Living Architecture Exploration Kits: Component Catalogue

Living Architecture Systems Group

This folio describes a series of exploration kits that have been developed by the Living Architecture Systems Group. These exploration Kits encourage experimentation with interactive architectural constructions. The web-based software and the physical kit components that have been included within this set are part of an evolving collection of tools and component designs that have been developed by the Living Architecture Systems Group under Creative Commons licensing.

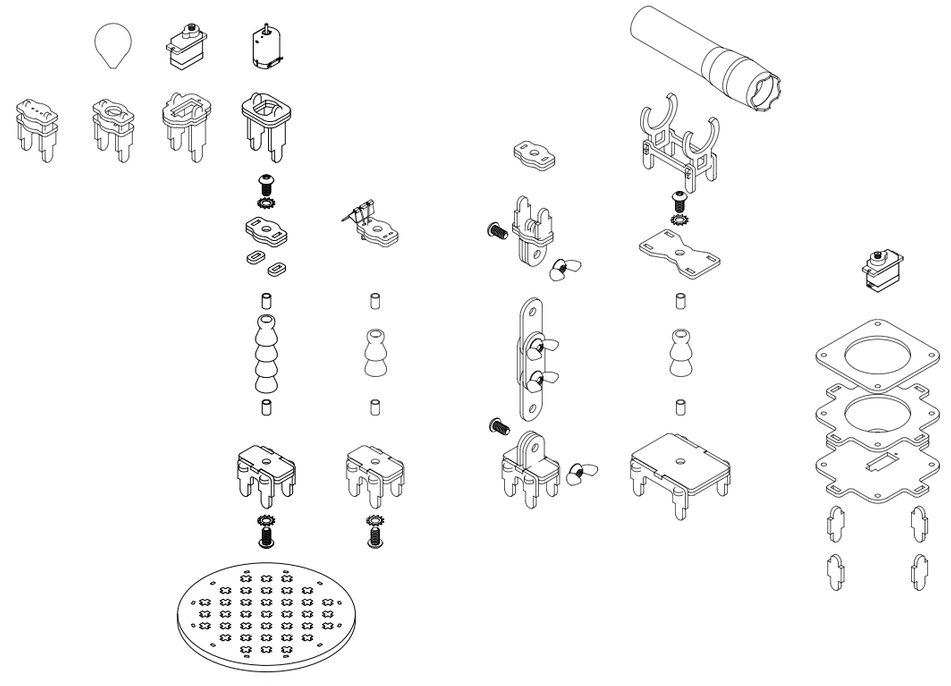
Included here are two kinds of elemental geometry kits titled Disk Hub and Star Hub for exploring nonelectronic structures, and a series of integrated system kits that include electronics and active devices.

These kits include components of skeletal lightweight architecture scaffolds, devices and mounts, and control electronics, accompanied by behaviour software and virtual interfaces. The kits are designed to encourage combinations of individual components within multiple distributed arrays.The scaffolds support electronic devices and behaviour software, interface and simulations, which in turn provide opportunities for programming and engineering. The kits in this folio use a range of materials, from rudimentary materials such as corrugated cardboard and bamboo skewers, to engineered high-performance materials including acrylic and stainless steel

ISBN 978-1-988366-54-8

9 781988 366548

Riverside Architectural Press



Living Architecture Exploration Kits

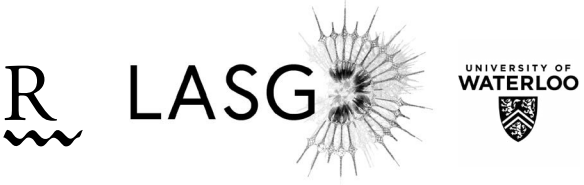
COMPONENT CATALOGUE

PHILIP BEESLEY, MICHAEL LANCASTER
& LIVING ARCHITECTURE SYSTEMS GROUP

R LASG UNIVERSITY OF WATERLOO

Living Architecture Exploration Kits
Component Catalogue

Philip Beesley, Michael Lancaster
& Living Architecture Systems Group



Publisher: Riverside Architectural Press
www.riversidearchitecturalpress.ca

© 2022 Living Architecture Systems Group and Riverside Architectural Press.
All rights reserved.

Title: Living Architecture Exploration Kits: Component Catalogue
Names: Beesley, Philip, 1956-author. | Lancaster, Michael, 1995-author. | Chîu, Adrian, 1996-editor | Lu, Glenn, 2000-editor. | Weeko Martin, Bianca, 1996-editor. | Living Architecture Systems Group, issuing body.

Description: Series statement: Living Architecture Systems Group folio series.

Identifiers: ISBN 978-1-988366-54-8

Publication: December 2022
Riverside Architectural Press
7 Melville Street
Cambridge, Ontario, N1S 2H4
Canada

Design and Production by Living Architecture Systems Group

The individual authors shown herein are solely respobsible for their content appearing within this publication.

This work is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 2.0 Generic License. To view a copy of this license, visit http://creativecommons.org/licenses/by-nc-sa/2.0/ or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.

Errors or omissions will be corrected in subsequent editions.
This book is set in Garamond and Zurich BT.

Social Sciences and Humanities Research Council of Canada
Conseil de recherches en sciences humaines du Canada

About the Living Architecture Systems Group

The publication forms part of a series of work-in-progress reports and publications by Living Architecture researchers and contributors. The Living Architecture Systems Group is an international partnership of researchers, artists, and industrial collaborators studying how we can build living architectural systems— sustainable, adaptive environments that can move, respond, and learn, and that are inclusive and empathic toward their inhabitants. "Smart" responsive architecture is rapidly transforming our built environments, but it is fraught with problems including sustainability, data privacy, and privatized infrastructure. These concerns need conceptual and technical analysis so that designers, urban developers and architects can work positively within this deeply influential new field.[1] The Living Architecture Systems Group is developing tools and conceptual frameworks for examining materials, forms, and topologies, seeking sustainable, flexible, and durable working models of living architecture.

A series of far-reaching critical questions can be explored by using the tools and frameworks that are described within this specialized publication series: can the buildings that we live in come alive? Could living buildings create a sustainable future with adaptive structures while empathizing and inspiring us? These questions can help redefine architecture with new, lightweight physical structures, embedded sentient and responsive systems, and mutual relationships for occupant that provide tools and frameworks to support the emerging field of living architecture. The objective of this integrated work envisions embodied environments that can provide tangible examples in order to shift architecture away from static and inflexible forms towards spaces that can move, respond, learn, and exchange,[2] becoming adaptive and empathic toward their inhabitants.[3]

1 Kas Oosterhuis and Xin Xia, *iA #1, Interactive Architecture* (Rotterdam: Episode Publishers, 2007); Nicholas Negroponte, *Being Digital* (New York: Vintage Books, 1995); Lucy Bullivant, *4dsocial: Interactive Design Environments* (London: AD/John Wiley & Sons, 2007); Neil Spiller, *Digital Architecture Now: A Global Survey of Emerging Talent* (London: Thames & Hudson, 2009). Michael Fox and Miles Kemp, *Interactive Architecture* (Princeton: Princeton Architectural Press, 2009).

2 For example the Living Architecture (LIAR) next-generation, selectively programmable bioreactor developed by LASG Metabolism Stream Lead Rachel Armstrong, Newcastle, uses microbial processes to generate electricity, oxygen, fertiliser, and other life-sustaining outputs from waste (carbon dioxide, grey water) that would otherwise be ejected from a building: "Living Architecture LIAR," accessed February 2, 2022, https://livingarchitecture-h2020.eu/.

3 Bullivant, *4dsocial.*

Contents

1 Introduction

3 Geometry Kits
5 Disc Hub Exploration Kit
9 Archimedean Polyhedra Geometry Kit
15 Star Hub Exploration Kit

19 Interactive Environment Kits
21 Sound and Shadow Performance Kit
33 Interactive Cell Exploration Kit

48 References

49 Open Access LASG Publications

50 Credits

Introduction

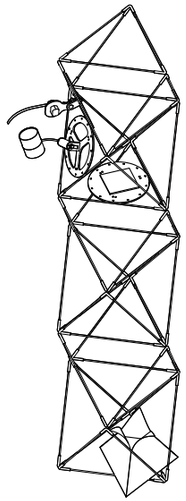
This folio describes a series of exploration kits that have been developed by the Living Architecture Systems Group. The accompanying volume, titled *Living Architecture Exploration Kits: Introductory Assemblies*[4] provides additional patterns that can be constructed using combinations of these components.

These kits include components of skeletal lightweight architecture scaffolds, devices and mounts, and control electronics. The kits are accompanied by behaviour software and virtual interfaces, described in accompanying folio volumes.The web-based software and the physical kit components that have been included within this set are part of an evolving collection of tools and component designs that have been developed by the Living Architecture Systems Group under Creative Commons licensing.

