



Sphere Packing: Henryk Mikołaj Górecki

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Sphere Packing: Henryk Mikołaj Górecki (2014)

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Technique

Dyed transparent polymer 3D print, 105 channels of sound, custom circuitry, stainless steel housing, headphone earbuds, audio extension cables

Dimensions

Sphere: 13 cm diameter

Housing: 20 cm x 20 cm x 15 cm (LxWxH)

Edition

3 copies + 1AP

Description

“Sphere Packing” is a series of 3D-printed pieces designed to concentrate the entire musical production of a composer in a single dense multi-channel device. The size of each sphere is directly proportional to how prolific the composer was, for example the sphere for Johann Sebastian Bach has 48 cm diameter and holds 1100 loudspeakers playing simultaneously Bach’s 1100 different compositions, while the sphere for Hildegard Von Bingen only has 11 cm diameter and 69 loudspeakers. The project presents at a glance the comparative production volume of many composers. As people are a couple metres away from a sphere they hear a quiet murmur of sounds, but as they approach and put their ear up close to individual speakers they can hone in on specific compositions. The series is inspired by American composer Charles Ives’ practice of simultaneity as a compositional tool.

Technically, a set of custom-made circuit boards allow the simultaneous playback of thousands of separate sound channels. The spheres are modeled algorithmically and then 3D printed in different materials depending on the composer. Each piece is suspended from a small playback box which is hung from the ceiling of the exhibition space. The piece begins playback immediately upon powering the box with 110 or 220V power. A small remote control allows the curator or collector to set an appropriate volume for the piece, although the piece is very quiet by its very design, even at its maximum volume a sphere produces a din that can be heard from about a 3 m radius. To discern individual compositions the public must be right beside a sphere, 5 cm away.

Operation

1. To turn on the piece, plug in the provided power cable. The electronics will start up and begin playback shortly after the piece is powered.
2. To turn off the piece, unplug the provided power cable. The electronics will power down safely shortly after power loss.

Technical Information

Power

Auto switching 80W 10A @ 3.3v power supply runs at 110/220v 50/60hz.

Music Files

All music is stored on the players in MicroSD cards. The files are 16bit uncompressed WAV files. They have one song in the left channel and one song in the right channel.

Playback Electronics

Playback is achieved through ATTiny85s which are Atmel 8-bit AVR RISC-based micro-controllers. They communicate with microSD cards over SPI with custom firmware designed to read a FAT file system and playback stereo WAV files.

