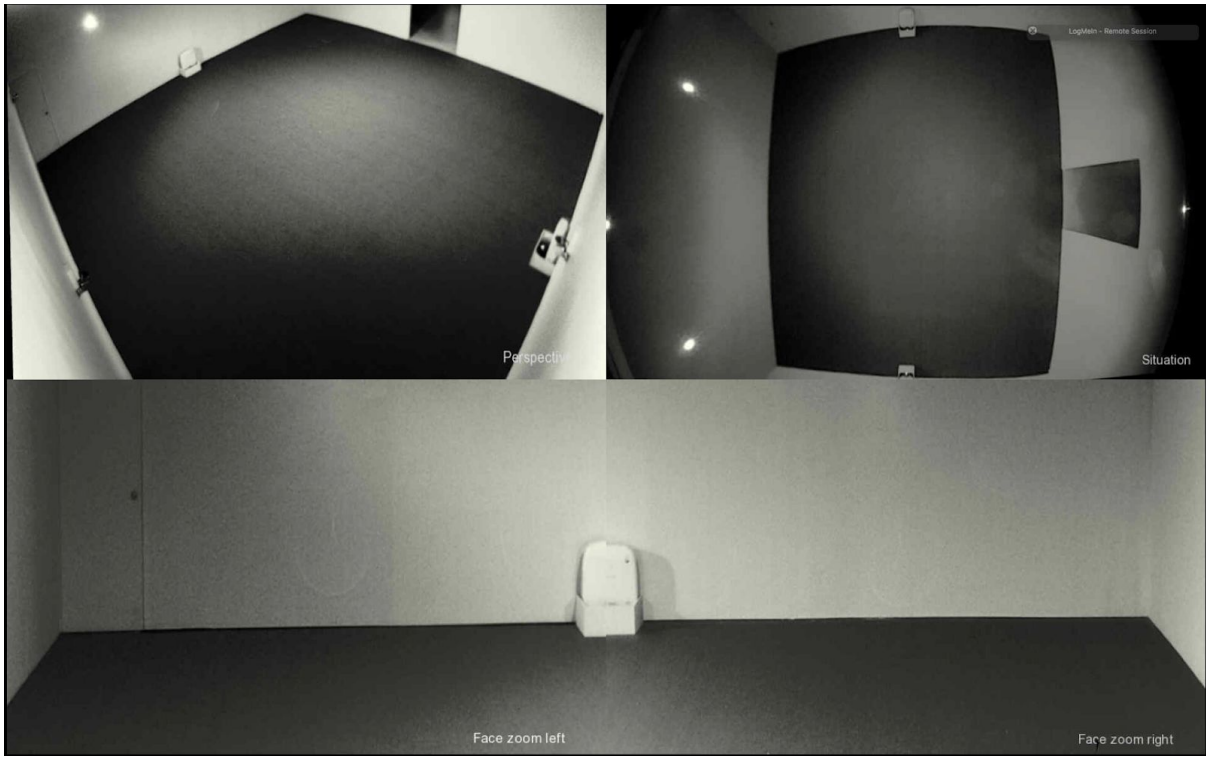
The face-detection cameras should be zoomed-in enough to detect people's faces even when they stand on the opposite wall. But not zoomed in too much, so that we see the beginning of the side walls, which creates a diagonal on the outer edge of the camera view.



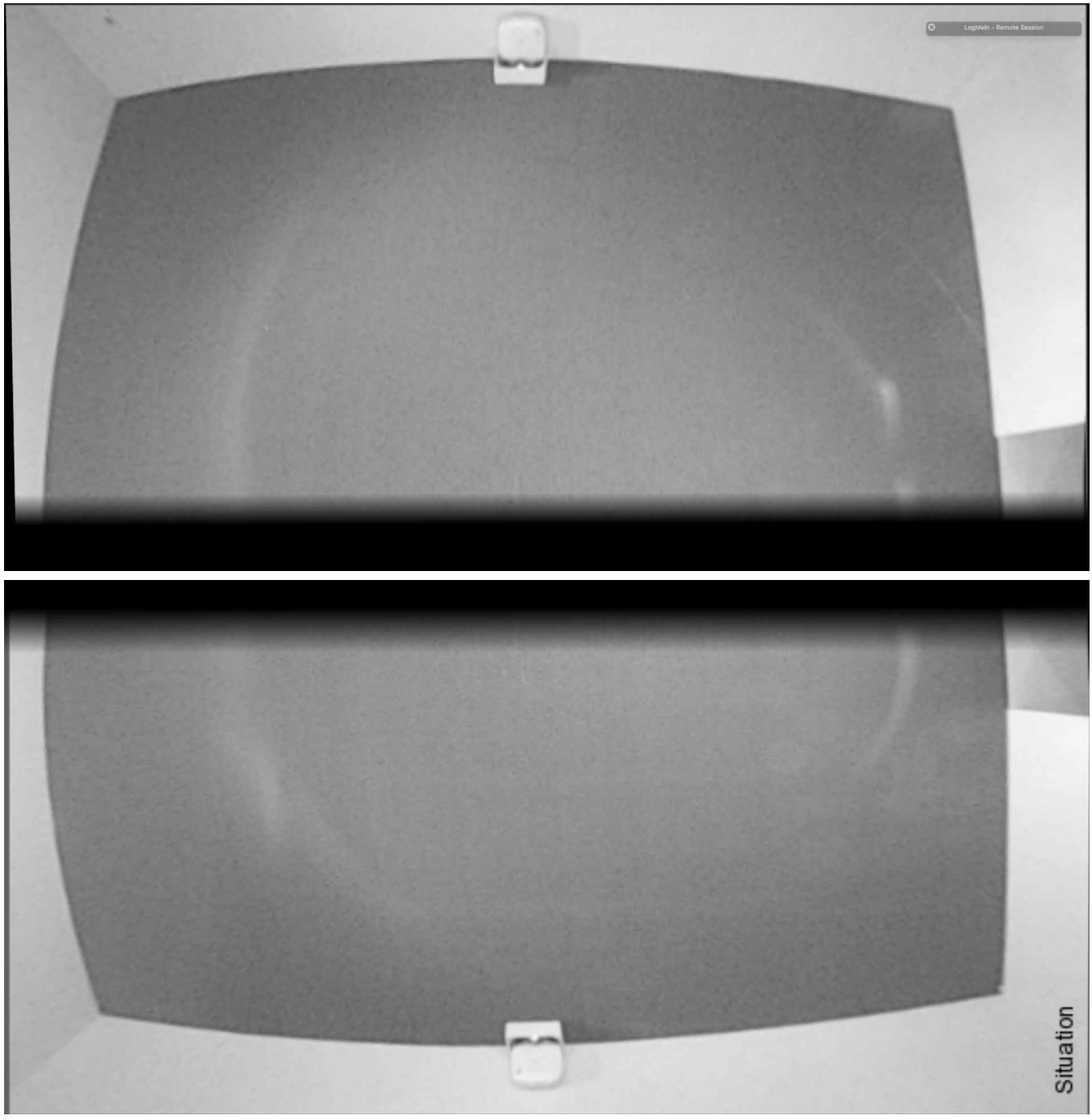
Left wall



Front wall



Right wall



Ceiling projection made from two projections

Below is a screenshot of the archive wall. You will notice that the images and doorway look squished. This is because during a particular exhibition in 2018, the projection-to-wall-ratio was not the same as the video projectors' ratio. Using the artwork's software, we can distort the image to match any wall.

Back wall

DETAILED TECHNICAL INFORMATION

Normal Software Operation

The left, front, and right walls run four apps each. Each app covers one quarter of the projected image. The archive projection and the ceiling projection is one-by-one fullscreen app.

All projections are greyscale with a slight hint of color: RGBA (255,255,240,0). Colors are controlled inside the software.

The left, front, and right walls each show four different camera views of the exhibition space.

The ceiling (if the artist chooses this option) shows an overhead view of the room.

The bottom two cameras on each of these walls performs the face detection and tracking.

The corner cameras located in the top left corner of each of these three walls zoom into people's bodies.