This kit has been developed in order to provide individual devices containing actuators and sensors with local "intelligence". These exploration kits encourage experimentation with interactive architectural constructions. The kits are designed to encourage combinations of individual components within multiple distributed arrays. The distributed organization of many inexpensive, small components can result in textile-like fabric surfaces that can be used in the creation of responsive architectural envelopes and canopy structures. The kits in this folio use a range of materials, from rudimentary materials such as corrugated cardboard and bamboo skewers, to engineered high-performance materials including acrylic and stainless steel.

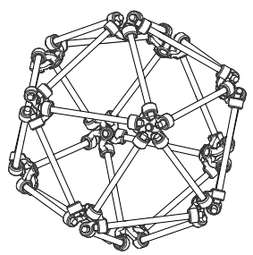
Components described here include interlinking scaffolds and electronic devices. These physical components are coupled to behaviour software, interface and simulations, which in turn provide opportunities for programming and engineering. Custom-written software titled "Smart Cell" accompanies this component series. Smart Cell interfaces support flexible development of distributed systems that can be easily multiplied and prototyped. Smart Cells take the forms of both physical electronic hardware and virtual software simulations and control modules. In parallel with individual physical devices, digital models can be constructed in order to create digital twins of designs. In turn, these virtual forms can be integrated with simulations of dynamic mechanisms and sensor networks, creating a wide range of interactive architectural constructions.

4 *Living Architecture Exploration Kits: Introductory Assemblies* can be found on LASG's website at https://livingarchitecturesystems.com/publications/



above

Endless Connections Domaine de Boisbuchet Kit, LASG/PBSI

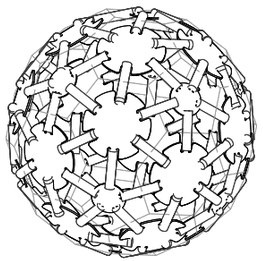


above

Star Hub Exploration Kit, LASG

top

Meander at Tapestry Hall, Cambridge, 2020, LASG/PBSI
The immersive installation is based on the same polyhedra as the Disc Hub and Star Hub Exploration Kits.

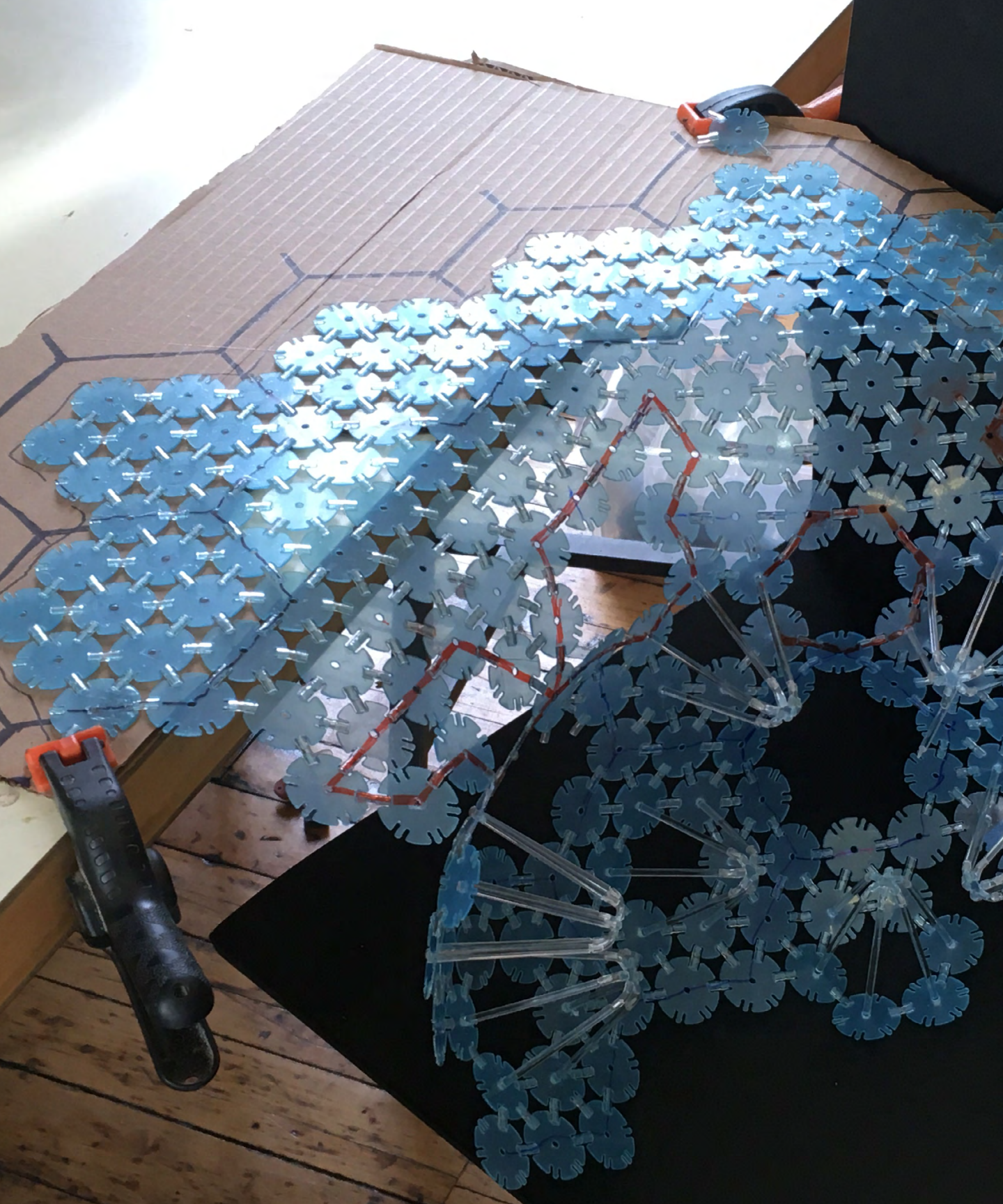


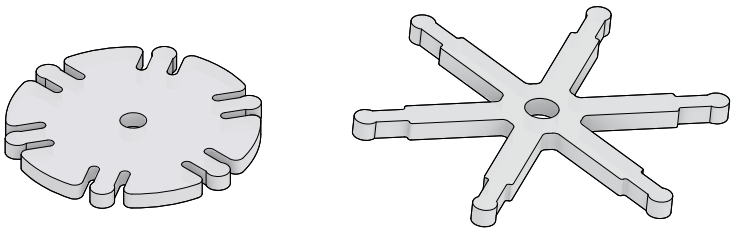
above

Disc Hub Exploration Kit, LASG

Scaffolds are the physical structures that support the exploration kits' devices, mounts, and electronics. Scaffolds can be constructed from lightweight efficient material such as bamboo skewers and wood skewers, and connected using acrylic, polyurethane, or flexible tubing. Mounts are attached to scaffolds to carry electronics parts. The mounts are the intermediary links that enable the scaffolds' interactive functions. These mounts include laser-cut plates and disks of thin wood-based and cardboard sheet materials. Electronic hardware is included within these kits, supporting exploration of motion, light, and sound. Mounted devices include light emitting diode (LED) actuators, direct current motor actuators, light dependent resistor sensors, and passive infrared sensors.

Living Architecture Exploration kits have been distributed and used at Domaine de Boisbuchet, Poitiers, France; LAUNCH Waterloo, Canada; and TU Delft, the Netherlands. Users have ranged from grade school students to adult workshop participants. The exploration kits are continuously evolving to accommodate new design objectives and user groups.





Geometry Kits

above

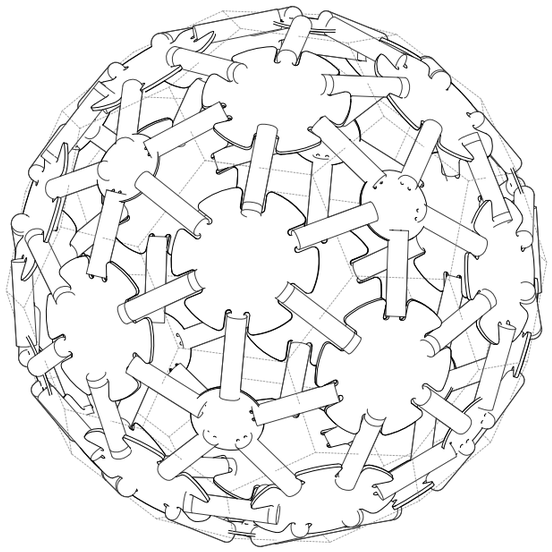
Various generations of LASG's Geometry Kit's connectors

