Please cite Dual brain cortical calcium imaging reveals social interaction-specific correlated activity in mice. Nicholas J. Michelson[1,2,] Federico Bolaños[1,2], Luis A. Bolaños[1,2], Matilde Balbi[1,2], Jeffrey M. LeDue[1,2], and Timothy H. Murphy[1,2,*] Designs by Luis Bolaños

DOCUMENTATION FOR RASPBERRY PI WIDE FIELD IMAGING RIG, REQUIRE 2X

PART LIST ~$2750 for each Pi rig

Note: All Prices Listed are in US Dollars

TRIPLE LED LIGHT GUIDE

Bought Parts

Manufacturer	Name	Part ID	Quantity	Cost	Subtotal
Thorlabs	Liquid Light Guide Ø3 mm Core, 4' (1.2 m) Length	LLG0338-4	1	$359.04	$359.04
Thorlabs	SM1 Lens Tube, 3.00" Thread Depth, One Retaining Ring Included	SM1L30	3	$27.03	$81.09
Thorlabs	SM1 Lens Tube, 0.50" Thread Depth, One Retaining Ring Included	SM1L05	3	$12.59	$37.77
Thorlabs	SM1 Lens Tube, 2.00" Thread Depth, One Retaining Ring Included	SM1L20	1	$16.50	$16.50
Thorlabs	f=30.0 mm, Ø1" Achromatic Doublet, ARC: 400-700 nm	AC254-030-A	1	$86.62	$86.62
Thorlabs	N-BK7 Bi-Convex Lens, Ø1", f = 25.4 mm, Uncoated	LB1761	3	$25.90	$77.70
Thorlabs	Ø3 mm LLG to SM1 Adapter	AD3LLG	1	$32.90	$32.90
Thorlabs	30 mm Cage Cube with Dichroic Filter Mount	CM1-DCH	2	$165.24	$330.48
Thorlabs	Cage Cube Connector for Compact 30 mm Cage Cubes	CM1-CC	1	$45.90	$45.90
Thorlabs	25 mm x 36 mm Longpass Dichroic Mirror, 550 nm Cutoff	DMLP550R	1	$239.70	$239.70
Thorlabs	Ø1" Laser Line Filter, CWL = 635 ± 2 nm, FWHM = 10 ± 2 nm	FL635-10	1	$95.88	$95.88
Thorlabs	Ø1" Bandpass Filter, CWL = 440 ± 2 nm, FWHM = 10 ± 2 nm	FB440-10	1	$100.98	$100.98
Thorlabs	SM1 Retaining Ring for Ø1" Lens Tubes and Mounts, 10 Pack	SM1RR-P10	1	$40.50	$40.50
Chroma	AT455DC Size: 26 * 38 mm	AT455DC	1	$150.00	$150.00
Chroma	ET480/30x Size: 25mmR R=Mounted in Ring	ET480/30x	1	$325.00	$325.00

Luxeonstar	Royal-Blue (448nm) Rebel LED on a SinkPAD-II 20mm Star Base - 1030 mW @ 700mA	SP-01-V4	1	$7.24	$7.24
Luxeonstar	Blue (470nm) Rebel LED on a SinkPAD-II 10mm Square Base - 65 lm @ 700mA	SP-05-B4	1	$8.85	$8.85
Luxeonstar	Red (627nm) Rebel LED on a SinkPAD-II 20mm Star Base - 64 lm @ 350mA	SP-01-D9	1	$11.15	$11.15
TOTAL					**$2018.30**

Machined Parts

File Name	Quantity
Milled as-1.50_2_v2.SLDPRT	3
Spacer_with_wire_hole_as-.500_v2.SLDPRT	3
LED_mount_as-1.50_v2.SLDPRT	3

3D Printed Parts

File Name	Quantity
TripleLEDLightGuide_Base.stl	1

RIG

Purchased Parts

Manufacturer	Name	Part ID	Quantity	Cost	Subtotal
N/A	¼-20 Set Screws, Bolts, Nuts, Washers; M2 Screws, Nuts	N/A	Enough	N/A	N/A
N/A	1.5 Inch Outer Diameter 1 ⅛ Inch Inner Diameter Acrylic Tubing	N/A	4 Inch Length	N/A	N/A
Thorlabs	Clamping Fork, 1.24" Counterbored Slot, Universal	CF125	2	$8.95	$17.90
Thorlabs	Ø1/2" Pedestal Post Holder, Spring-Loaded Hex-Locking Thumbscrew, L=1.19"	PH1E	2	$23.46	$46.92
Thorlabs	Ø1/2" Optical Post, SS, 8-32 Setscrew, 1/4"-20 Tap, L = 4"	TR4	1	$5.87	$5.87
Thorlabs	Ø1/2" Optical Post, SS, 8-32 Setscrew, 1/4"-20 Tap, L = 6"	TR6	1	$6.91	$6.91
Thorlabs	Ø1/2" Optical Post, SS, 8-32 Setscrew, 1/4"-20 Tap, L = 1.5"	TR1.5	2	$4.97	$9.94
Thorlabs	Compact Variable Height Clamp, 1/4"-20 Tapped	CL3	2	$5.15	$10.35

Edmund Optics	6" x 6", Breadboard	#56-930	1	$90.00	$90.00
Edmund Optics	12" x 12", Breadboard	#53-830	1	$195.00	$195.00
Edmund Optics	4" Length, ¼-20 Thread, Post Holder	#58-980	1	$15.25	$15.25
Edmund Optics	Right Angle Post Clamps	#53-357	1	$19.00	$19.00
Edmund Optics	12.7mm - 12.7mm (Rotatable), Right Angle Post Clamp	#58-994	1	$30.50	$30.50
Siskiyou	AS-.500 Aluminium Spacer 0.5 Inches Package of 4	60400000E	1	$20.00	$80.00
Siskiyou	AS-2.00 Aluminium Spacer 2 Inches Package of 4	60430000E	1	$28.00	$112.00
Sherline	Vertical Milling Column	3050	1	$157.50	$157.50
TOTAL					**$605.09**