The ceiling cameras in the middle of the ceiling also zoom into people's bodies.

The back wall (called the archive wall) shows a 9x13 grid of small, coupled face recordings.

When no one is in the camera's view, the cameras will zoom out and show the maximum field of view.

When one person is seen, a white rectangle is drawn around their face or body, and the camera will zoom-in all the way until this rectangle fills the screen.

When two people are detected, a relationship between them is established. This means that the cameras will zoom in and out to fit both people onto the screen.

A line is dawn between these two people, and a word describing their distance or "relation" is visible. No line is drawn between zoomed faces, just zoomed bodies.

The corner camera does not draw a rectangle around people, it only draws a line between them.

While zooming, a faint white noise sound can be heard. Other sounds also play when the zooming starts and stops.

When two people are shown on the face-tracking cameras, they are being displayed together as a "couple" above the camera. Just below them, a black-and-white line indicates the physical distance between them.

If this couple is present for long enough, their recording will be sent to the archive wall.

A loading message will appear on the archive wall and, seconds later, the couple.

Each “video couple” shows a timestamp, its current frame number, and a camera ID.

In general, the images are very low resolution and even appear ghost-like due to the infrared lights. This creates a surveillance-like experience.

Manual Software Calibration

Double-clicking with the mouse on the screen or pressing key **g** will make the GUI (Graphical User Interface) appear. Remember that the left, front, and right walls each run four separate apps, which each occupy one-quarter of the screen. This means that only the app that was selected or clicked on will react to keyboard and mouse commands.

Left, Front and Right Walls:

All four apps have very similar GUI elements. The two top apps have the exact same GUI elements, as do the two bottom ones. In fact, the two top apps are a copy of each other but are located on a different part of the screen, with a different camera attached. The same goes for the two bottom apps.

Screenshot of GUI elements in all four apps

Screenshot of more GUI elements for the top two apps, that did not fit on the previous screen

Here is a list of the app names and their on-screen descriptive label, which are located in each bottom right corner of the screen:

faceTracker (in bottom left corner) with label **Face zoom left**;
faceTracker2 (in bottom right corner) with label **Face zoom right**;
blobCam (in top left corner) with label **Perspective**;
blobCam2 (in top right corner) with label **Situation**.

The following includes a break-down of each app, each field, and their specifications.

We have a total of six face detection and recording apps. Each of these apps needs to have **appID** set to a unique number.

All the apps on one wall should be set to the same **language**:

0 = en, 1 = fr, 2 = de, 3 = es, 4 = ko

appWidth and **appHeight** are one half of the projectors' native resolution, width, and height.

appX and **appY** define where each app sits on the screen: 0,0 or 960,0 or 960,600 or 0,600.

displayWidth and **displayHeight** basically determine at which resolution the camera is queried at. blobCam and blobCam2 should be set to 1024+576, while faceTracker and faceTracker2 are set to 960+600.

camID_topCam or **camID_wallCam** define which USB camera is connected to which app. Change this number if the app is showing the wrong camera's image (exit and restart the app for the change to take effect.) Now, if you plug the cameras into different USB ports, these settings will probably need to be changed again.

typeX, typeY, typeColor set the location and the color of the app's label.

show_topCam needs to be selected.

scaler_topCam is a digital zoom of the image (should be 1.)

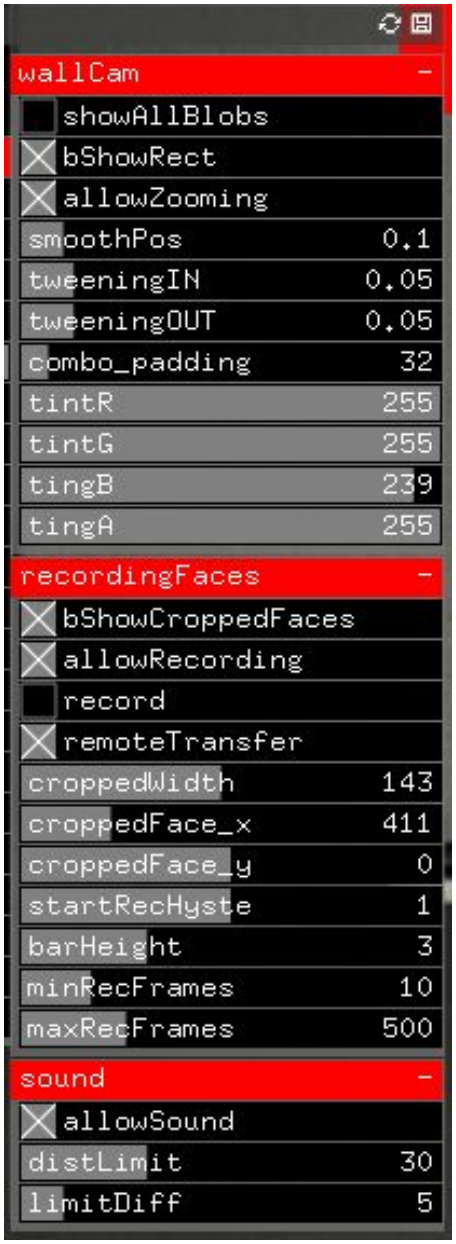
x_topCam, y_topCam or **x_wallCam**, **y_wallCam** set the location of image within the app.

show_topCamBG will show the background subtraction image. It should only be used for debugging.

scalerBG defines how big this subtraction image is. Changing this number has no influence on the app's performance—it's just there to make debugging easier.

bUseMapper should be selected if projection-mapping is being used.

editMapper will make the mapping points and the grids appear. Each of the four corners of this app can be dragged around or changed using the arrows. **editMapper** can help, for example, if the projector's keystone function cannot be used to correct a skewed projection. Please note that these image changes have no effect on the face or blob detector. This means that if one corner is pulled way past the app's boundaries, then zoomed faces or blobs might not appear properly on the screen. See warping for manipulation of the actual camera feed.



This menu is for **faceTracker** and **faceTracker2.**

showAllBlobs is used for debugging and exposes all found blobs and their history paths.

bShowRect draws a rectangle around the one or two selected faces.

allowZooming allows zooming to occur.

smoothPos smooths the position of the tracked face.

tweeningIN and **tweeningOUT** determine how fast and smooth the zooming occurs.

combo_padding determines how much padding is around the two selected faces when zoomed in.

tintR,G,B,A determines the tint of the camera image.

bShowCroppedFaces needs to be selected. It allows the two selected faces to be shown as a combined “couple.”

Leave **allowRecording** selected. It will record found couples.

record will be selected when recording is happening.

Leave **remoteTransfer** selected. This allows for recorded couples to be transferred to the archive computer.

croppedWidth, croppedFace_x, _y determine the size and location of the combined couples in this app.

startRecHyste determines how long a couple has to be found before recording starts.

barHeight determines the size of the little black/white distance bar appearing underneath each combined couple.

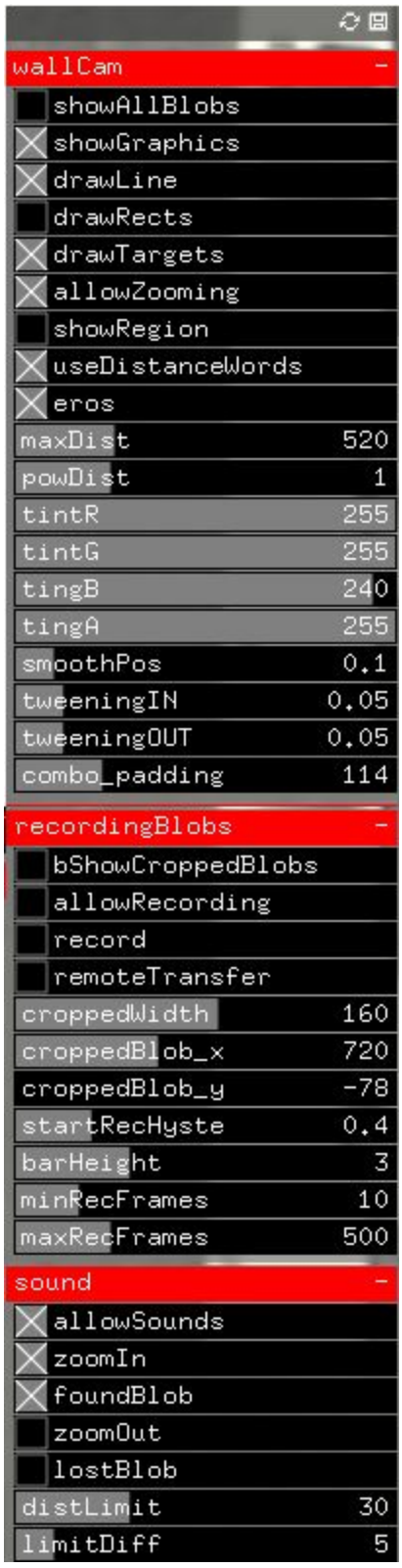
For **minRecFrames**, if less frames get recorded, this recording will be deleted.

maxRecFrames stops recording after maximum the recordings are reached.