facing

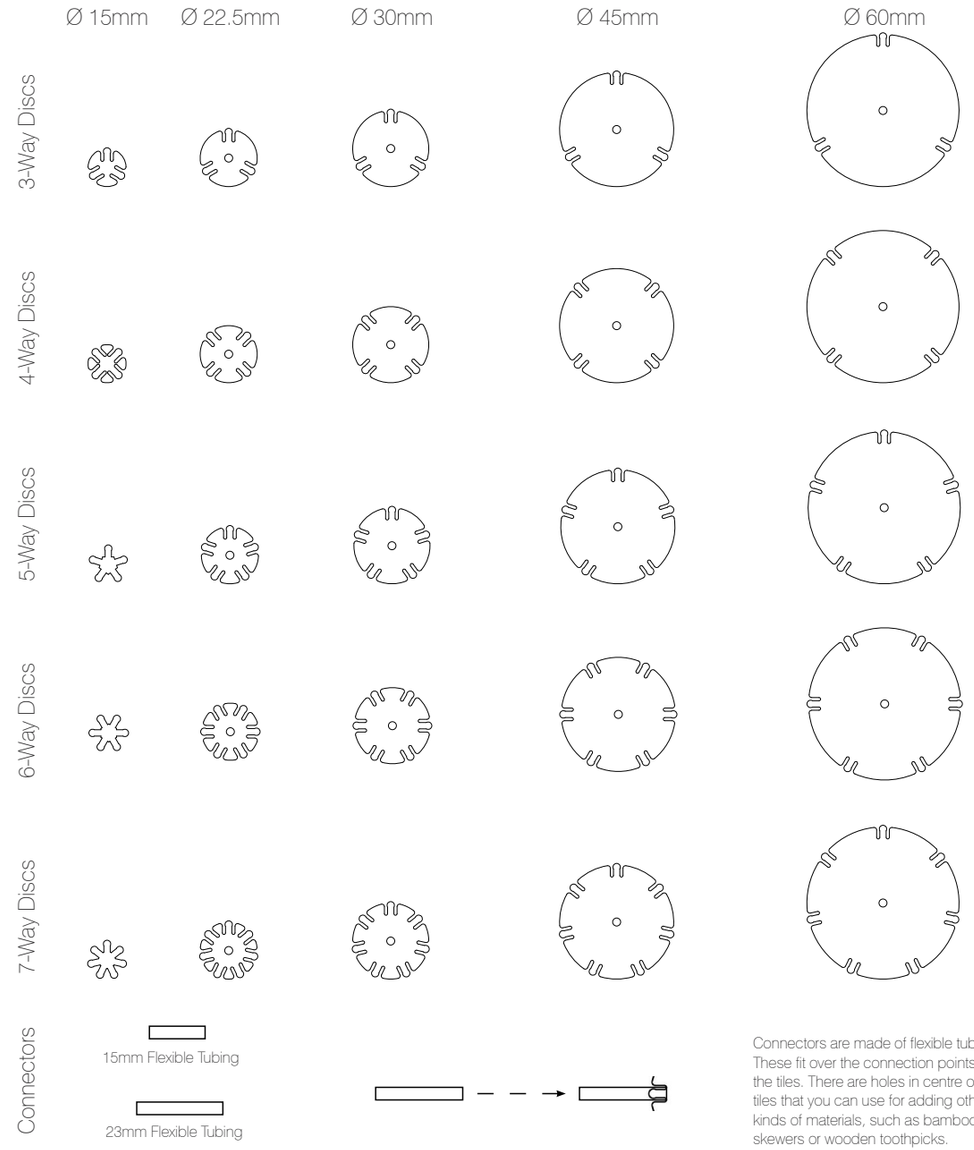
LASG Disc Hub Exploration Kit used for design development of Meander in Tapestry Hall, Cambridge

The following section of this folio documents Living Architecture Exploration Kits that explore Archimedean polyhedra and other geometric explorations, titled Star Hub Exploration Kit, Disc Hub Exploration Kit and Archimedean Polyhedra Geometry Kit. Illustrated bill of materials provides quantities so that kits can easily be assembled from home. Assembly patterns and possible configurations are shown. These kits are intended to accommodate new explorations and form finding exercises.

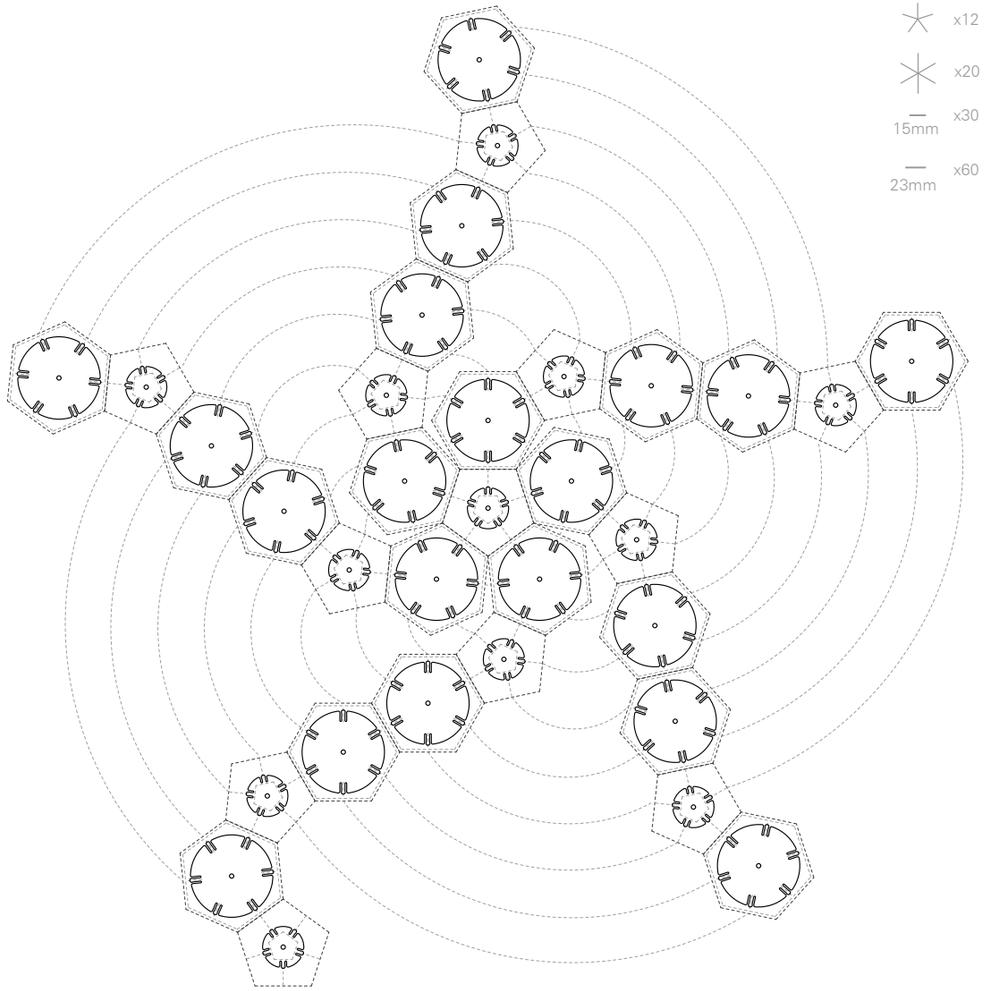
Disc Hub Exploration Kit



The LASG Disc Hub Exploration Kit is made up of laser cut discs and PVC tubing, in two standard cut lengths. This system can be used to construct the full suite of Archimedean polyhedra as well as further explorations.



Component Lexicon

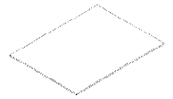


Truncated Icosahedron Assembly

To make this shape, a truncated icosahedron, use 15mm tubes to connect hexagonal tiles and 23mm tubes to connect hexagonal tiles to pentagonal tiles.

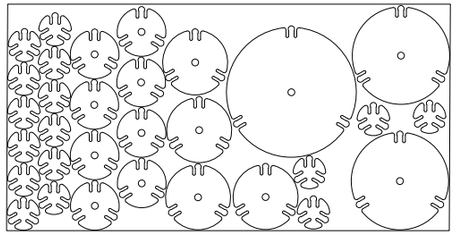
Materials

Millboard/PETG/Acrylic Sheet
12x24in, 1mm Thick
(divided into 5 4x8in sheets)

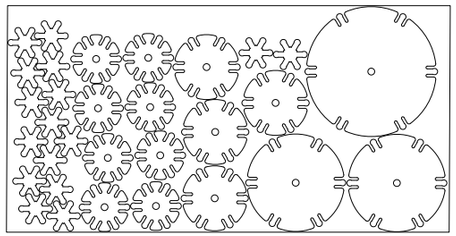


Flexible Tubing
12x24in, 1mm Thick

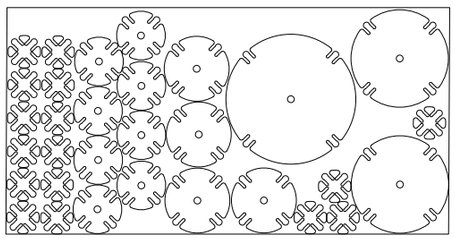
Cut Sheets



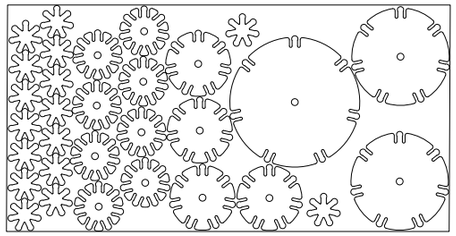
3-Way Discs



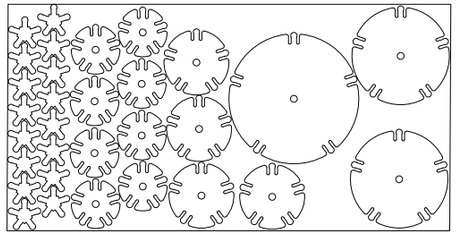
6-Way Discs



4-Way Discs



7-Way Discs



5-Way Discs

Each 4x8in Sheet Contains:

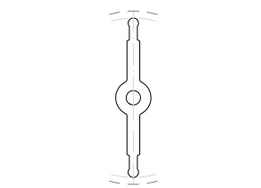
Ø 15mm	x16
Ø 22.5mm	x8
Ø 30mm	x4
Ø 45mm	x2
Ø 60mm	x1

Archimedean Polyhedra Geometry Kit

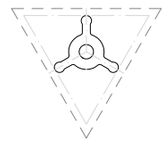
Designed by and named after Greek mathematician Archimedes in the 3rd Century BCE, the Archimedean Solids are a group of thirteen semi-regular convex polyhedra whose faces are composed of regular polygons with symmetrically identical vertices. The LASG Geometry Kit recreates the Archimedean Solids through a combination of uniquely designed polygon acrylic plates and tubing of varying sizes. The kit provides an opportunity to explore the forms and language of traditional geometry, and build arrays and combinations of polyhedral forms. It is intended to create familiarity with the terminology and basic form-language of polyhedra and related constructions. Published as separate volumes, a 2020 volume titled *Geometry Kit: Archimedean Polyhedra Folio* and a later volume entitled *Star Hub Exploration Kit* accompany these physical kits, providing a lexicon of parts and complete polyhedron assemblies. Digital fabrication patterns are included within these volumes, providing patterns that can be adapted for personal use. Graphic scales are included on polyhedron cutsheet pages. These can be matched with laser-cuttable sheets provided in the Geometry Kit in order to guide adaptation and assembly.

link

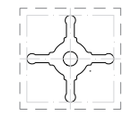
https://livingarchitecturesystems.com/publication/geometry-kit/
Link to associated folio *Geometry Kit: Archimedean Polyhedra*



2-Way Unit

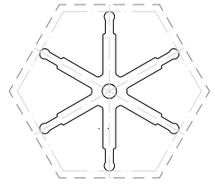


3-Way Unit



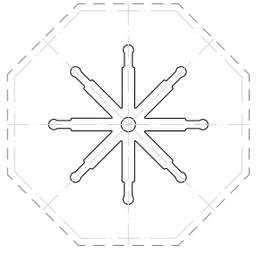
4-Way Unit

5-Way Unit

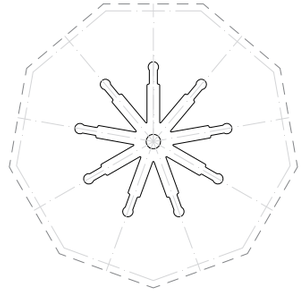


6-Way Unit

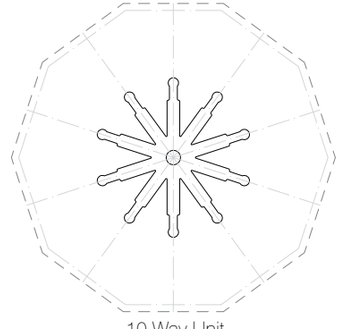
7-Way Unit



8-Way Unit

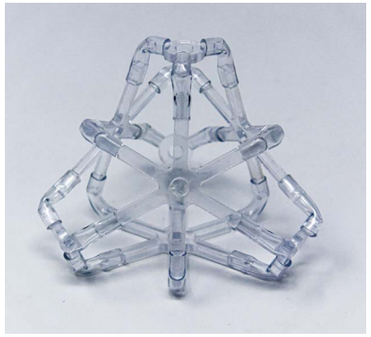


9-Way Unit



10-Way Unit

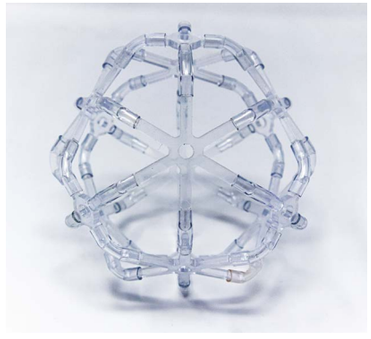
Component Lexicon



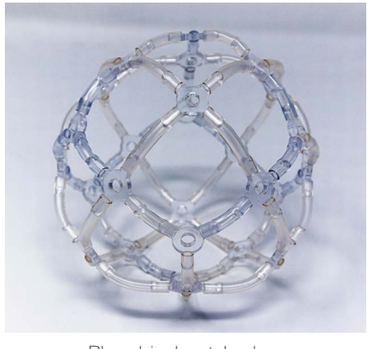
Truncated Tetrahedron

Cuboctahedron

Truncated Cube



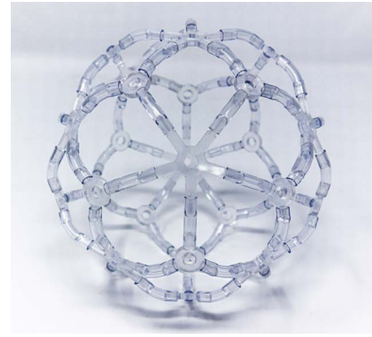
Truncated Octahedron



Rhombicuboctahedron

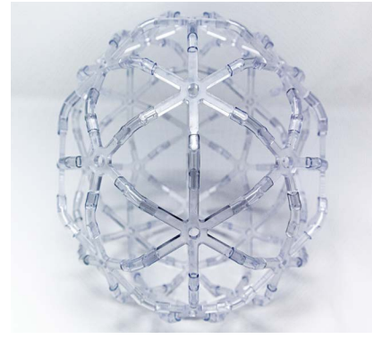
Truncated Cuboctahedron

Snub Cube

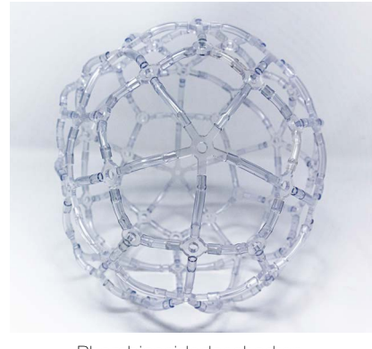


Icosidodecahedron

Truncated Dodecahedron



Truncated Icosahedron

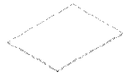


Rhombicosidodecahedron

Truncated Icosidodecahedron

Materials & Cut Sheets

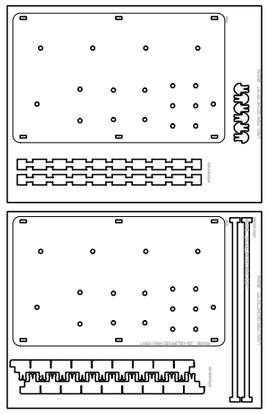
ACRYLITE® Resist™ 65 Acrylic Sheet
8x10 inches, 3mm thick
Specs: 12 sheets for Archimedean Polyhedra
2 sheets for Basic Exploration
11 sheets for Expanded Exploration



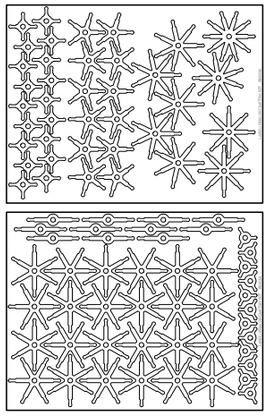
McMaster PVC Tubing
OD 1/4 inch, ID 1/8 inch
Specs: 50/100 ft

McMaster Extruded Acrylic Rod
L10.6mm, D1/8 inch
Specs: 18 pieces

Base & Miter Board



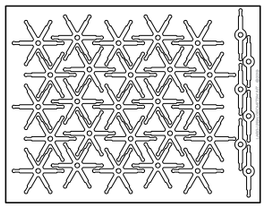
Basic Edition



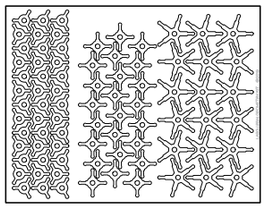
Basic exploration kit allows for the assembly of select polyhedra described in this folio.