Machined Parts

File Name	Quantity
BarClamp_V.SLDPRT	2
Clamp.SLDPRT	2

3D Printed Parts

File Name	Quantity
TubeHolder_Even.stl	1
Camera_Holder_Mark_II.stl	1
Light Guide Mount_MarkII.stl	1
4PiTower.stl	1
BehaviourCameraArms.stl	1

Electronics

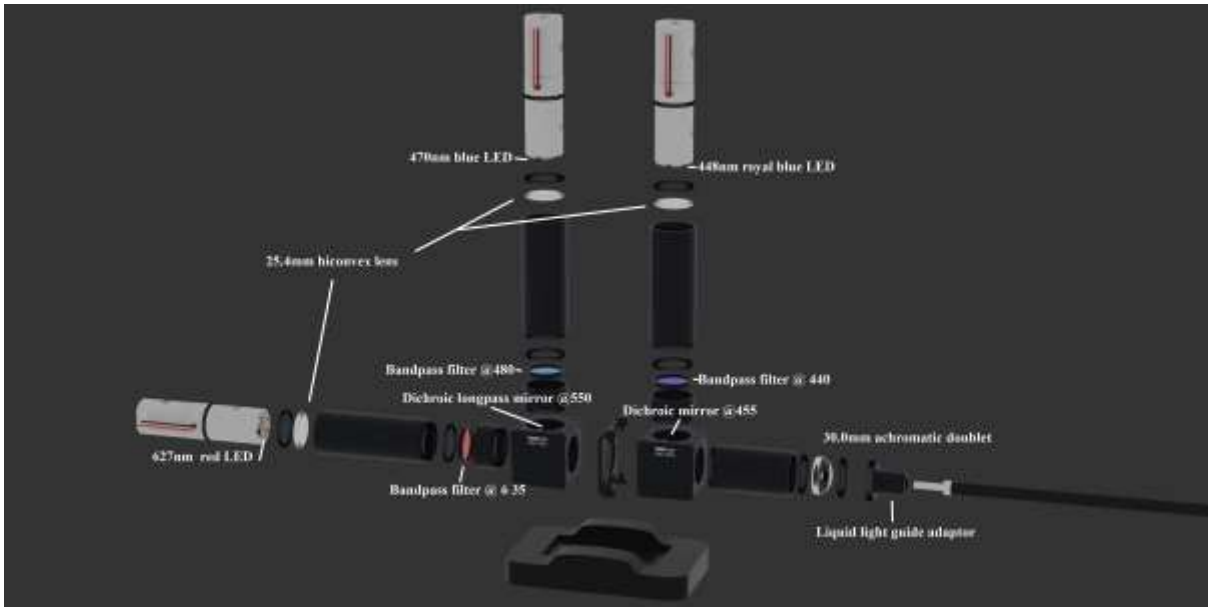
Manufacturer	Name	Part ID	Quantity	Cost	Subtotal
Sparkfun	Hook-Up Wire - Assortment (Stranded, 22 AWG)	11375	1	$16.95	$16.95
RaspberryPi	Raspberry Pi Model 3	N/A	2	$35.00	$70.00
Waveshare	RPi Camera (B), Adjustable-Focus	RPi Camera (B)	1	$18.99	$18.99
Waveshare	RPi Camera (F), Supports Night Vision, Adjustable-Focus	RPi Camera (F)	1	$22.99	$22.99