Sphere Packing: Górecki Parts List

Electronics Housing - Stainless Steel

3D Printed Sphere w/ Embedded Headphones

62x - 1.8m White 3.5mm Stereo Extension Cable

1x - Power Cable

4x - Aluminum Unthreaded Spacer, 5/8" OD, 1/2" Length, 1/4" Screw Size

4x - #10 3" Flat Head Screw

4x - 10-24 2-1/2" Flat Head Bolt w/ Toggle

1x - Screw Adapter

1x - 80W 10A @ 3.3v power supply

2x - Fan

4x - Music Playback Card

15x - ATTiny85

15x - MicroSD Card

15x - MicroSD Card Slot

15x - 3.5mm Headphone Jack

1x - Blue LED

1x - Custom PCB

Components

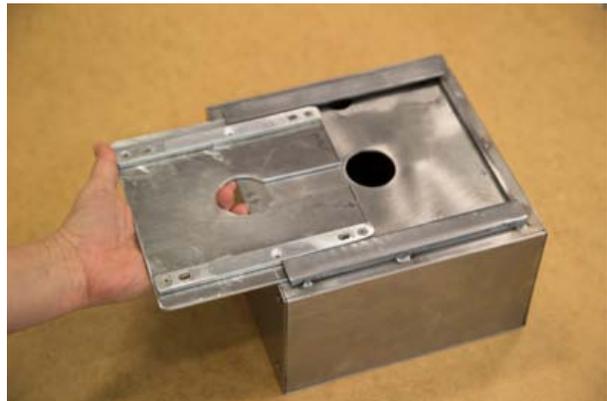
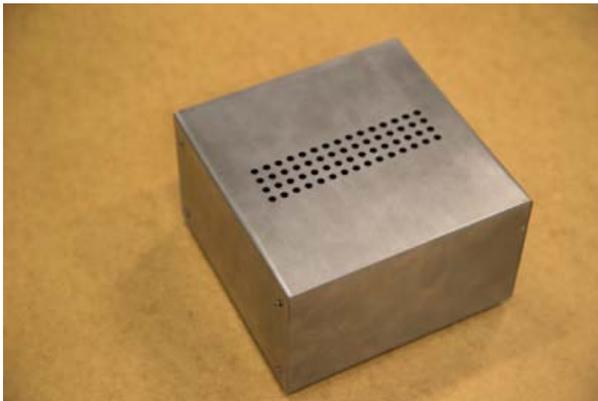
The Sphere

A dyed transparent polymer 3D print which contains 105 individual headphones coming to 53 headphone cables out of the top of the sphere.



The Housing

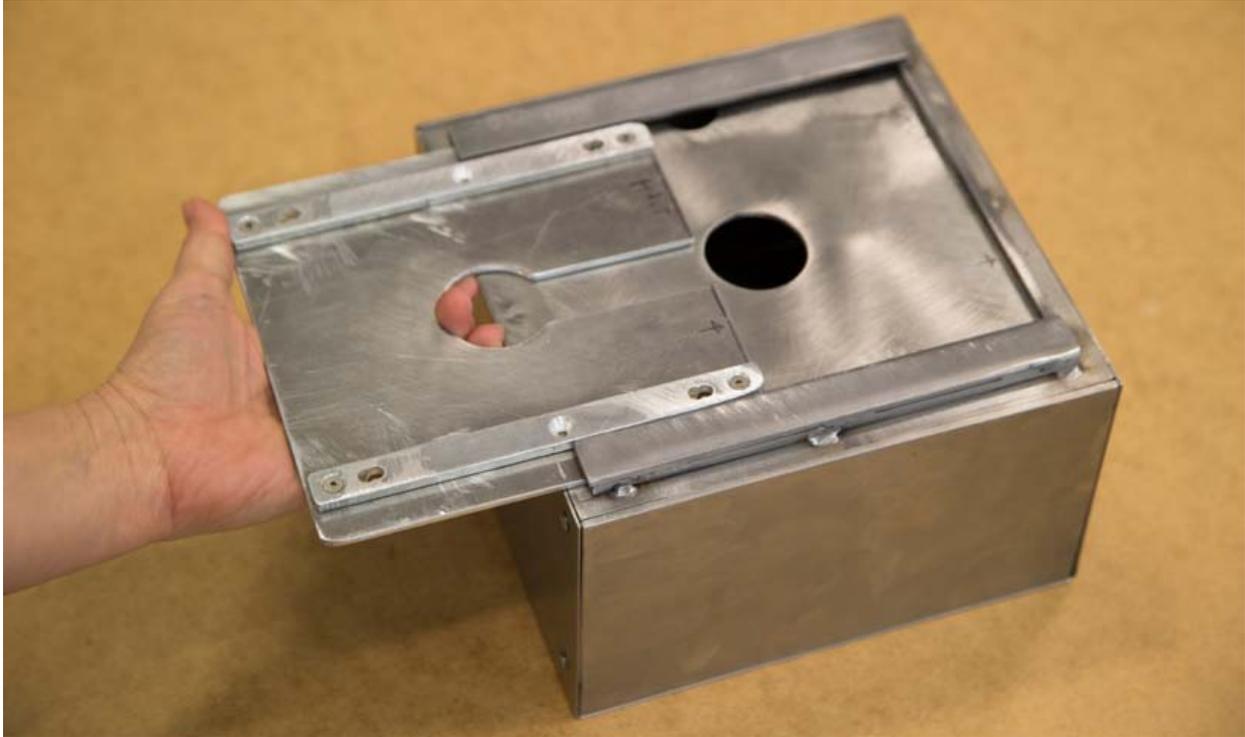
A stainless steel box (20x20x15cm) containing a sliding mounting bracket, 4 custom circuit boards, a power supply and cooling fans.