Leave **allowSound** selected, it causes the sounds to play during zooming.

distLimit determines that if the distance between two faces is large enough, the zoom sound will happen.

limitDiff determines that if the change between zoom in and zoom out is large enough, the zoom sound will happen.



This menu is for **blobCam** and **blobCam2**.

showAllBlobs is used for debugging and exposes all found blobs and their history paths.

Don't use **showGraphics**.

drawLine draws a line between the two selected blobs.

drawRect draws a rectangle around the selected blob.

drawTargets draws a little red cross on top of the blob.

allowZooming allows zooming to occur.

showRegion shows the tracking area (for debugging.)

useDistanceWords draws words in the middle of the line between the blobs.

eros selects a different list of words describing distance.

maxDist determines the maximum distance between two blobs, onto which the full range of "distance" words is mapped.

powDist changes how distance is mapped onto the range of words: from linear = 1 to quadratic ≠ 1.

For **tintR,G,B,A**, see previous section.

s**moothPos** smooths the blob's tracked position.

tweeningIN and **tweeningOUT** determines how fast and how smooth the zooming happens.

combo_padding determines how much padding is around the two selected faces when zoomed in.

blobCam and **blobCam2** do not record! See above section for all other descriptions.

This menu is for **faceTracker** and **faceTracker2**.

mirror and **flip** match viewers' motion and with their orientation.

tracker_persistence determines how long an app waits for a lost face to reappear in the same location.

tracker_maxDistance determines the maximum distance a face can travel in one frame before it is considered a different face.

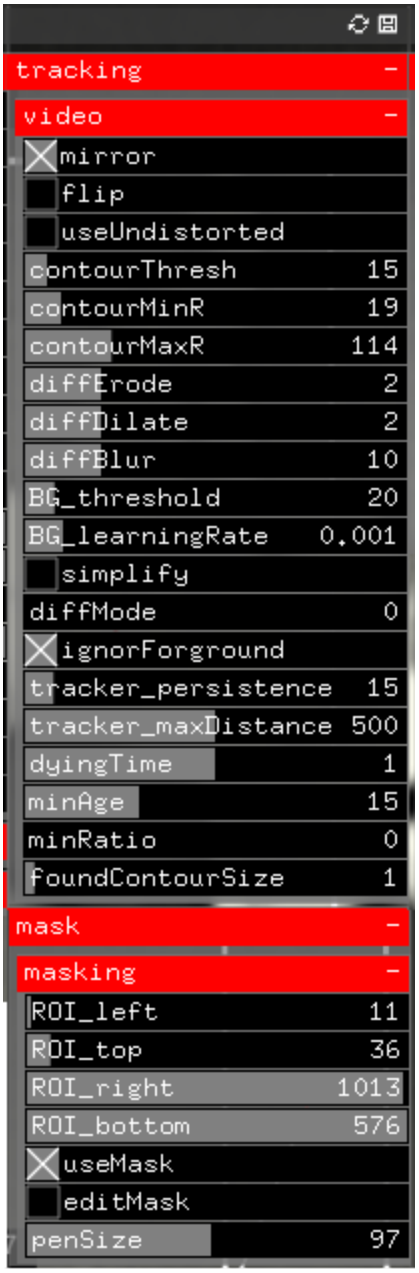
Don't touch **dyingTime**.

minAge determines the minimum amount of frames needed for a face to be detected before it is shown.

minSize determines the minimum size of a face for it to be considered and detected.

maxSize determines the maximum size of a face for it to be considered or detected.

foundFaceSize determines the current number of faces seen by the camera.



This menu is for **blobCam** and **blobCam2**.

mirror and **flip** match viewers' motion with their orientation.

For **useUndistorted**, if a fisheye lens is being used, read our calibration.yml file from data folder to undistort the image.

Don't touch **contourTresh**.

contourMinR determines the minimum pixel radius a blob needs to have.

contourMaxR determines the maximum pixel radius a blob can have.

diffErode removes the small white pixels in the background subtraction image. See here to make pixels visible.

diffDilate increases white pixels.

diffBlur blurs black-and-white pixels.

BG_threshold determines how much detail is being detected.

BG_learningRate determines the inverse time it takes for an object to become part of the background.

tracker_persistence determines how long an app must wait for a lost face to reappear in same location.

tracker_maxDistance determines the distance a face can travel in one frame before it is considered a different face.

Don't touch **dyingTime**.

minAge determines the minimum amount of frames needed for a face to be detected before it is shown.

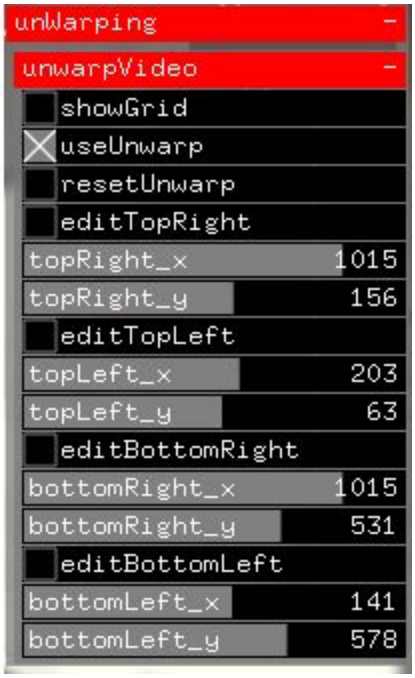
If **minRatio** is ≠ 0, then the blobs need to have at least this size ratio.

ROI_left, ROI_top, ROI_right, ROI_bottom define the tracking area.

useMask enables the use of a drawn mask.

editMask makes a new camera view visible for a mask to be drawn. Use control+drag to erase.

penSize determines the size of the pen used for mask drawing.



This menu is featured in all the apps. Unlike the mapping tool, here, the received camera image can be warped and distorted before it is passed on to the face or blob detector.

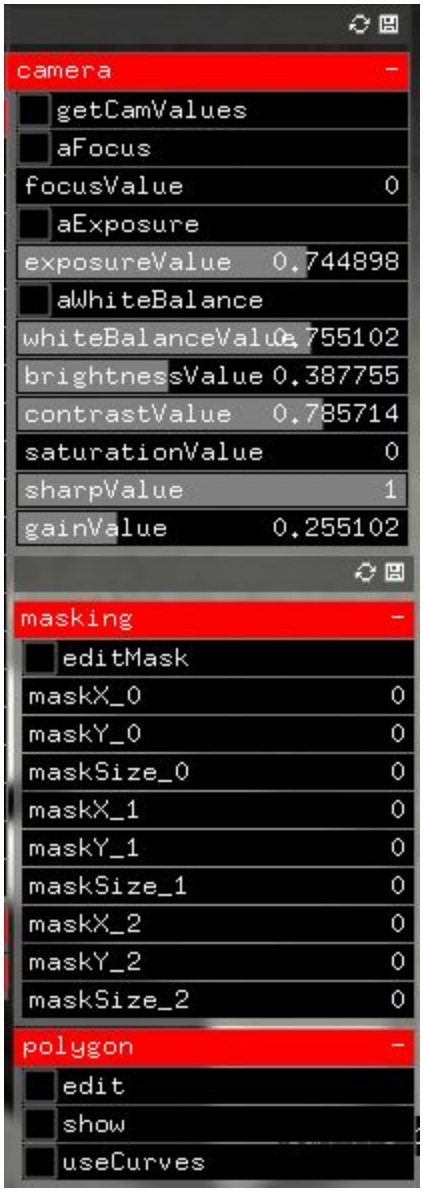
showGrid draws a grid to better see the effects of an image.

useUnwarp defines whether or not these settings effect the image.