N/A	LED Driver	N/A	2	N/A	N/A
TOTAL					**$128.93**

ASSEMBLY OF RIG

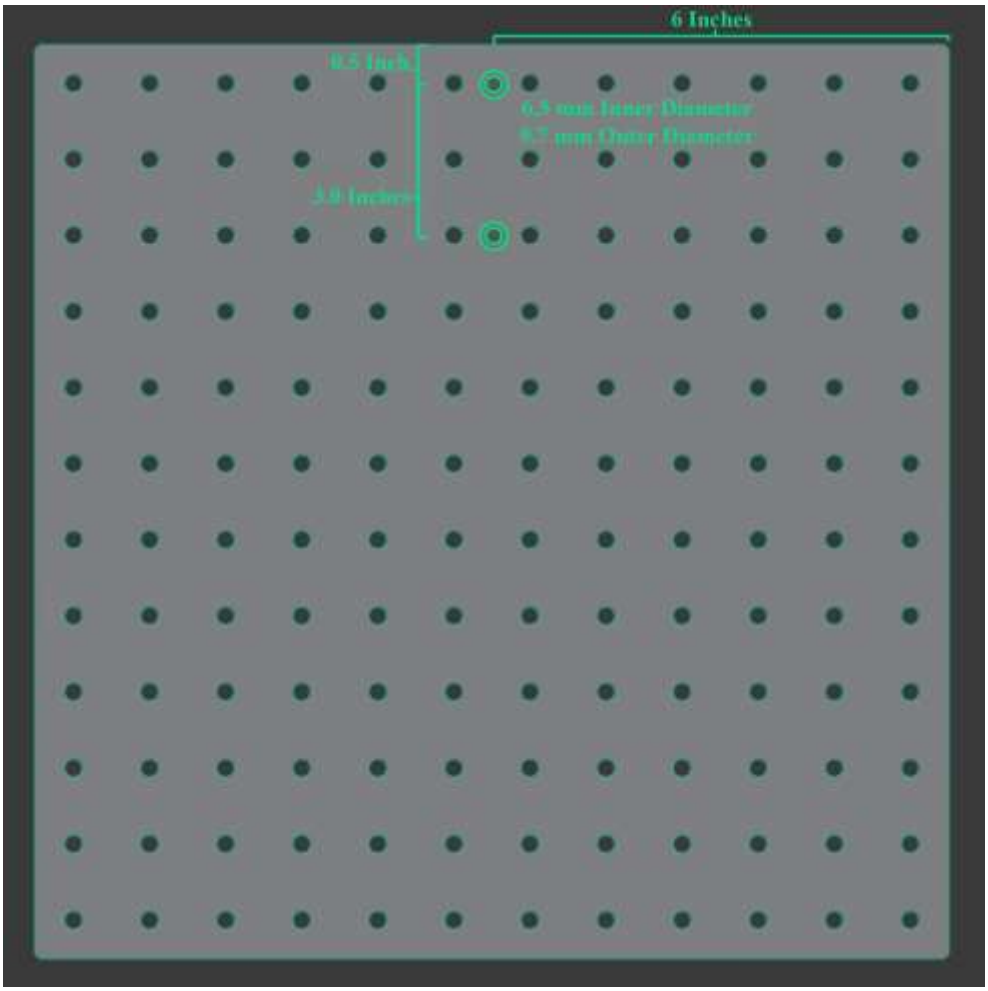
Triple LED Light Guide Assembly

Note: To ensure proper placement on the 3D printed light guide base ensure the rotation of the cage cubes with the dichroic mirror backings and the cage cube connectors matches the base as one of the widths is larger from the midpoint.

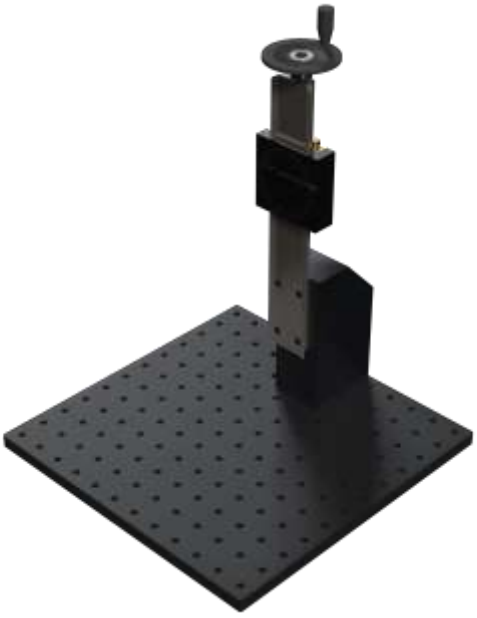


Platform Setup

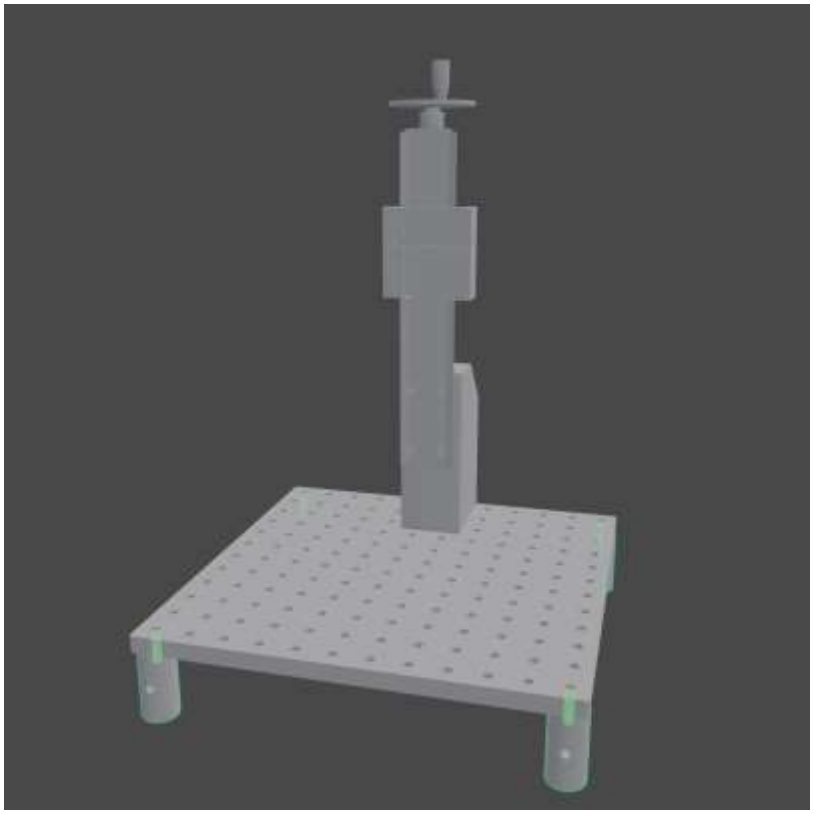
1) Drill 2 countersink holes at the edge of the 12 inch by 12 inch breadboard.