Installation

Step 1

Prepare a cable hole, and mount the included bracket.

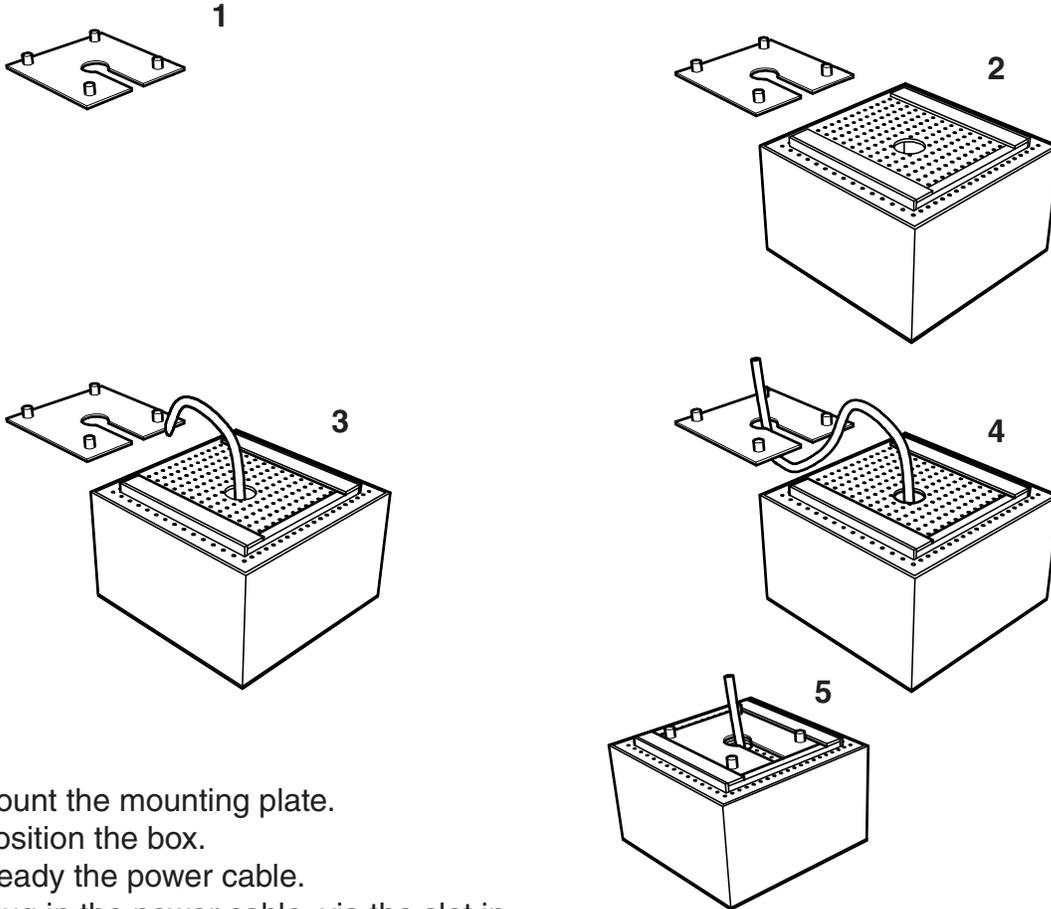


The mounting plate, shown in the first image, attaches to the ceiling from 4 mounting points. This plate allows the housing to slide onto and off of the ceiling to provide easy mounting. Use either the included screws, or bolts with mounting toggles to attach the plate to the ceiling. Centering the plate above where the sphere is to be located. Insert the included aluminum standoffs above the mounting plate to provide a cable and air gap above the housing. See the final mounting diagram for reference.

Installation

Step 2

Plug in and slide on the housing.