For **resetUnwarp**, set all _x and _y to their default value.

If **editTopRight, editTopLeft, editBottomRight, editBottomLeft** are selected, you can use the arrow keys to move these corners.

topRight_x, _y changes the corresponding corner positions.



This menu is featured in all the apps.

Don't use **getCamValues**.

Don't use **aFocus** (cameras have manual focus lenses.)

aExposure sets the use of auto exposure.

exposureValue determines the manual exposure value.

aWhiteBalance sets the use of an auto-white balance.

whiteBalanceValue determines the manual white balance value.

For **brightnessValue, contrastValue**, and **gainValue**, adjust as needed.

saturationValue should be set to 0.

sharpValue should be set to 1 for the best image results.

Masking allows three circles to be drawn, which mask the light that might fall from the projector onto the camera lenses. (However, it has not been used in recent exhibitions.)

Polygon masking is only used in **blobCam** and **blobCam2**. It allows us to draw a custom shape to mask out any unusual ceiling structures that the projector light might get caught on.

edit enables the mask editing and draws the mask in brown.

show enables the display of the mask.

useCurves converts straight lines into curves.

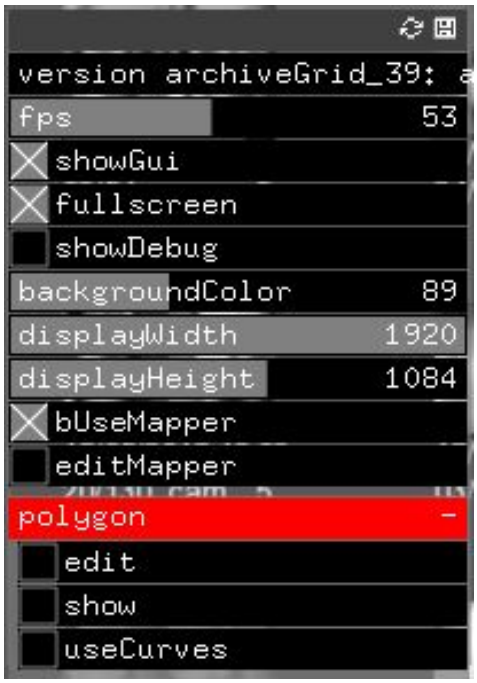
Back Wall:

Only one app is running on this computer, called **zoom_pavilion_archiveGrid**. All the other computers mount this computer's hard drive as a remote disk. Each of the other computers do this by executing their **mountServer** app. Internally, the app does a system call, mounting the remote disk.

```
osascript -e 'try' -e 'mount volume \"smb://192.168.1.237/admin/Desktop\" as
```

Shell

The following includes a break-down of each app, each field, and their specifications.



fullscreen should always be selected.

backgroundColor sets the gray color behind the couples' images.

displayWidth should be the same as the projector's resolution.

displayHeight should be the same as the projector's resolution.

bUseMapper should be selected if projection mapping is being used.

editMapper will make mapping points and grids appear. If the video projector's keystone function cannot be used to correct a skewed projection, than editMapper can help. Use the arrows to drag around or change each of the four corners of this app can. First, click on the corner you want to activate. Then, it will change from white to yellow.

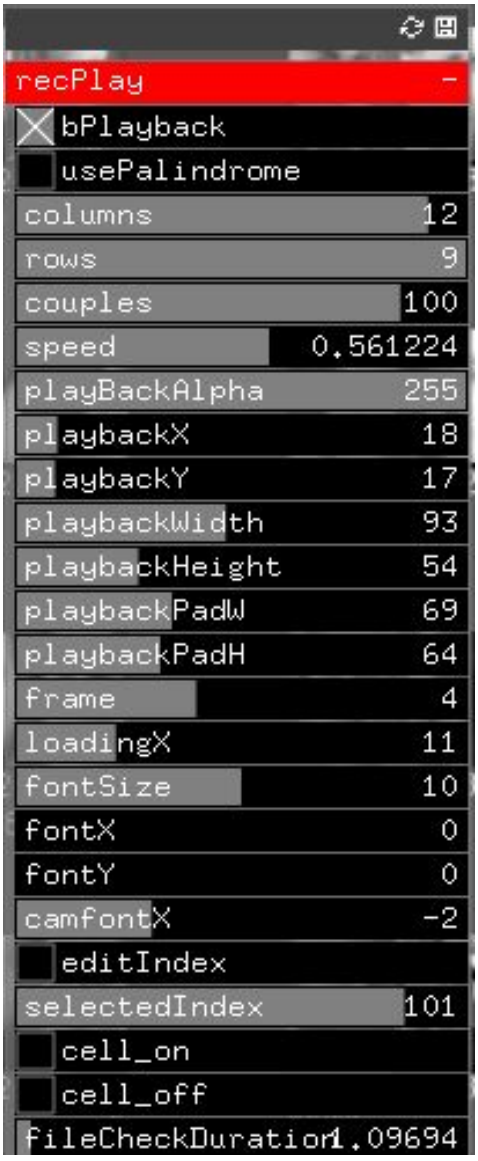
edit enables the mask editing function and draws the mask in brown. This can be used for masking light spill.

show enables the display of the mask.

useCurves converts straight lines into curves.

editMask enables the editing of the doorway polygon mask. Grab one of the four doorway corners to adjust their position.

Do not use **maskX, maskY, maskSize** (they would draw circular masks.)



bPlayback shows or hides all recorded couples' images.

usePalindrome sets the video looping type.

columns and **rows** define the layout of the couples. Note that it will only take effect after restarting the app.

couples is automatically generated = columns * rows.

speed determines the video playback speed.

Do not use **playBackAlpha**.

playbackX and **playbackY** moves the grid.

playbackWidth and **playbackHeight** compress or stretch the entire grid. This will distort the images and can be used to un-stretch distortions created by an unideal wall ratio.

playbackPadW and **PadH** determine the spacing between each video.

frame determines the thickness of the red frame around the most recent video.

loadingX determines the position of the word "loading..."

fontX and **fontY** determine the offset of the text displayed under each video.

camfontX offsets the word "cam 2" displayed under each video.

Use **editIndex** to remove the videos located behind the doorway polygon enabled during the editing of the video index list.

selectedIndex selects a yellow frame to highlight the video index being edited.

cell_on, cell_off turns this cell on or off. This information is stored inside **omitList.txt**.