- x12
- x11
- x16
- x12
- x24
- x5
- x2
- x1
- x1

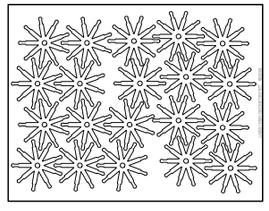
Expanded Edition



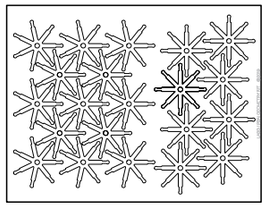
x6



x1



x1



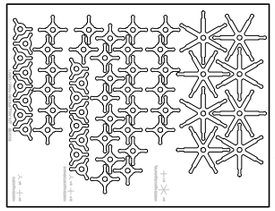
x1

Expanded exploration kit allows for assembly of all polyhedra described in this folio, as well as further experimental form-finding.

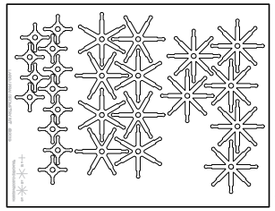
- x36
- x39
- x24
- x18
- x150
- x13
- x8
- x10
- x10

Individualised Cut Sheets

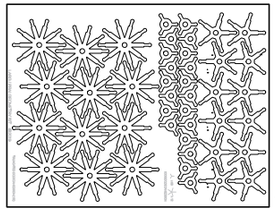
These sheets are individualised for specific polyhedra and can be cut as a stand alone or be cut altogether to produce the entire Archimedean Polyhedra Geometry Kit



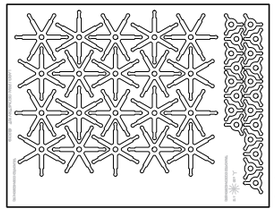
Truncated Octahedron
Rhombicuboctahedron
Cuboctahedron



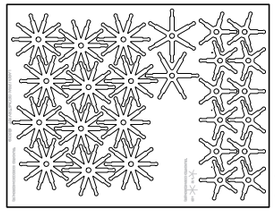
Truncated Cuboctahedron



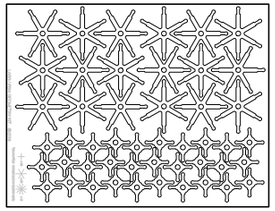
Icosidodecahedron
Truncated Dodecahedron (1/2)



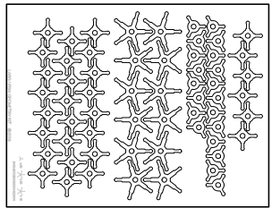
Truncated Dodecahedron (2/2)
Truncated Icosahedron (1/2)



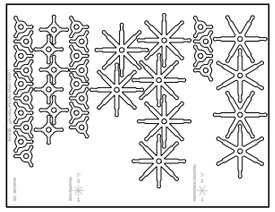
Truncated Icosahedron (2/2)
Truncated Icosidodecahedron (1/2)



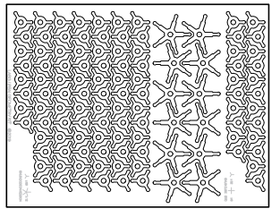
Truncated
Icosidodecahedron (2/2)



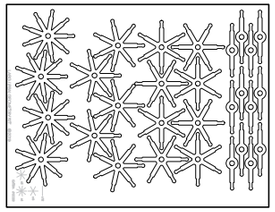
Rhombicosidodecahedron



Truncated Tetrahedron
Truncated Cube
Snub-Cube (1/2)



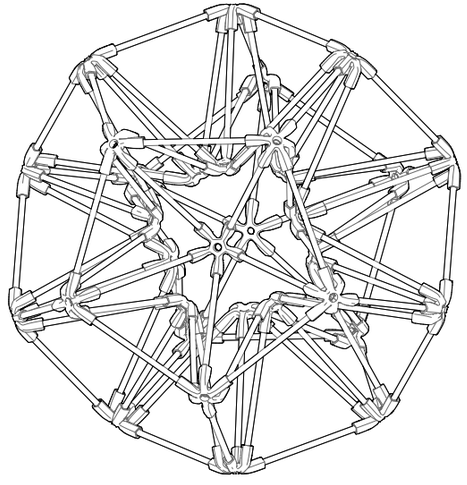
Snub-Cube (2/2)
Snub Dodecahedron



Extra Pieces

- x14
- x200
- x108
- x48
- x72
- x5
- x10
- x4
- x24

Star Hub Exploration Kit



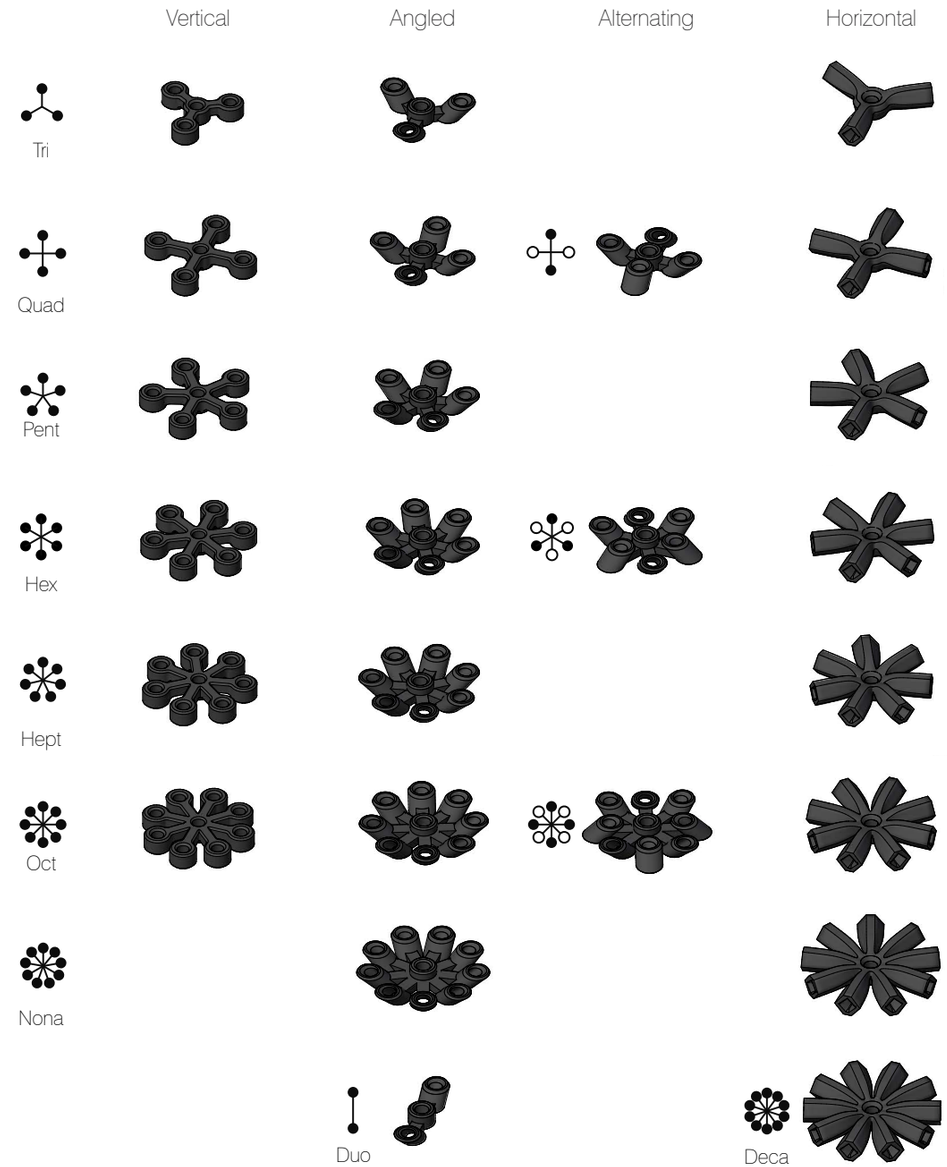
A construction kit was developed in 2022 by the Living Architecture Systems Group employing soft, resilient star-shaped socket joints combined with short push-in struts. By combining arrays of these joints and struts, many kinds of geometric organizations can be easily explored. The LASG Star Hub Exploration Kit is made up of 3D printed polyurethane hubs and wooden skewers. This system can be used to construct the full suite of Archimedean polyhedra as well as further explorations. Textile-like cellular fabrics can easily be explored by using the kit components.

Fold-up patterns involving complex arrays of cellular tiles can readily be accommodated. The flexible joints support translation from two-dimensional unfolded tile layouts into three-dimensional spherical and hyperbolic forms. The compliant joints employed within this construction system introduce flexibility and bi-stable qualities. Flexible hinging within the joints permits concave and convex formations to shift into new positions, introducing substantial opportunities for kinetic functions to develop.