1. Mount the mounting plate.
2. Position the box.
3. Ready the power cable.
4. Plug in the power cable, via the slot in the mounting plate.
5. Slide the box onto the mounting plate.



Once the mounting plate is mounted, pull a length of power cable down, plug it into the back of the housing, and slide the housing with the mounting plate in its groove until it rests against the edge of the mounting plate.

Installation

Step 3

Plug in the extension cables.



Once the housing is mounted begin plugging in extension cables. This is best done when the piece is hung so that the cables will hang down evenly, and won't knot or twist.

Installation

Step 3

Plug in the sphere headphone cables.

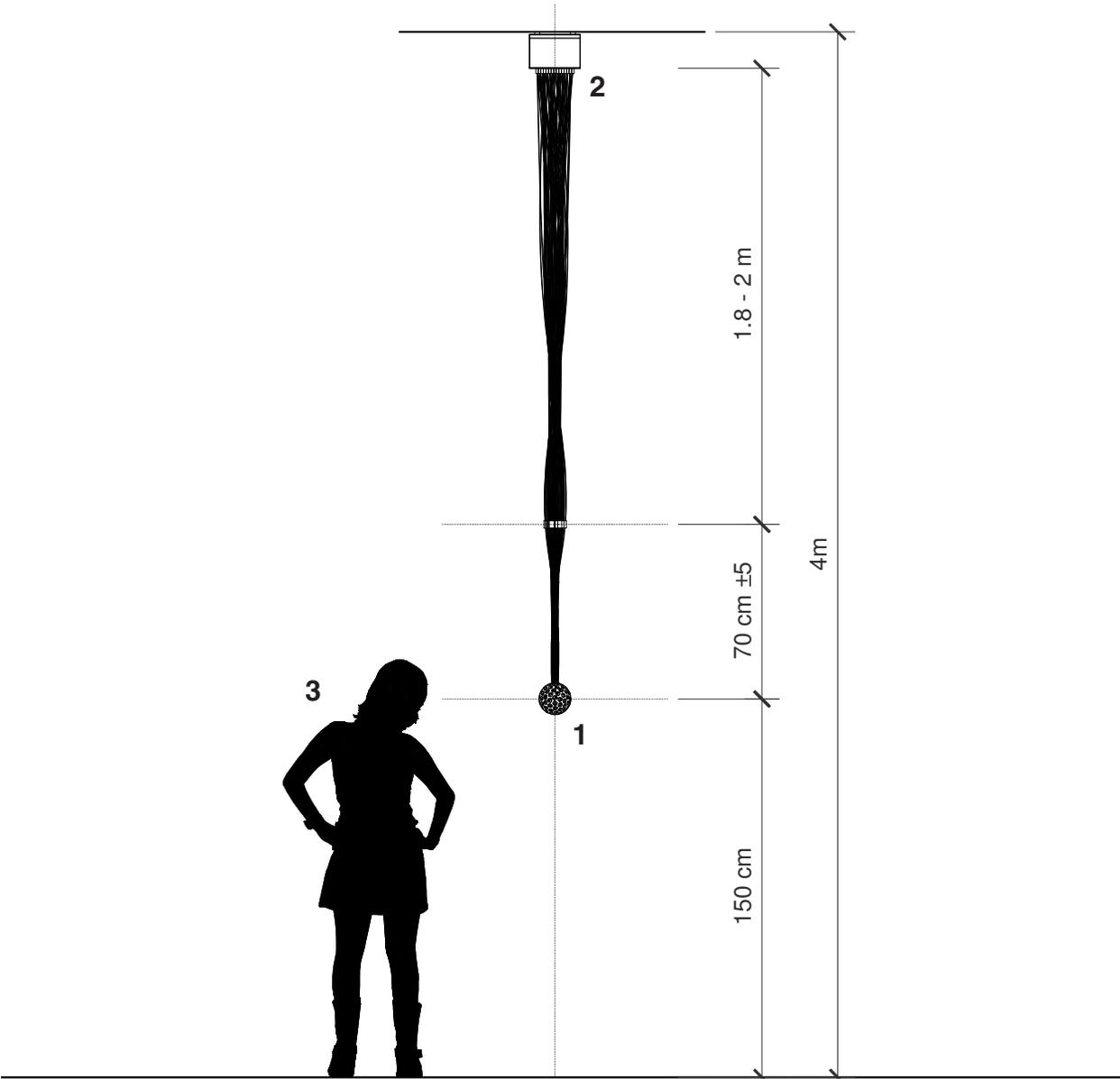


After plugging in the extension cables, the sphere can be plugged in. Take careful note of where the sphere headphone cables are connected. The cables vary in length, it is best to connect the longest cables to the headphone cables from the outside of the housing. This distributes the weight and provides the best way for the cables to hang.

Also note that the sphere comes with tape around the cables near the sphere, and a plastic collar near the connections. The tape is to protect the cables during transit, and the collar is to keep the cables together at the point of connection. The collar should be left on, and the tape removed. Once all the cables are connected, the sphere is ready.