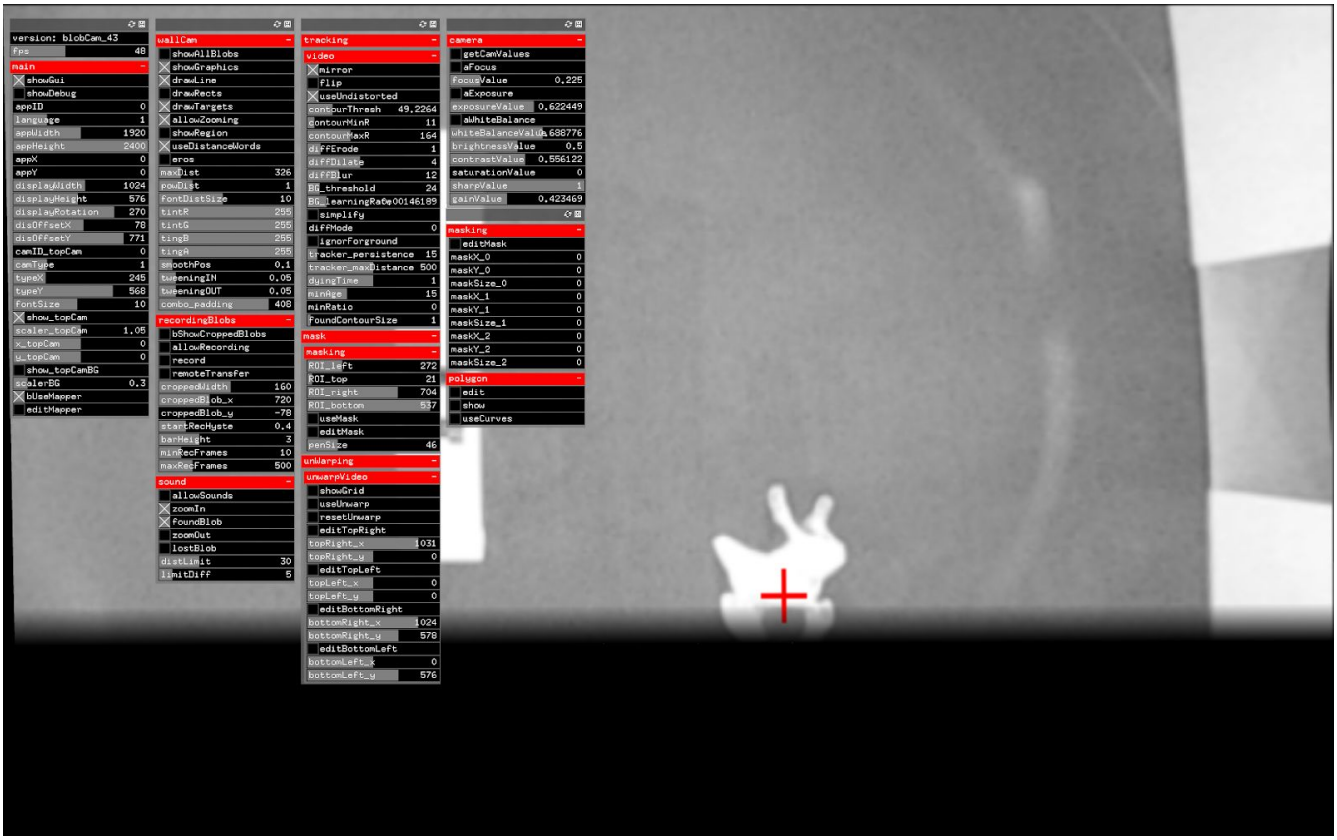
Ceiling:

The name of the app is **zoom_pavilion_blobCam_multiProjection.** This is the only app running on the ceiling computer. It is very similar to the **blobCam** app on the left, front or right computers, except that it stretches over two projectors. Since two projectors are used to generate one seamless image, the app will implement an edge-blending and mapping tool.

Only the mapping and blending GUIs are explained in this section. Please refer to the previous descriptions for the other GUI elements.

It is important to note that the position of visitors shown on the ceiling image is NOT a match to where they are located on the floor, but rather a mirror which places them on the opposite side.

The below GUI can be made visible or hidden by pressing key **g**. The mapping and blending GUI below is made visible by the keys **1** and **2**. Key **1** brings up the GUI for the top half of the projection, while key **2** shows the GUI for the bottom half. Both should have nearly identical settings except for **Blend Top, Blend Down, UV Start, UV End,** and **Scissor Start Y**.



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

All camera images are frozen.

A watchdog script that runs in the background will try to restart frozen apps and, if unsuccessful, will eventually try to reboot the computer.

If rebooting does not happen, please manually reboot the computer. There are three options:

1. Press the computer's power button for 10 seconds and then again to boot-up the computer.
2. Follow the LogMeIn instructions below to do reboot the computer remotely.
3. Install an AC power relay that can be controlled using a remote control (this will avoid someone having to climb behind the walls.) Such as: Etekcity Programmable Wireless Remote Control Power Outlet On/Off Switch.

One camera image is frozen.

Wait a few minutes. Hopefully, the watchdog script will exit the frozen app and restart it a couple of seconds later.

You can also find the wireless keyboard for this computer by clicking on the frozen app, then try to exit the app using the shortcut "command q", or the **esc** key. The watchdog should restart the app automatically.

One of the camera images is over exposed or under exposed.

Use the wireless keyboard to exit the specific app. The watchdog should restart the app automatically. If this app restart still did not change the camera setting, press key **g**, which will expose the GUI.

Find the camera control. Press the little plus-sign beside the word "camera."

Adjust exposure, gain, contract, and brightness until you find the right mix.

Recorded couples are not being transferred to the archive wall.

Two things could be causing this:

1. The local ethernet router/switch is turned off or is down. Check its power or contact IT about this.

2. The computer on the specific wall did not mount the archive wall computer as a remote hard disk. Locate the **mountServer** app in the macOS dock, then click it. It should mount the archive hard disk. A similar icon (but blue) should appear on the far right side of the dock.

Only one app is visible or the apps do not fill the projection.

It could be that the other three apps are not running. However, it is more likely that they are all running, but on top of each other. This might happen when the computer boots up without a projector present.

Either reboot the computer (using the instructions on the following page) or manually exit all the apps. The watchdog will start them up again.

How to Reboot the Computer Remotely:

Login to logmein.com.

Locate the correct computer in the list. Click on it.

Enter the username and password for this computer: user: **admin**, password: **hemmer**.

Click “Preferences”
Click “Advanced”
Click “View Reboot Options”
Click “Hard Reboot”

Wait up to one minute for the reboot to happen.

One of the ceiling projections is black.

Check that the connection between the projectors and the computer is working.

If for some reason the ceiling computer loses its connection to one of the projectors, the app might change the projection ratio. When the lost projector reconnects, the app should notice this change, and re-adjust accordingly. So, please wait and see if things fix themselves.

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

Software Dependencies

FFMPEG Library:

In order for the recording of found faces to work, a software called FFMPEG needs to be installed on the computer.

1. Install the open-sourced software **homebrew:** http://brew.sh.
2. Then, install FFMPEG using this terminal command:

```
brew install ffmpeg
```

Shell

3. Make sure that both the folder name that the zoom pavilion app is located and the file name of the zoom pavilion app itself do not contain spaces. Otherwise, recording does not work reliably.

Folders:

On the desktop of each computer, please create a folder named “recordings.” Also, the archive computer for the back wall will need a folder named “recordings_backup” on the desktop.

Description of Components

This artwork requires the following components:

Fractal design Node 202-BK custom computer

Hackintosh, i7, 4Ghz, 16GB RAM, GTX1070 with macOS 10.12.6, 250GB hard drive

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

Camera without lens

www.kurokesu.com

Logitech C920 camera in custom housing with CS mount + IR pass filter

Tamron C-Mount 4 to 12mm Varifocal Manual Iris Lens, MFR# M12VM412

Computar CS-Mount 1.8-3.6mm Varifocal wide-angle Lens, MFR# T2Z1816CS

Computar C-Mount 12-36mm Varifocal Lens, MFR# M3Z1228C-MP

1.45MM 190° 10MP FISHEYE wide-angle lens, www.back-bone.ca

Varifocal standard zoom lenses for the face-tracking cameras and corner cameras.
Wide-angle lenses for the ceiling cameras (Remove any IR cut filter!)

www.kurokesu.com
(Product Code: F2HIGH830)

www.back-bone.ca, INFRARED COLD MIRROR 2-PACK (HERO4 | YI 4K/4K+ | RX0)

IR Pass Filter (to only see IR light)

USB 2.0 over Cat5 extender for Kinect - Computer connection, Black Box IC280A-R2

HDMI extender DXE-CAT-TX2-4K and power supply

8-port Gigabit ethernet switch - unmanaged

Bosch, EX12LED-3BD-8W, 60° wide, 850 nm, 12 - 24 VDC, 9W

Raytech, model: rm200-ai-120-pr 110-240vac 80w

Nine small IR illuminator with 12VDC 1.25 amp power supply and one large IR illuminator

Logitech wireless RF keyboard

Three active loudspeakers 6301NE with 65-ft patch cables
24AWG 1/4Mono-M & BRTB 3.5mm TRS