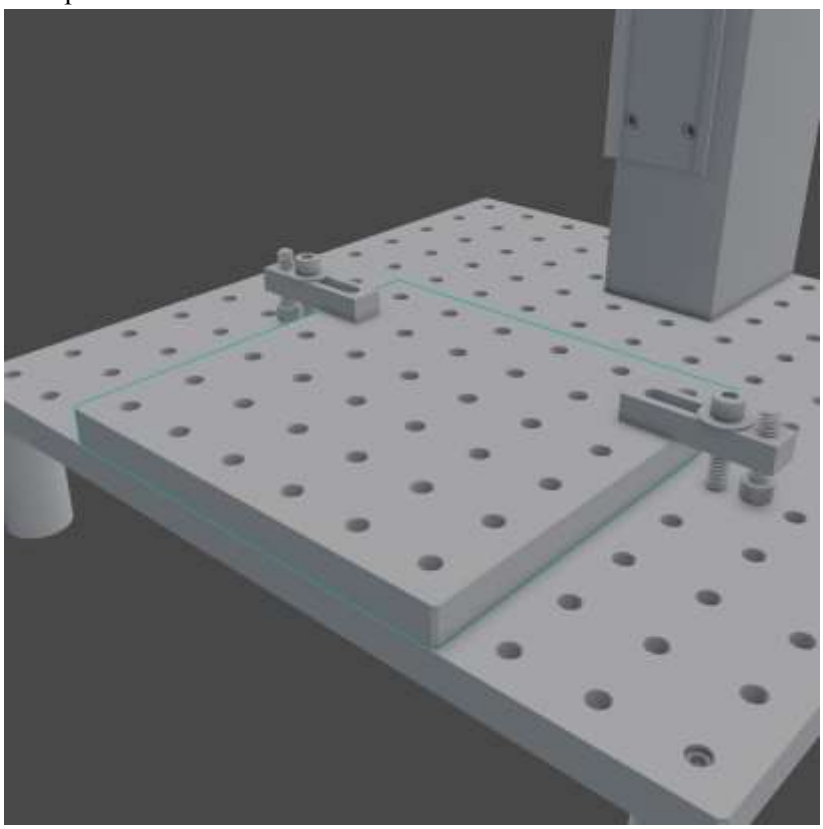
2) Attach the vertical milling mount on the plate using the provided bolt from Sherline.



3) To allow easier handling of the rig, attach the four 2 inch spacers from Siskiyou at the four corners of the breadboard using ¼-20 set screws.

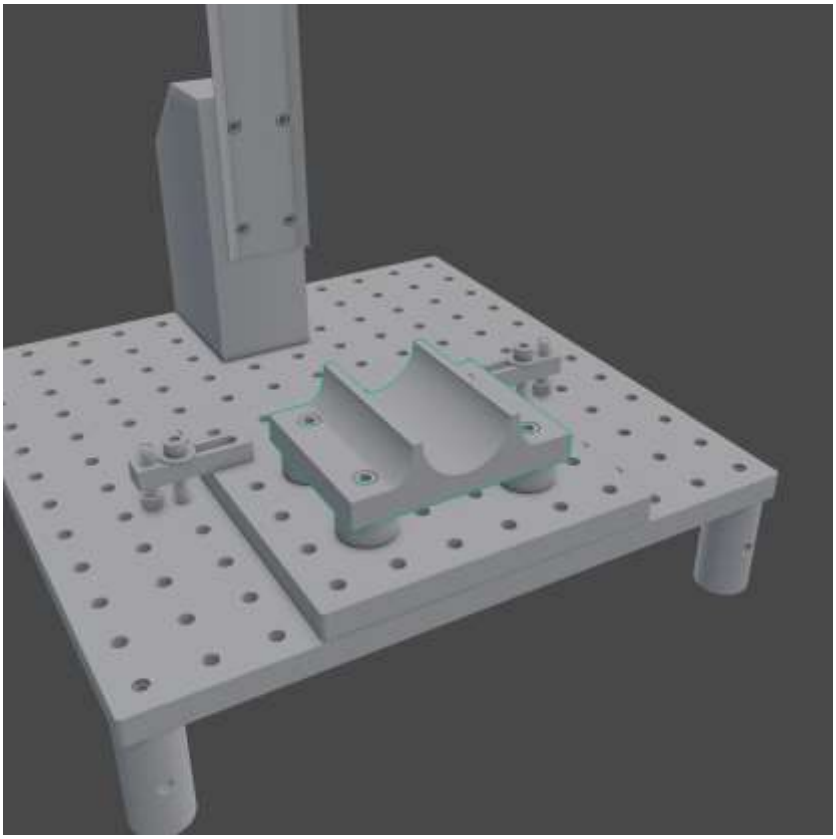


4) Place the 6 inch by 6 inch breadboard on top of the platform and secure using the 2 compact variable clamps from Thorlabs.