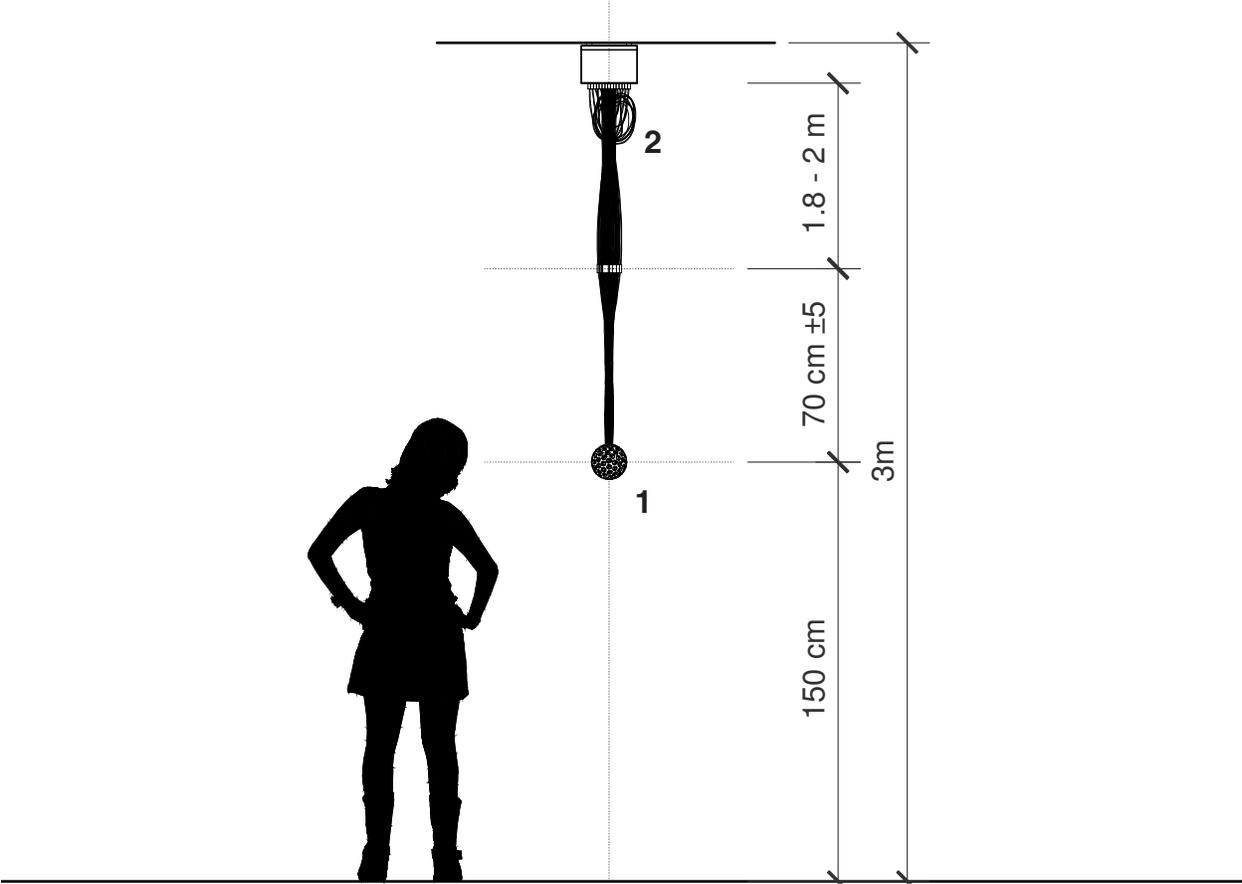
Installation Diagram



Notes

- 1. The final position of the center of the sphere needs to be 150cm from the floor.
- 2. The weight of the sphere when properly hung is distributed across all the plugs and they provide needed support.