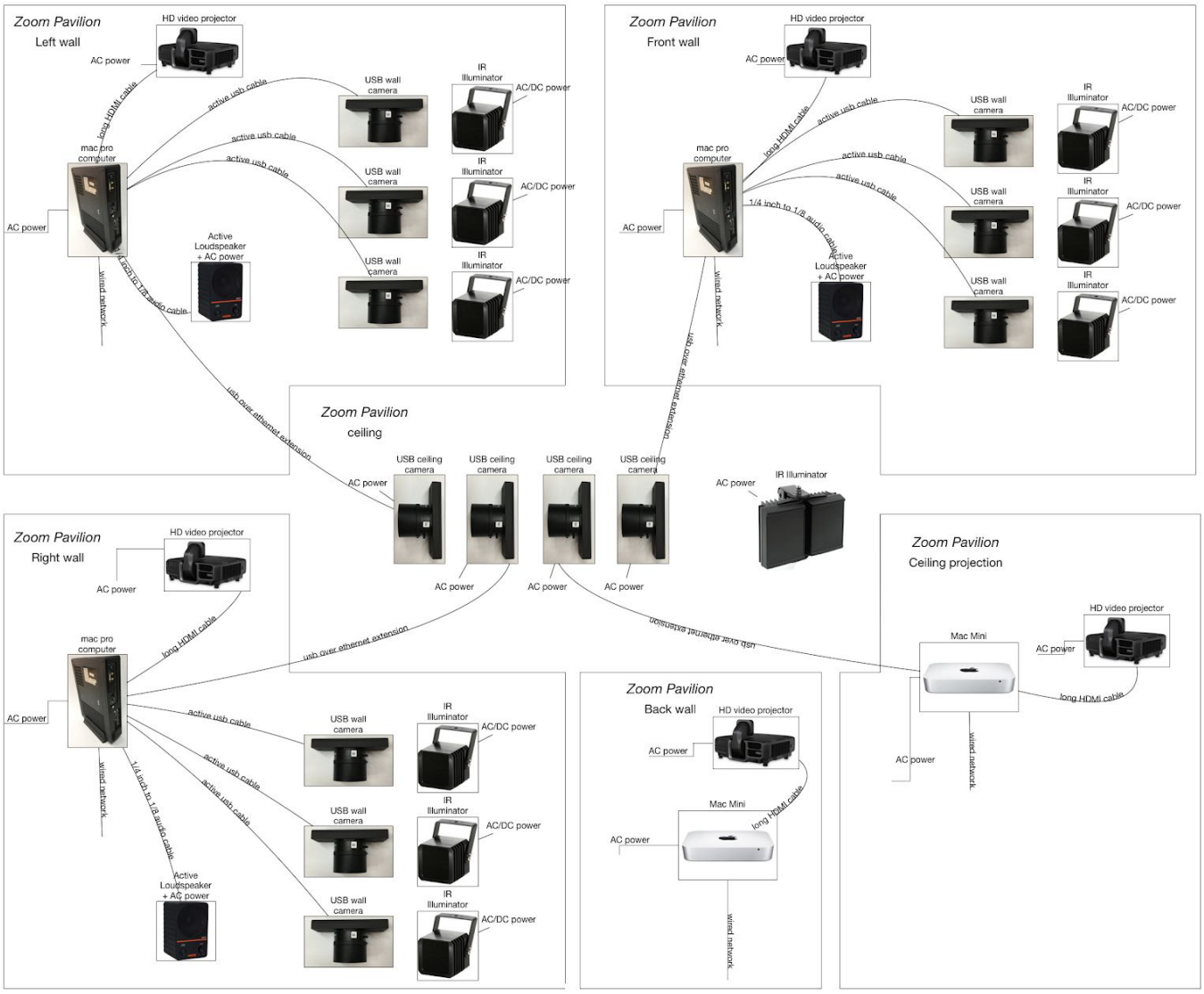
Panasonic projector + ET-DLE030

Epson projector + ELPLX01

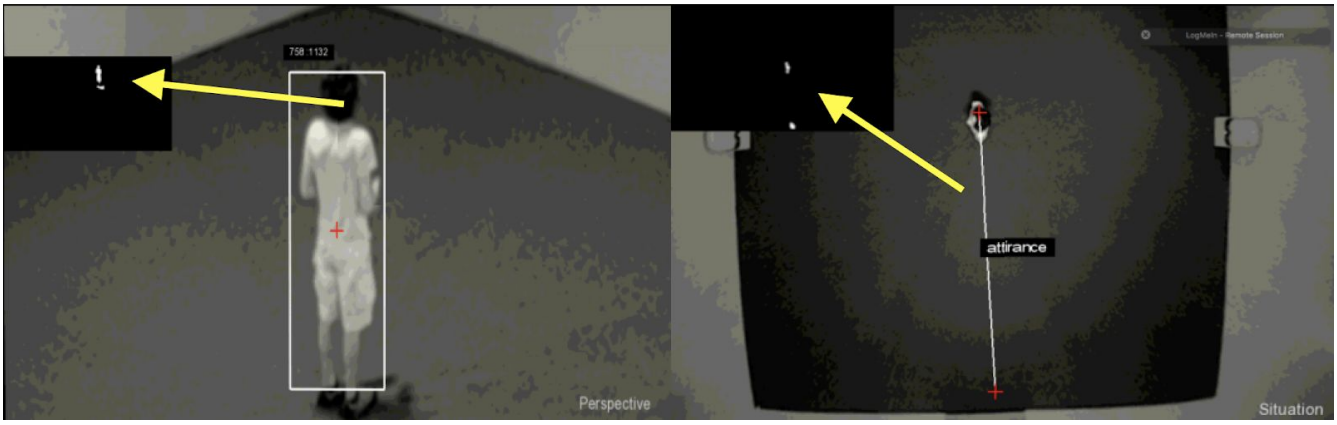
Projector with Ultra Short Throw Lens

Wiring Diagrams and Connections

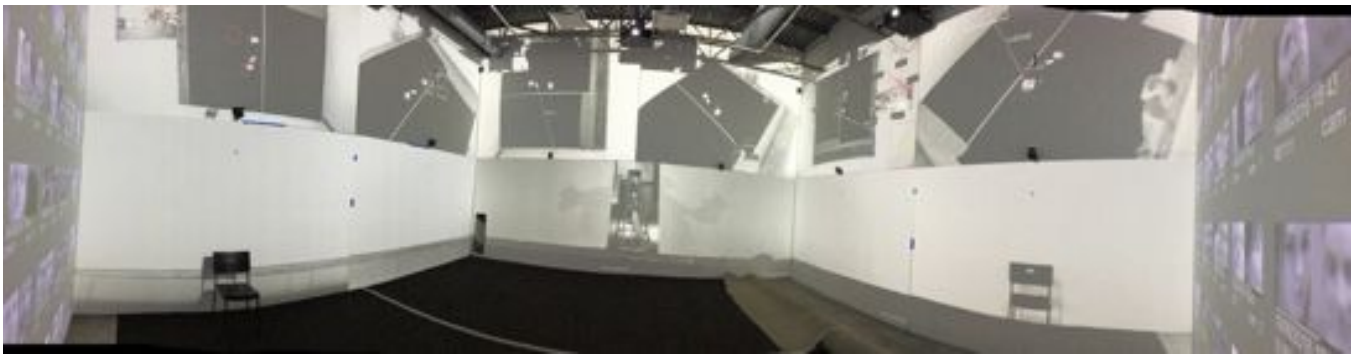
In order to have the piece running properly, the equipment should be connected according to the following diagrams. All USB cameras use the Black Box USB-Cat5e extender.