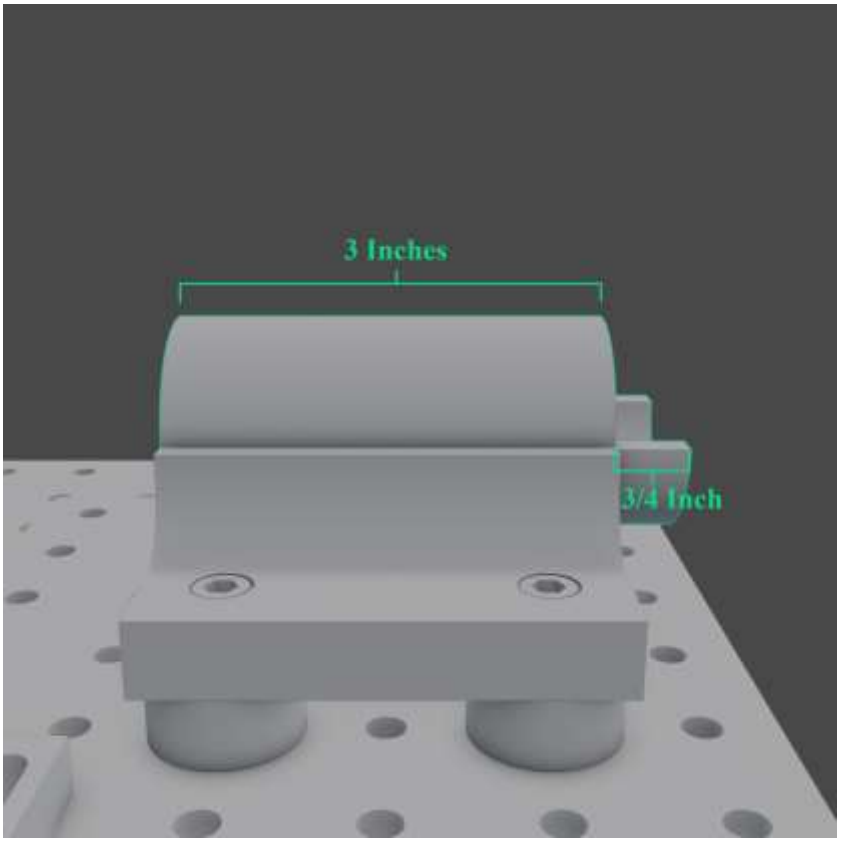


5) Using the four half inch spacers from Siskiyou, attach the 3D printed tube holder using ¼-20 screws, ensuring that they are not long enough to penetrate the entire breadboard and make

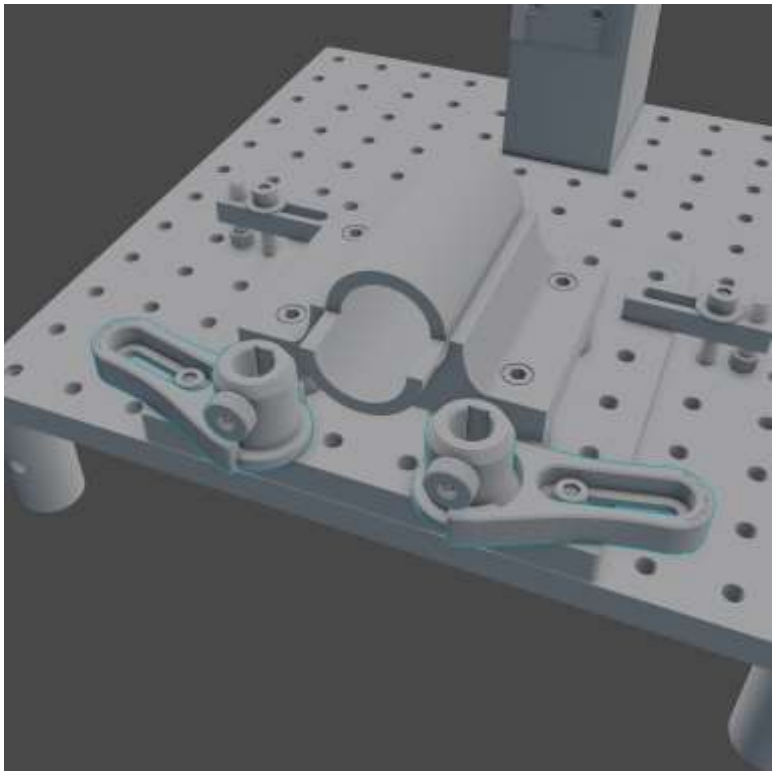
contact with the platform.



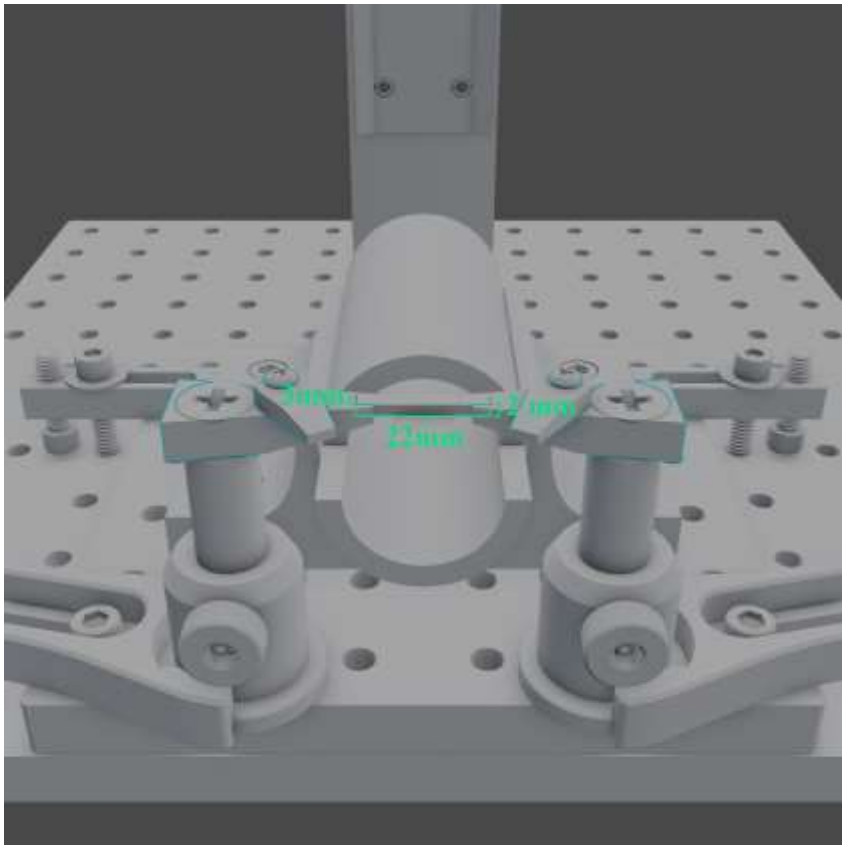
6) Cut and superglue the acrylic tubing as shown below