- 3. To discern individual compositions the public must be right beside a sphere, 5 cm away.

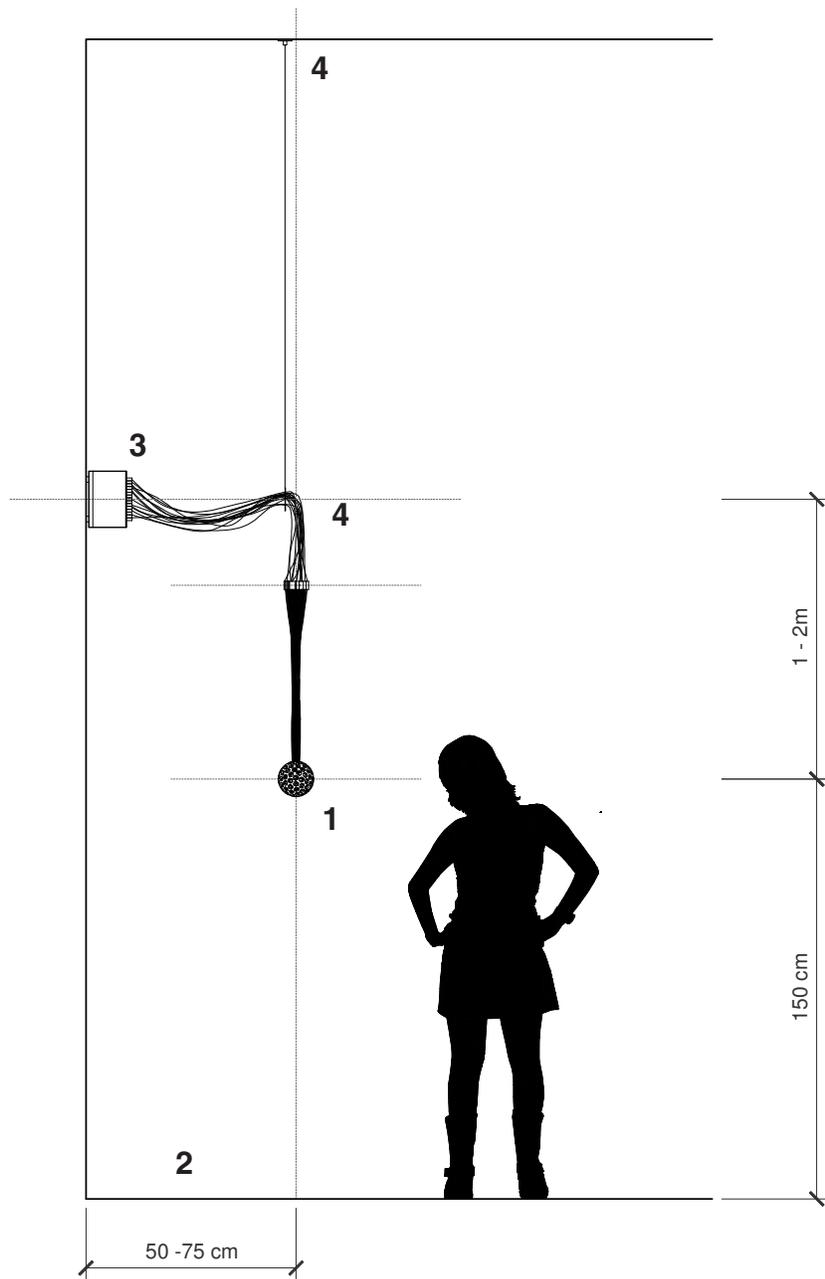
Installation Diagram



Notes

- 1. The final position of the center of the sphere needs to be 150cm from the floor.
- 2. With low ceilings the extension cables can be looped once to center the sphere at 150cm.