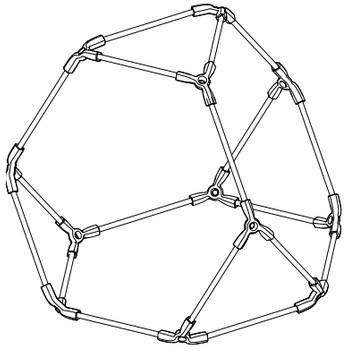
Downloadable 3D printable patterns and assembly instructions are included within this publication, supported by open-source Creative Commons licensing that permits adaptation and extension of the construction kit.

link

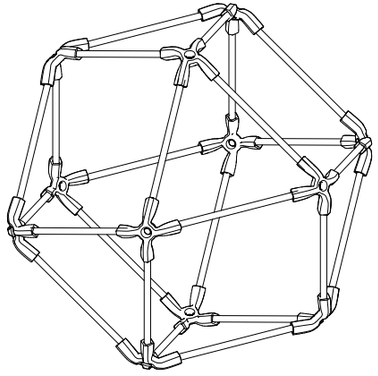
https://livingarchitecturesystems.com/publication/star-hub-kit-exploring-archimedean-polyhedra/
Link to associated folio: *Star Hub Kit: Exploring Archimedean Polyhedra*.



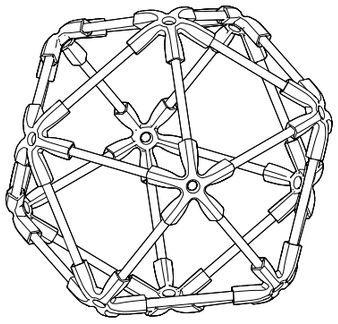
Component Lexicon



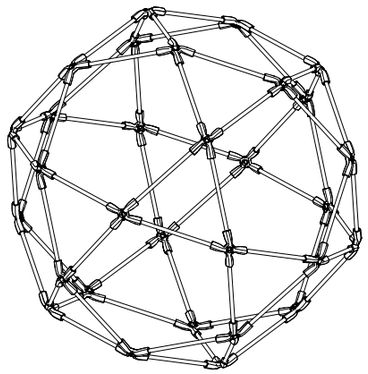
Truncated Tetrahedron



Cuboctahedron

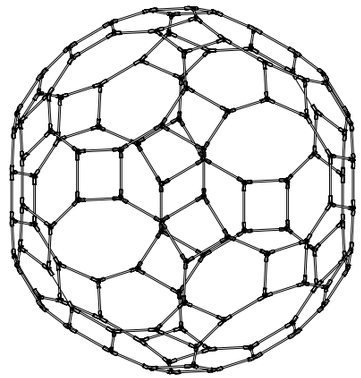


Icosahedron

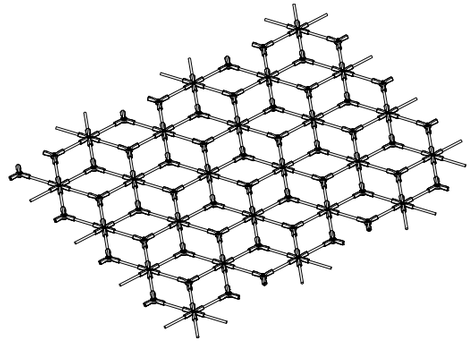


Icosidodecahedron

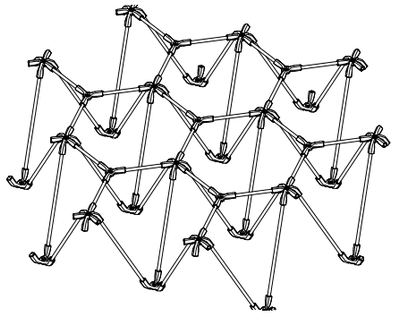
Geometry Lexicon



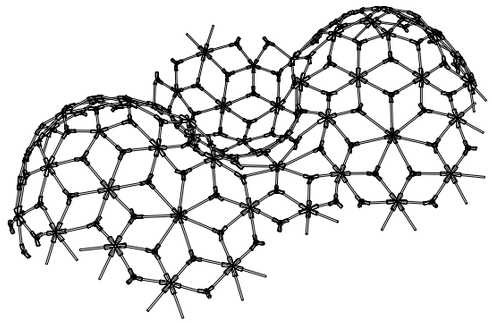
Truncated Icosidodecahedron



Cloud

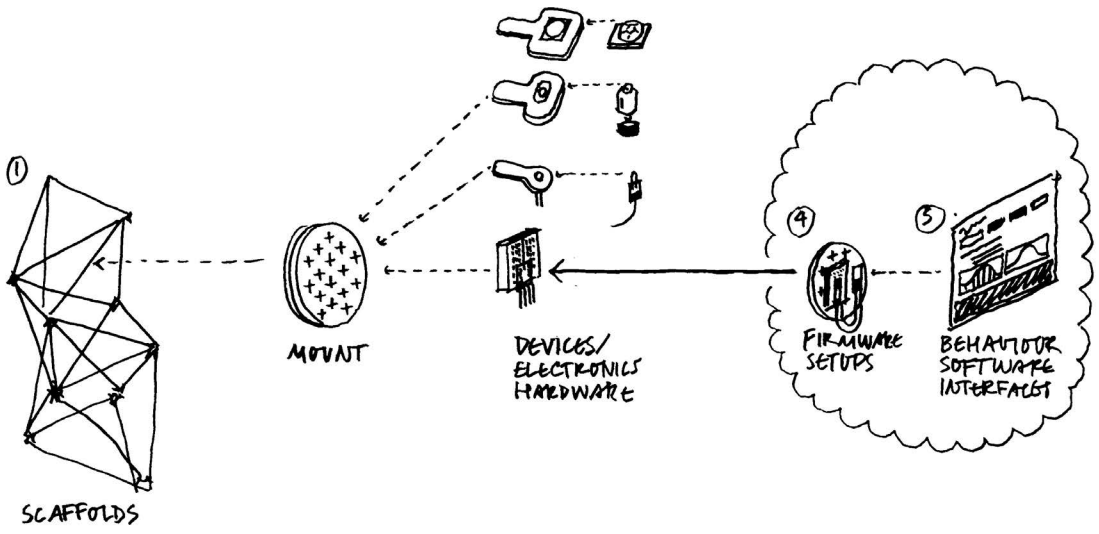


Waffle



Crenellated Membrane

Geometry Lexicon



Interactive Environment Kits

above

Conceptual diagram of the overall Smart Cell System and how it interfaces with LASG's Interactive Environment Kits

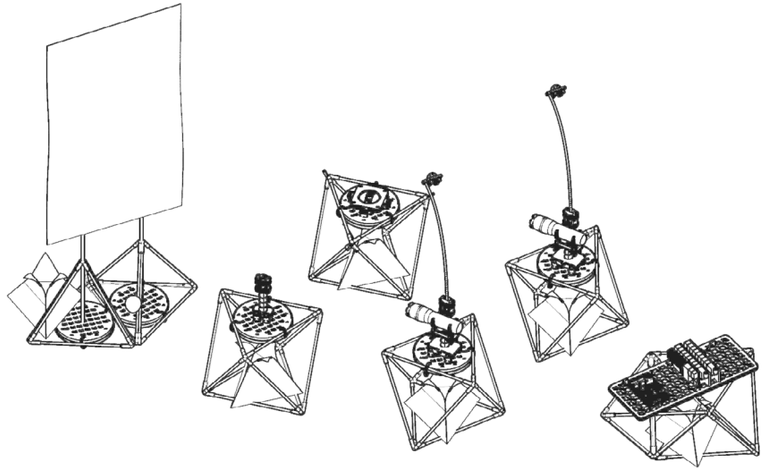
facing

LASG Disc Hub Exploration Kit used for design development of Meander in Tapestry Hall, Cambridge

The following section of this folio documents Living Architecture Exploration Kits exploring interactive environments: the Sound and Shadow Performance Kit and the Interactive Cell Exploration Kit. These kits have been assembled and distributed in collaborative workshops that have been developed at various educational venues. Each kit is documented through an illustrated bill of material list and assembly diagrams of actuator and sensor modules that serve as a basis for larger construction when used in combination. Examples of potential assemblies of multiple modules that combine to form interacting systems can be found in the accompanying folio *Living Architecture Exploration Kits: Introductory Assemblies.*[5]

5 *Living Architecture Exploration Kits: Introductory Assemblies* can be found on LASG's website at https://livingarchitecturesystems.com/publications/

Sound and Shadow Performance Kit



This kit supported a performance of sound and light. Shadows and Whispers: Emerging Forms at the Edges of Nature was a workshop that produced an environment mounted within a stone barn in Lessac, France. The workshop brief asked evocative questions, speculating that within whispering sounds, new voices might be heard, and within glimmering shadows, dream-like worlds might be seen. Could nature and technology cross over and combine into new forms? What can we learn from the patterns of nature and, in reverse, what can we offer nature? Could the subtle boundaries between artificial and natural worlds hold keys to new kinds of harmony in our expanded, turbulent world? Workshop participants created an interwoven new world, operated with the support of technical and digital devices and installed within Boisbuchet's unique architecture and nature. The final environment consisted of a projection screen, sound and lighting devices, and numerous skeletal interaction systems making a theater of shadows and garden of forms.