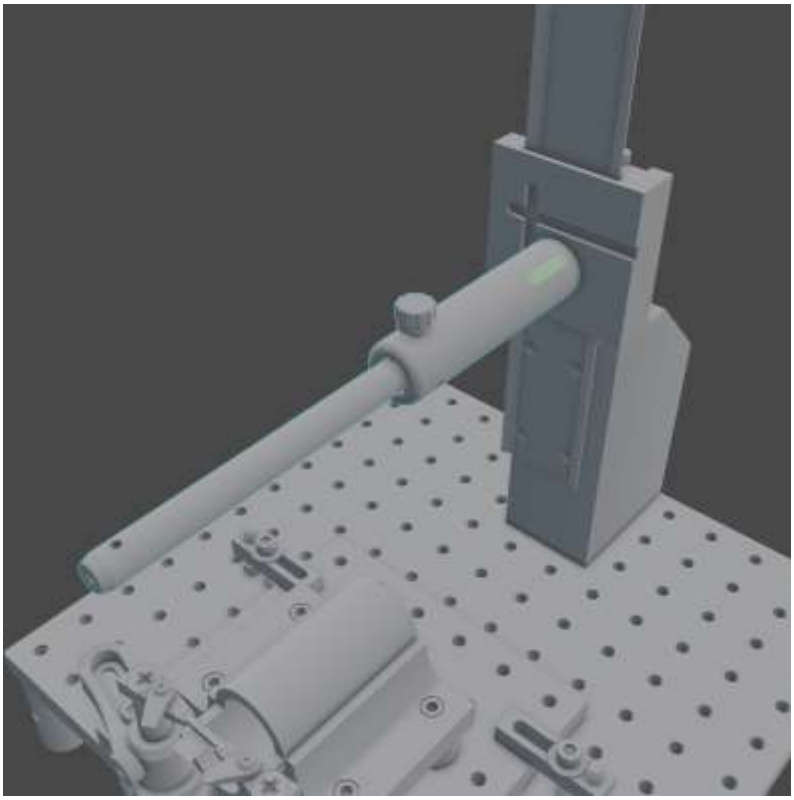
7) Clamp the pedestal post holders beside the forward segment of the tube. Do not tighten yet as adjustment for the bar clamps will need to be done.



8) Assemble the bar clamps and attach them to the 1.5 inch posts and place them on the pedestal post holders. At this point you can bring a bar to adjust the location of the fork clamps.

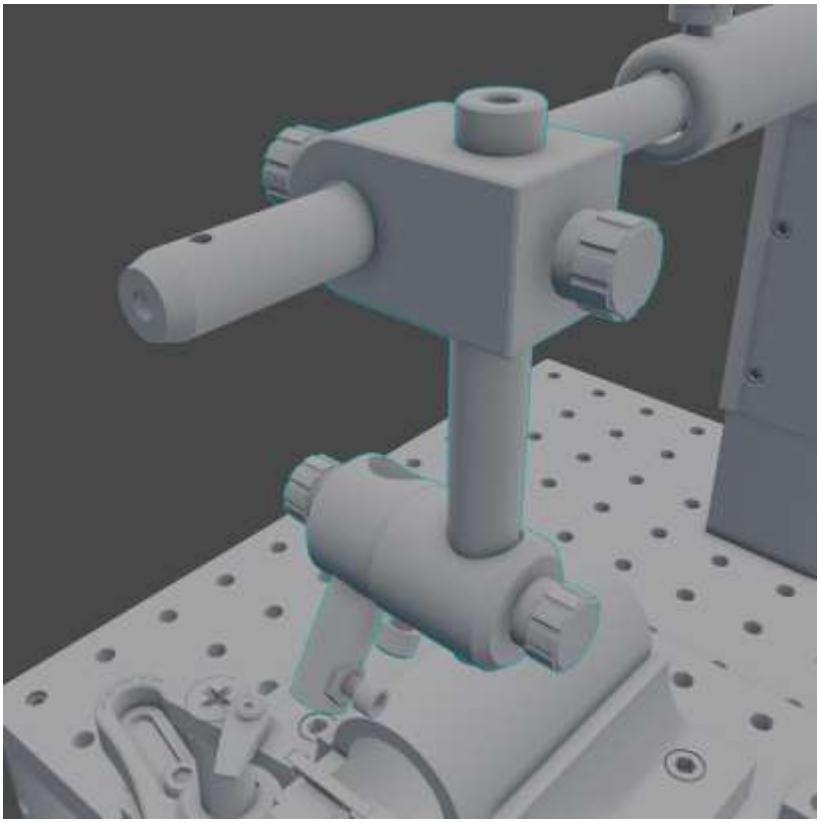


9) Using a ¼-20 set screw, attach the 4 inch post holder to the vertical milling mount and place the 6 ½ inch post in it.