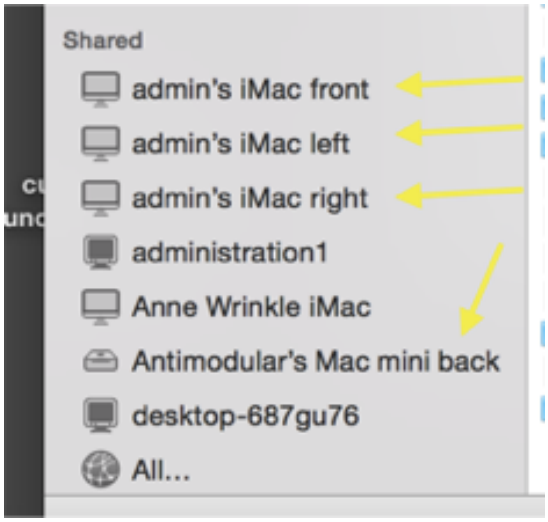
Additional Images



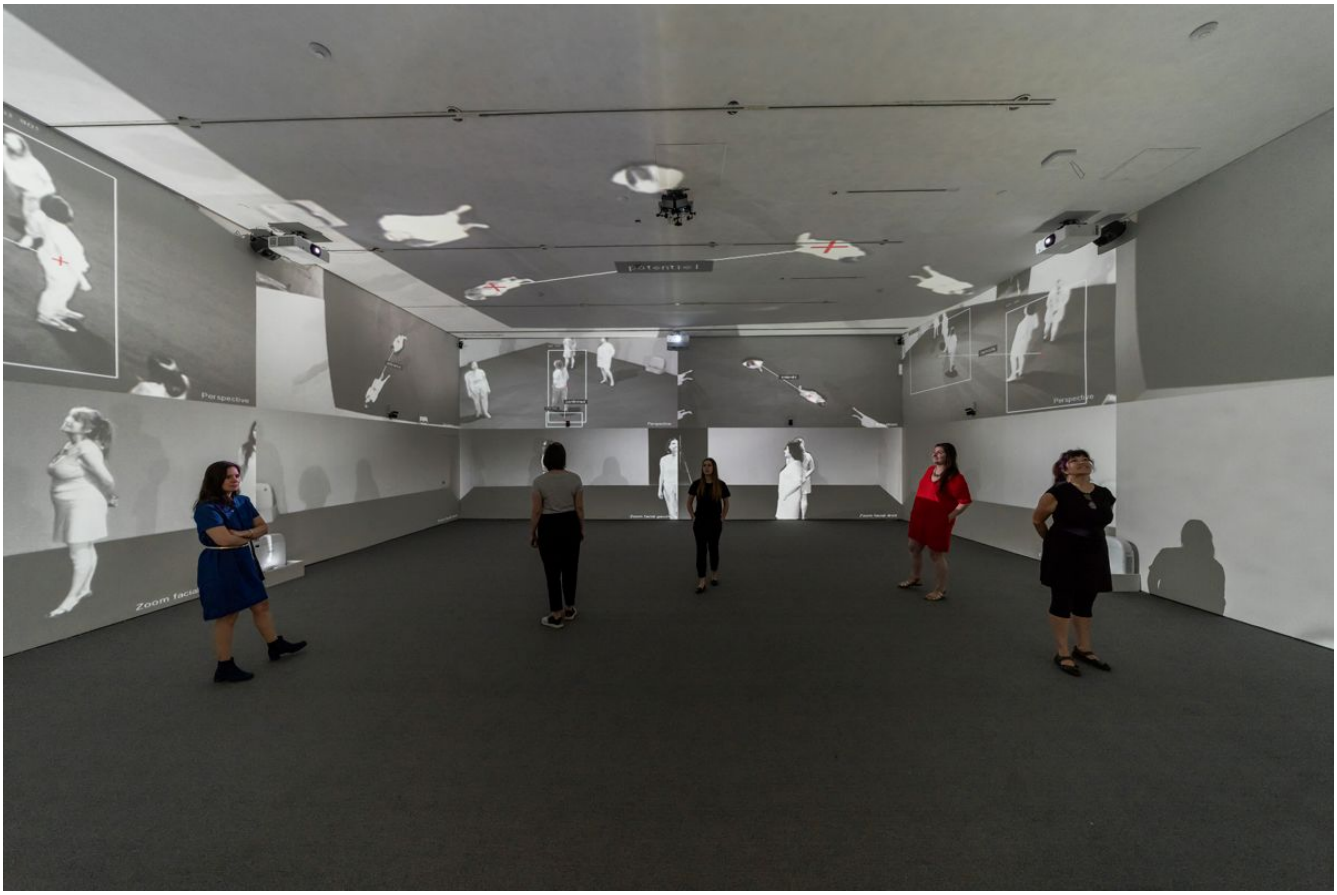
Screenshot with background subtraction view enabled



360 degree photo of setup in Santa Fe



All local computers should appear in the list of **Shared** computer in Finder sidebar.



Montreal iteration featuring a ceiling projection

APPENDIX II - TECHNICAL DATA SHEETS

USB Camera Logitech c920

Rework Instructions for Custom Housing

Please consult: https://www.kurokesu.com/main/kitc920-resources/.

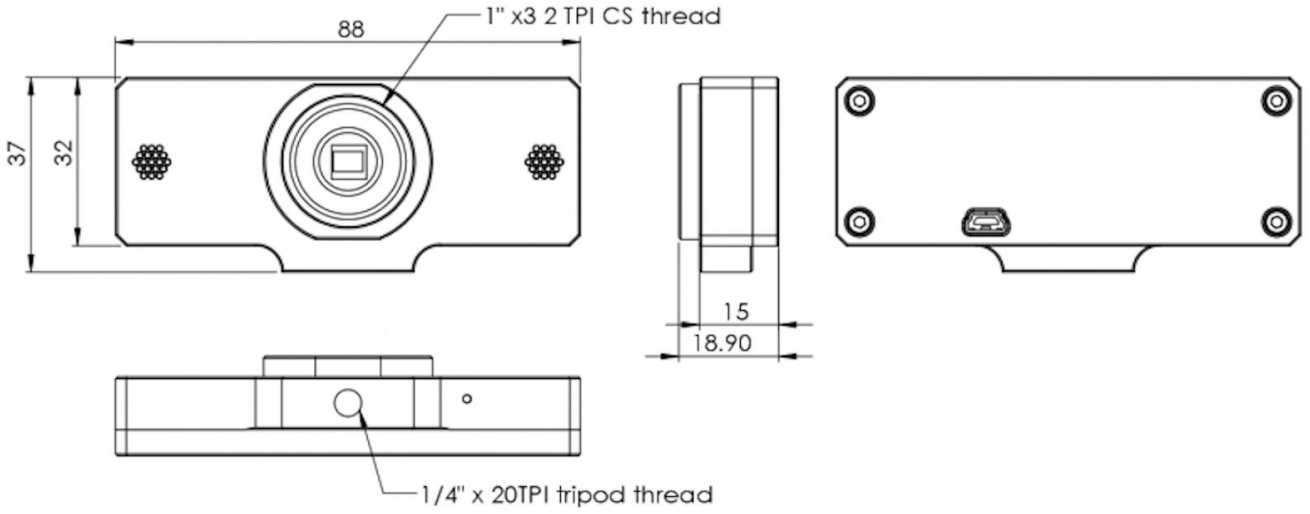
Cut five cables 4.5 cm in length.