Installation Diagram



Notes

1. The final position of the center of the sphere needs to be 150cm from the floor.
2. When mounting the sphere from a wall, the sphere should be between 50 to 75cm away from the wall.
3. The Housing should be mounted between 2 and 3 metres above the floor, high enough so that people can pass underneath.
4. The cables should be draped out from the housing and through a steel cable loop mounted from the ceiling.

Teardown



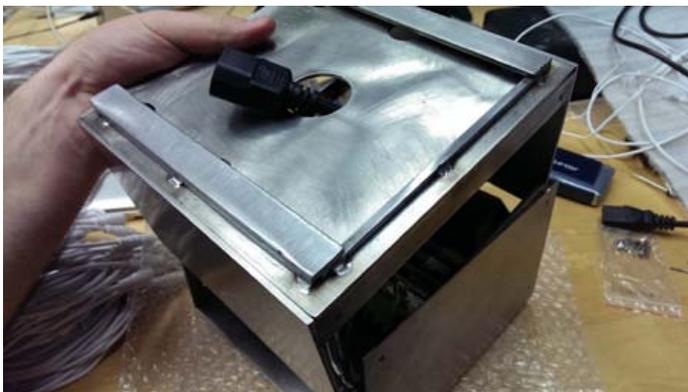
Dismount the housing.

Be sure to place it on a clean, protected surface. Rotate the housing so that the headphone jacks are face down.



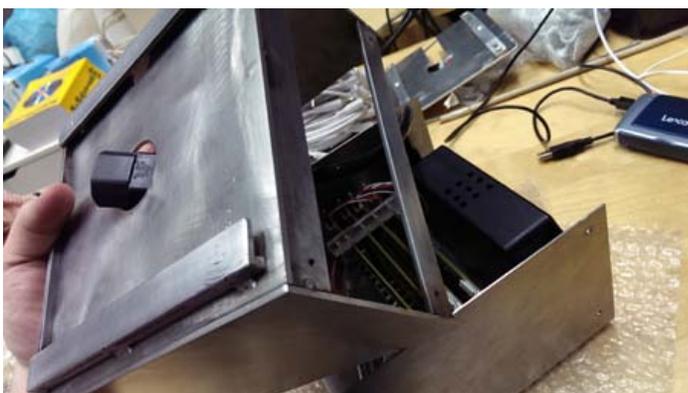
Unscrew the 8 screws on the box.

The screws can be removed with approximately a 2mm hex screw driver or key.



Begin to lift off the back.

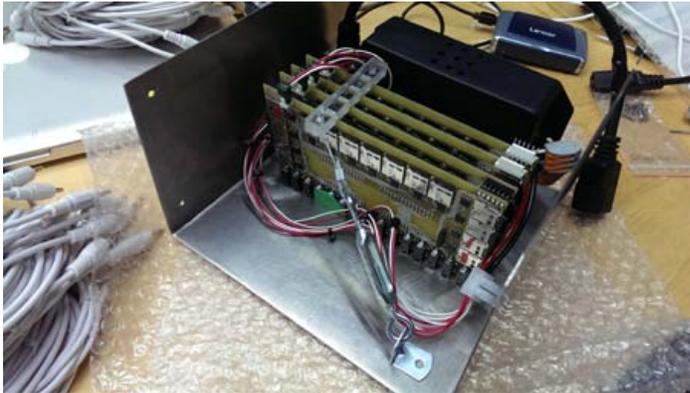
Note that two sides of the box are attached to the back of the box.