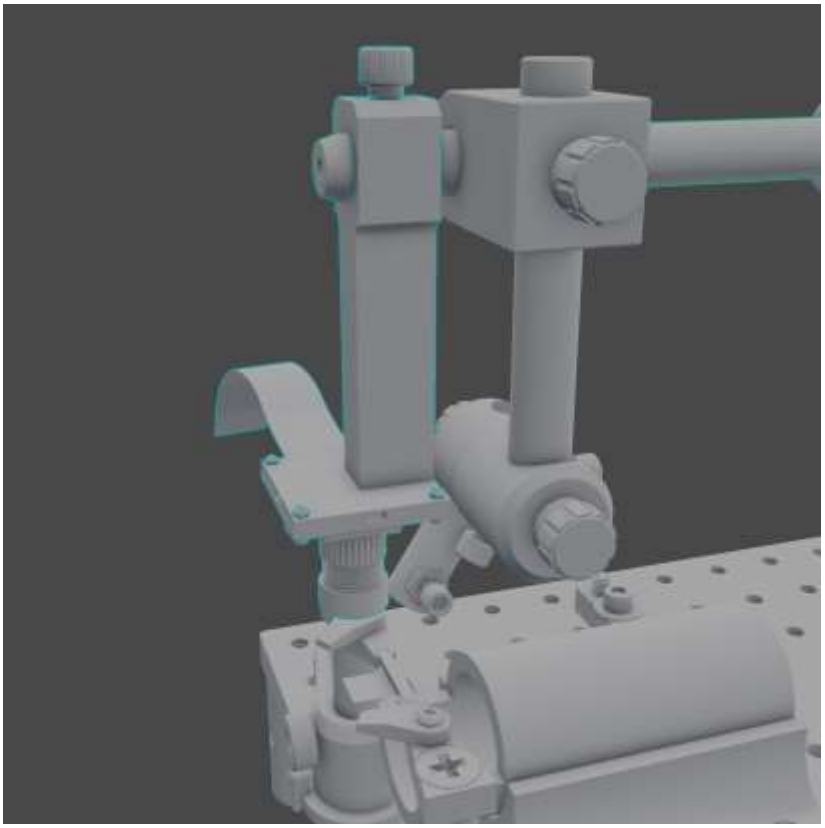
10) The liquid light guide will be projecting from the back of the mouse's head and will be attached using the 3D printed adaptor that has an 8/32 nut and bolt attached to it for securing the guide as shown below. You can super glue the nut in, ensuring that it does not slip into the guide's hole and prevents it from being slipped in.

11) The adaptor will be held in place using the rotatable clamp and right angle clamp from Edmund Optics with the 4 inch ½ inch post connecting them as shown below.

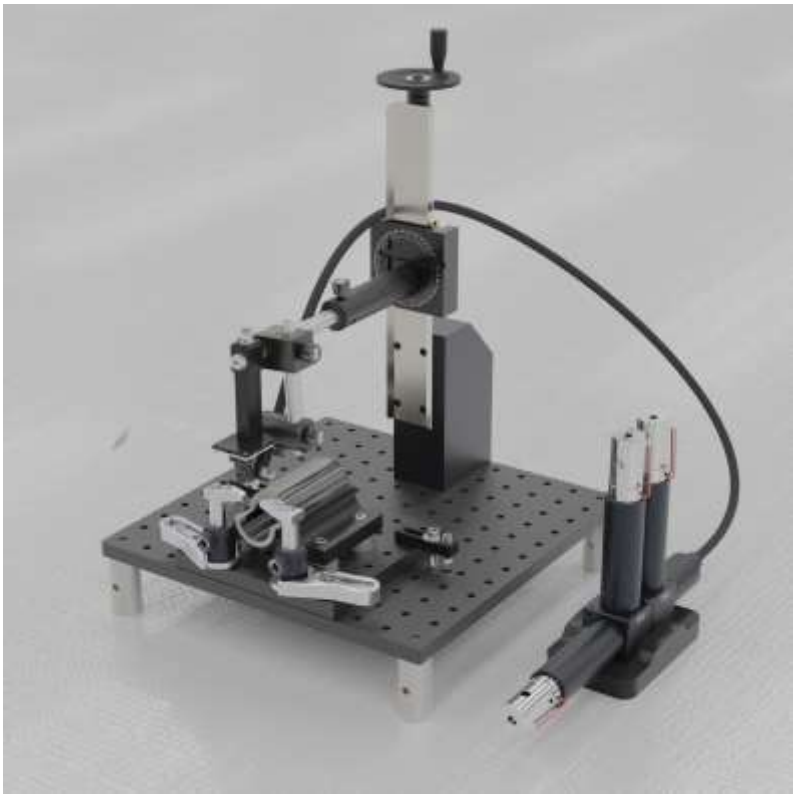


12) The camera mount will have a similar setup to the light guide adaptor in which you will need to superglue a ¼-20 nut to allow the fixation of the mount on the post. Attach the camera using 4 M2 screws (you may have to drill the holes on the camera board to match as they are made pretty small)

13) Attach the camera mount onto the ½ inch post and secure tightly. Due to the mismatched widths of the right angle clamp and rotatable clamp, you will have to rotate the right angle clamp so the light guide can come straight from the back.