Four construction kits including introductory stations, scaffolds, geometry explorations, and electronics hardware and software were combined to support the exploration and creation of polyhedra, geotextiles, and truss systems, activated by electronics and sound. The Shadows and Whispers workshop preceding the installation focused on sound, light, and the boundaries between movement and sound. Initial intensive building exercises included a series of experimental perception exercises. Patterns of movement, clapping, whispering, and singing led to phased overlapping systems. These collective exercises were accompanied by talks and explorations. In the final installation, fields of new space were created by using artificially created sounds and tones, interwoven with lights and shadows.

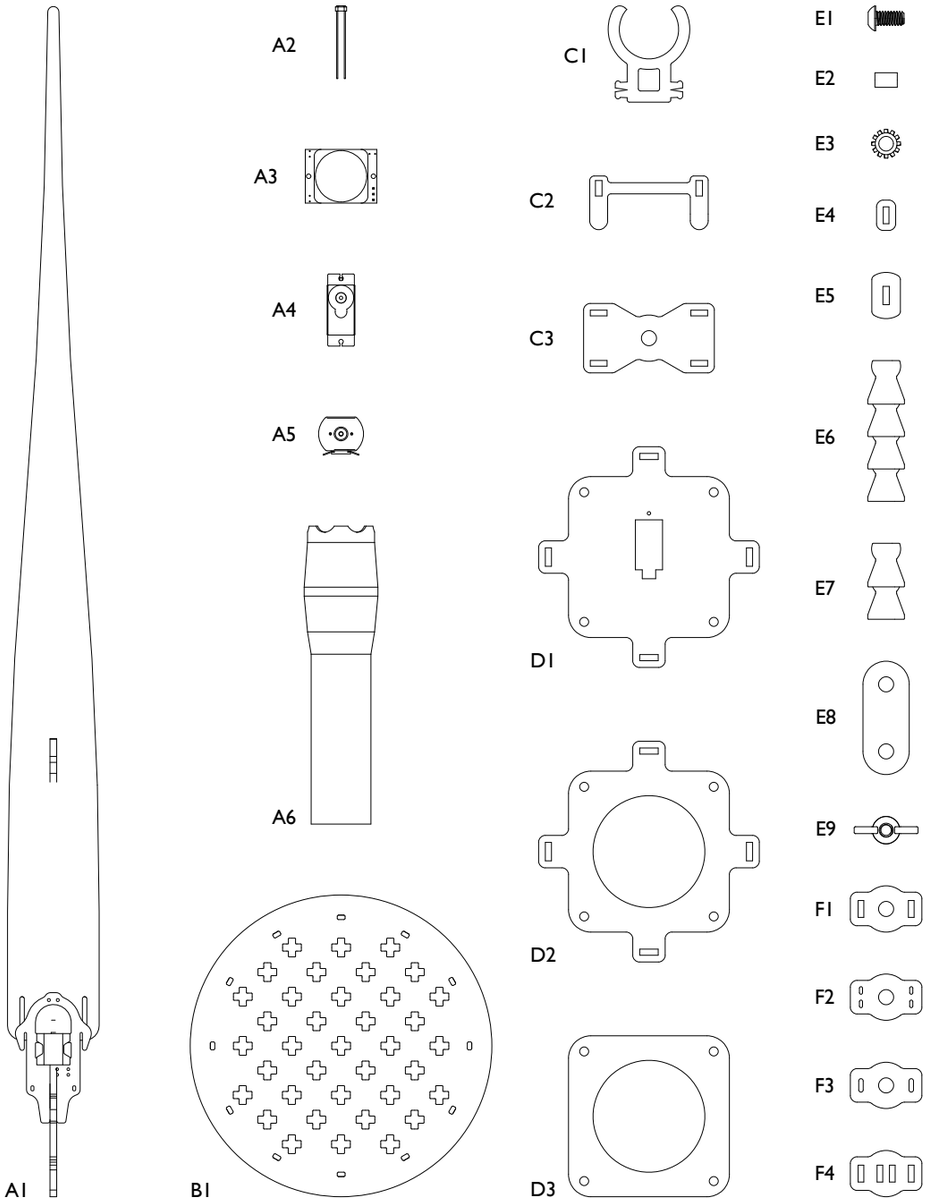
1

2

3 4 5

Raw Construction Materials & Cables

1 Zip Ties 2 Tubing 3 Skewers 4 Jumper Wires 5 USB Cable



Component Lexicon - Part A

A. Actuators & Sensors

A1 Reflective Mylar Blade of Grass
A2 Photoresistor
A3 PIR Sensor
A4 Servo Motor
A5 DC Motor
A6 Modified Flashlight
A7 Crystal
A8 Binder Clip

B. Mounting Trays

B1 Cardboard Peg Disk

C. Flashlight Mount Assembly

C1 3D Printed Flashlight Ring
C2 Flashlight Dual Peg Legs
C3 Flashlight Flexible Arm End Plate

D. Turntable Servo Mount Assembly

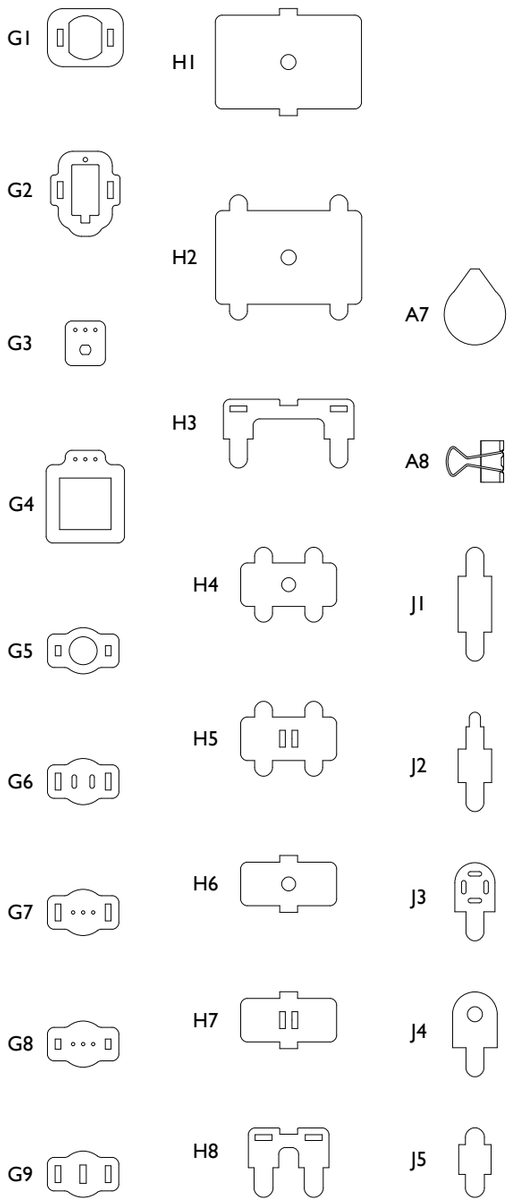
D1 Turntable Bottom Plate
D2 Turntable MiddlePlate
D3 Turntable Top Plate

E. Hardware

E1 Bolt (1/4"-20 - 1/2)
E2 PVC Tubing for Flexible Arm Mounting
E3 Locking Washer
E4 Acrylic Locking Clip
E5 Acrylic Blade of Grass Foot
E6 4-cone Flexible Arm
E7 2-cone Flexible Arm
E8 Chain Link
E9 Wing Nut

F. Flexible Arm and Chain End Plates

F1 2-Peg End Plate
F2 Binder Clip End Plate
F3 ZipTie End Plate
F4 Chain End Plate



Component Lexicon - Part B

G. Actuator & Sensors Mounting Plates

G1 DC Motor Mounting Plate
G2 Servo Motor Mounting Plate
G3 Photoresistor Wire Mounting Plate
G4 PIR Sensor Wire Mounting Plate
G5 Crystal Top Mounting Plate
G6 Crystal Bottom Mounting Plate
G7 Wire Bottom Mounting Plate
G8 Wire Top Mounting Plate
G9 Blade Of Grass Mounting Plate

H. Peg Platforms

H1 Large Quad-Peg Platform Bottom Plate
H2 Large Quad-Peg Platform Top Plate
H3 Large Quad-Peg Platform Leg
H4 Small Quad-Peg Platform Bottom Plate (Flex Var)
H5 Small Quad-Peg Platform Bottom Plate (ChainVar)
H6 Small Quad-Peg Platform Top Plate (Flex Var)
H7 Small Quad-Peg Platform Top Plate (Chain Var)
H8 Small Quad-Peg Platform Leg

J. Pegs

J1 1-Plate Extension Peg
J2 2-Plates Extension Peg
J3 ZipTie Peg
J4 Swivel Peg
J5 Short Peg