Push the plug through.

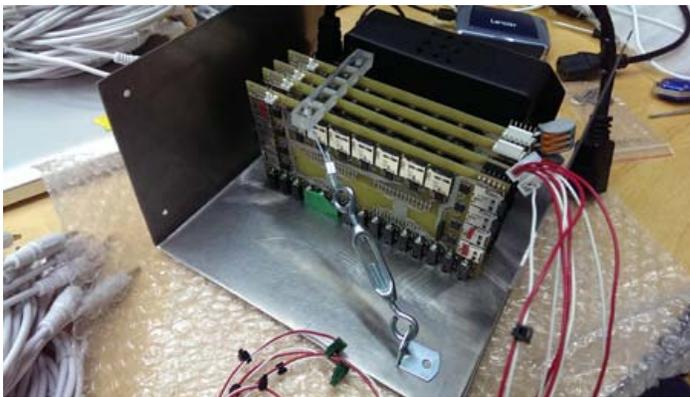
While removing the top, push the plug back through the hole. There is around 20cm of cable to work with.

Teardown



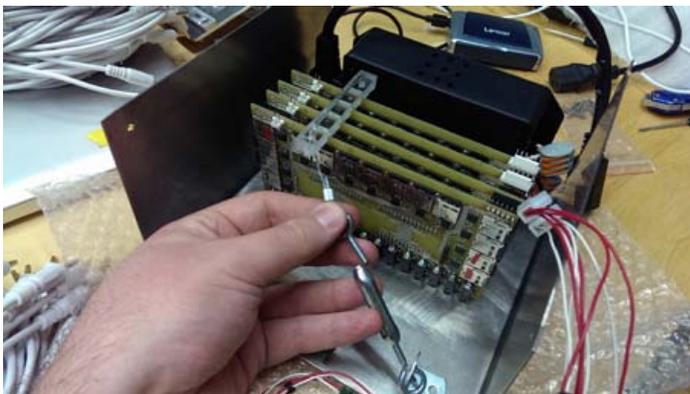
The electronics.

All of the AC power conversion is done in the black plastic housing, the cards play the music and the red and white cables carry 3v DC.



Unplug the player cards.

The connectors lift off easily, straight up.



Loosen or tighten the cable.

Turn the turnbuckle to either loosen or tighten the cables holding the cards in place. Do not over tighten, test if the cards move with a simple push of your finger from the other side of the box.



Remove the cable and clamp.

The cards can now be removed or adjusted.

Cleaning

Housing

The housing is stainless steel, it can be cleaned with a soft towel and a small application of lemon oil, or another cleaner designed for stainless steel. Care should be taken to not get any moisture into the inside of the housing, or into the plugs for the headphones during the cleaning process.

Cables

The cables are a mix of rubber and plastic, when they are not in use, care should be taken to protect the connectors on the cables so they are not damaged or dirtied. The cables can be dusted off, or wiped down with a damp cloth.

Sphere

The nature of the sphere's as experimental objects in new and comparatively untested materials means that they may react strongly or not at all to a variety of cleaners. As a result the spheres should never be cleaned with any cleaning agent. This sphere, Górecki, is a dyed transparent polymer 3D print, this means that if it is cleaned with a wet or damp cloth the dye may run. *The sphere should ONLY be cleaned with a dry microfiber cloth to remove dust and small smudges.*

Troubleshooting

While plugging in the headphones, the sockets go up into the housing.

During transport the cable that tightens the cards in place may have come loose. The housing can be opened to tighten that cable, or the cards can be pushed back into place through the cable hole if it is a minor adjustment. Please see the housing breakdown for instructions on how to tighten the cards.

There are more extension cables than headphone cables to connect them.

Depending on the sphere, there is an uneven number of plugs, please connect the extra extension cables so that all the plugs on the housing are connected, and tuck them into the area where the extension cables and sphere cables connect.

Support

If you would like support please call Lozano-Hemmer's studio in Canada.

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