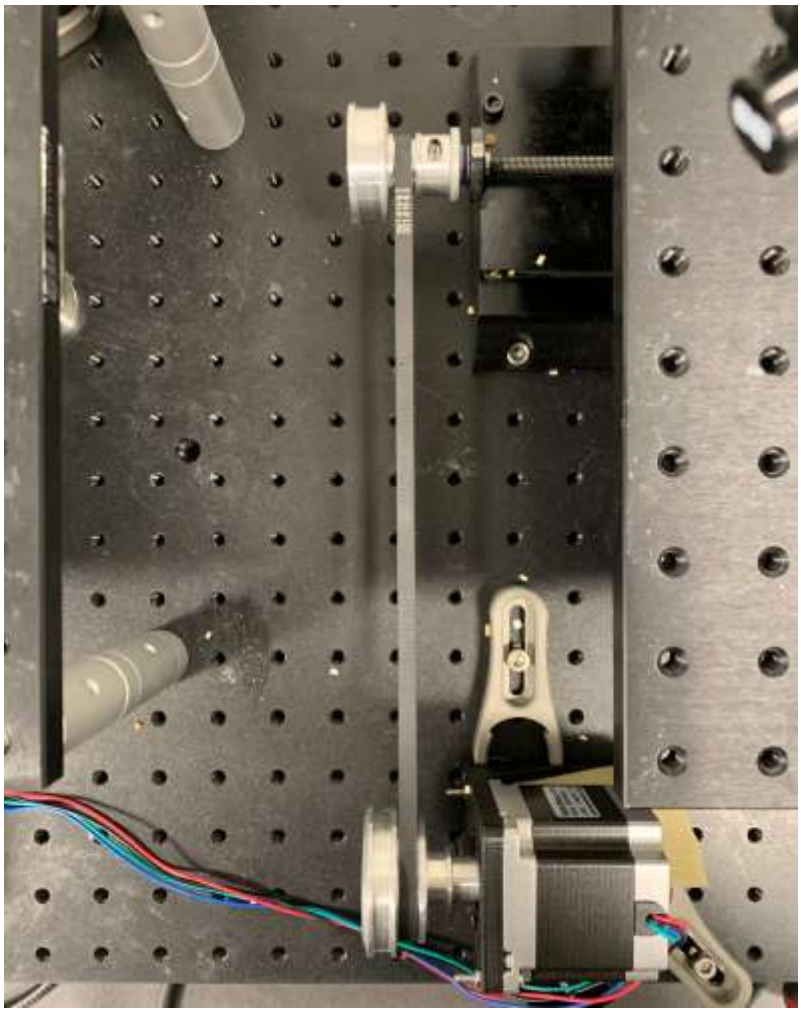


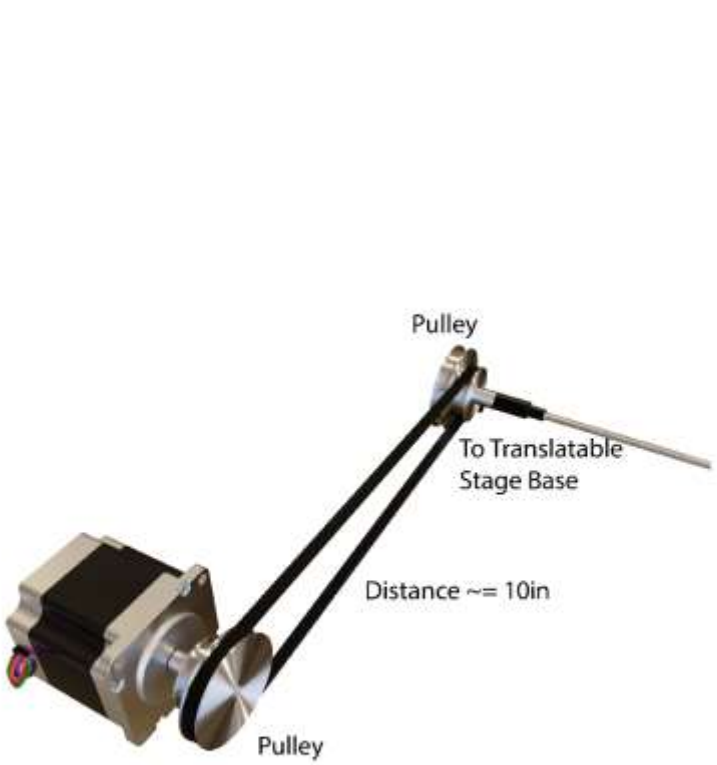
14) Attach the light guide to the mount and secure using the 8/32 bolt. A render of the completed rig is shown below.



Social interaction paradigm

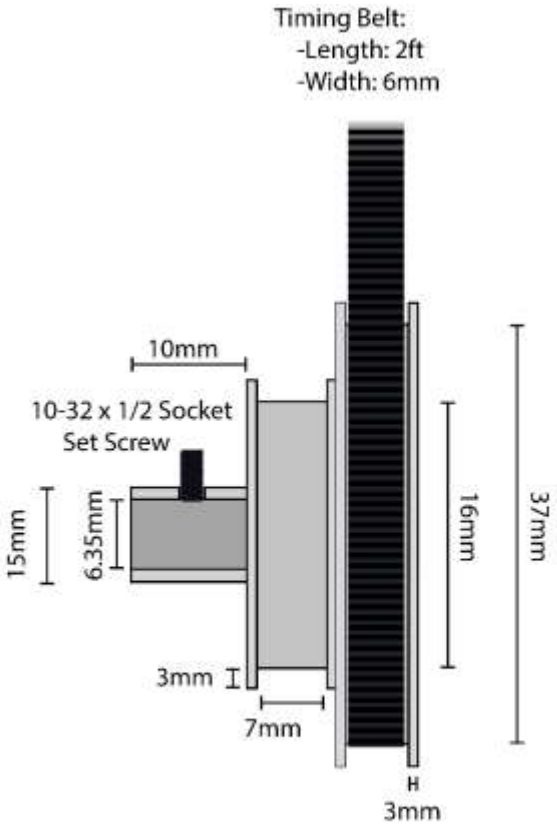
The social interaction paradigm consists of two opposing Raspberry Pi Widefield Imaging rigs, where one rig is placed atop a translatable rail (Sherline 5411 XY Milling Machine Base). The stage translation was driven by a stepper motor using aluminum pulleys and a timing belt. The stepper motor was mounted using a 3D printed L-bracket, which was fixed to the optical breadboard with two clamps. A small piece of foam was wedged between the motor and the L-bracket to dampen vibrations. Details regarding this configuration and the pulley dimensions are shown below.





Stepper Motor

http://cdn.sparkfun.com/datasheets/Robotics/57BYGH420-2.pdf



Machined out of
Aluminium