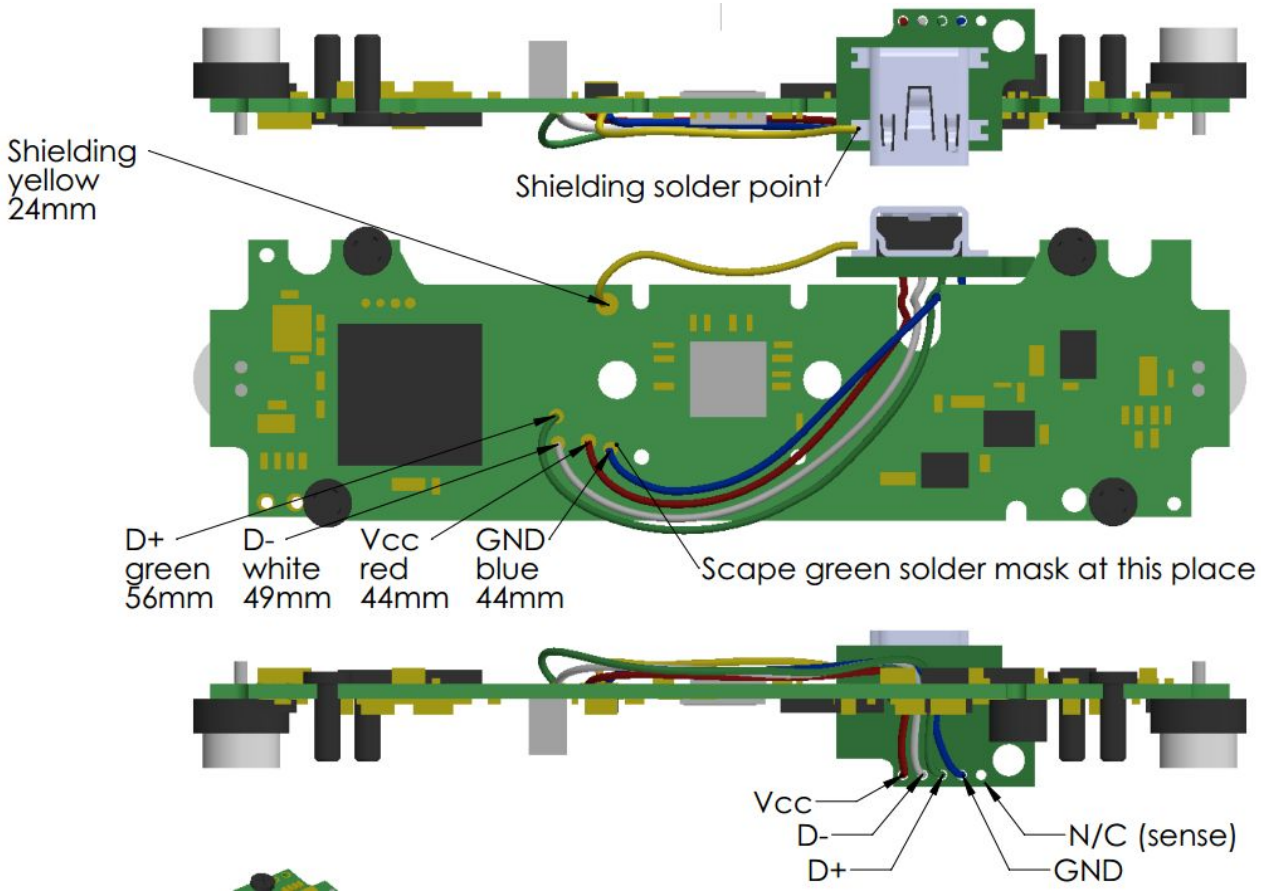
Use one of the screws that holds the original C920 lens to attach the new usb PCB.

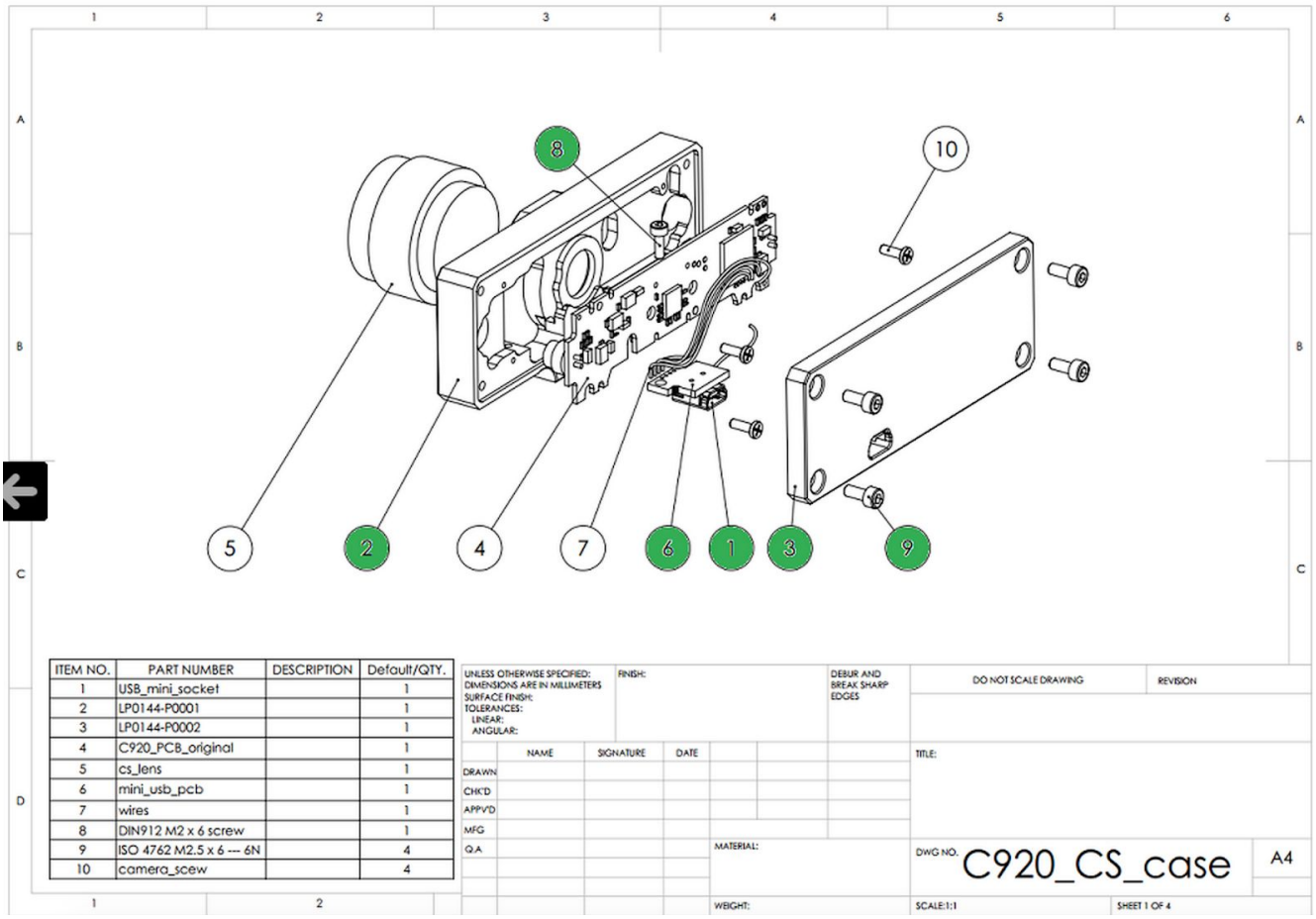
Leave the original lens on as long as possible on the PCB to protect image sensor.

Use the lens cap or IR filter on the new housing until the new lens is attached, to protect the image sensor from dust.

Use the three screws that hold the original PCB to attach it to the metal housing. You will also need to use the second screw that holds the lens in place.




Shielding
yellow
24mm
Shielding solder point
D+
green
56mm
D-
white
49mm
Vcc
red
44mm
GND
blue
44mm
Scape green solder mask at this place
Vcc
D-
D+
N/C (sense)
GND



ITEM NO.	PART NUMBER	DESCRIPTION	Default/QTY.
1	USB_mini_socket		1
2	LP0144-P0001		1
3	LP0144-P0002		1
4	C920_PCB_original		1
5	cs_lens		1
6	mini_usb_pcb		1
7	wires		1
8	DIN912 M2 x 6 screw		1
9	ISO 4762 M2.5 x 6 --- 6N		4
10	camera_scew		4

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MILLIMETERS
SURFACE FINISH:
TOLERANCES:
LINEAR:
ANGULAR:

FINISH:

DEBUR AND BREAK SHARP EDGES

DO NOT SCALE DRAWING

REVISION

	NAME	SIGNATURE	DATE
DRAWN			
CHK'D			
APPV'D			
MFG			
Q.A			

MATERIAL:

WEIGHT:

TITLE:

DWG NO. C920_CS_case

A4

SCALE:1:1

SHEET 1 OF 4