Actuators & Sensors

Mounting Plates

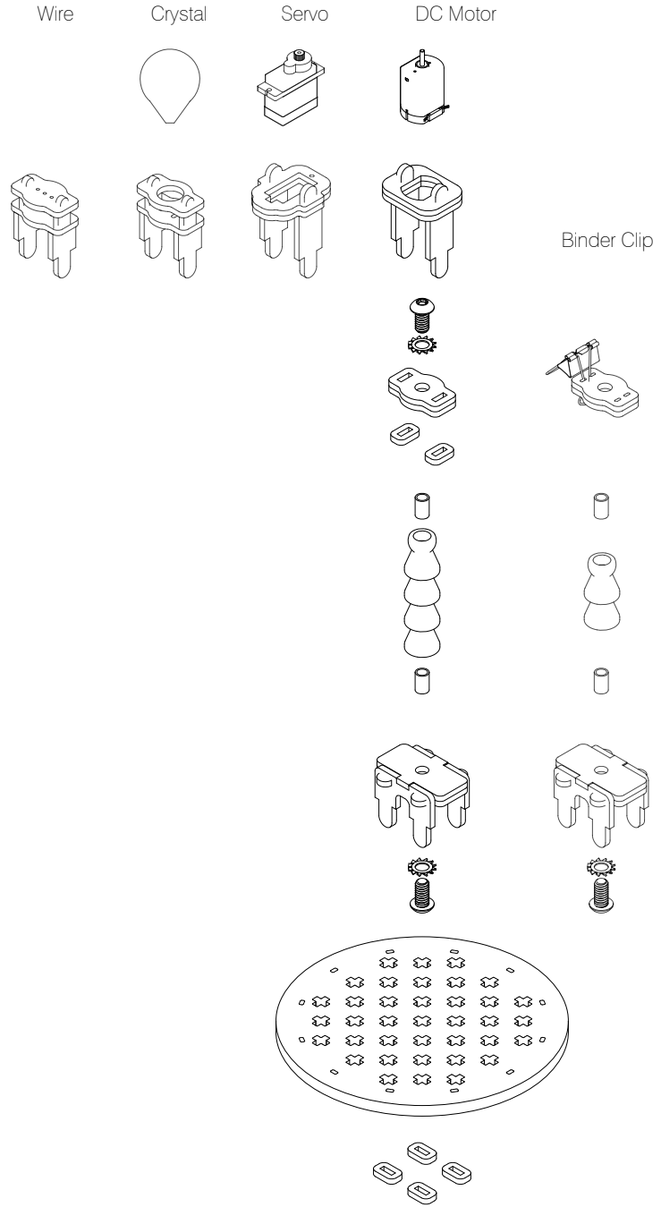
Arm End Plates

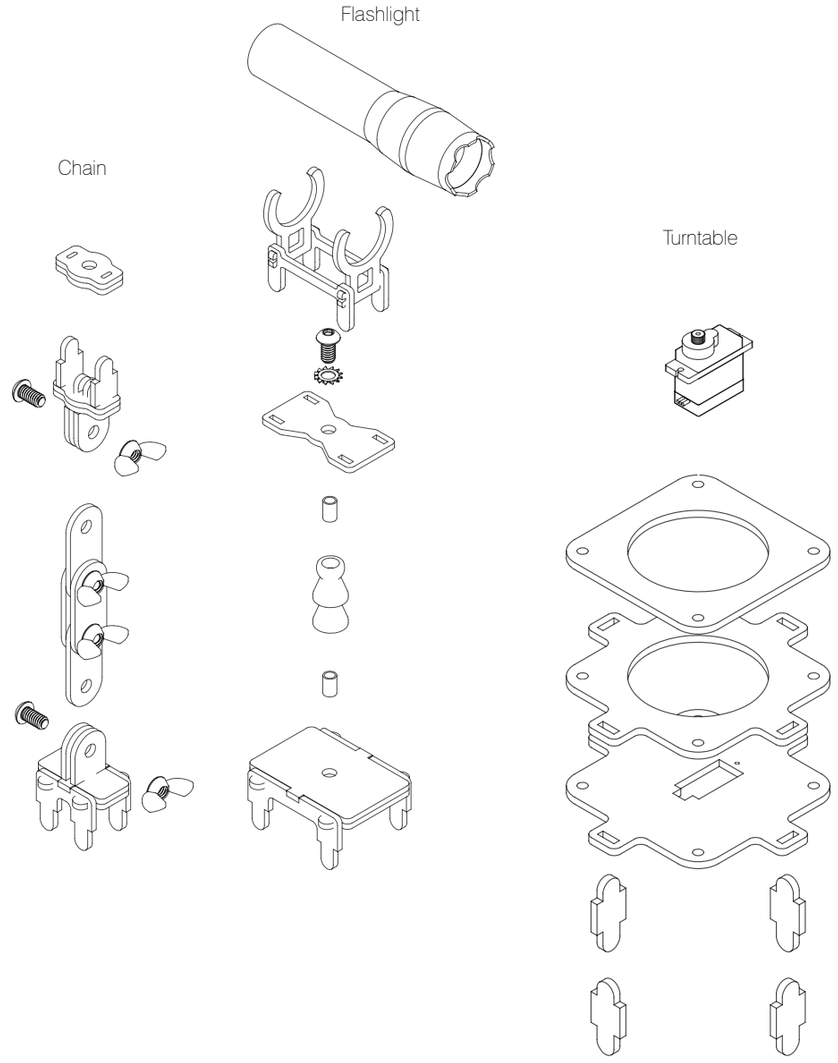
Arms (Flexible or Chain)

Peg Platforms

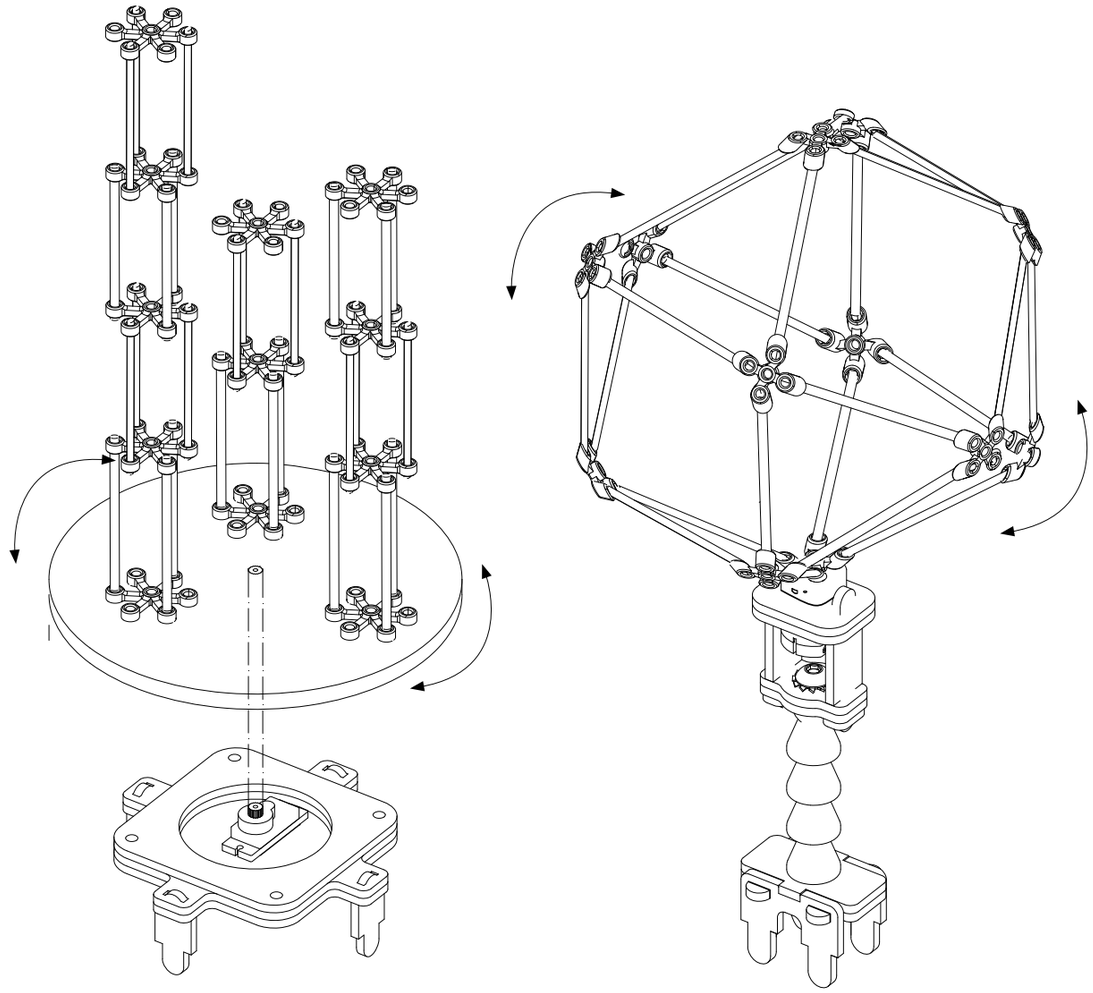
Cardboard Peg Disks

Locking Clips

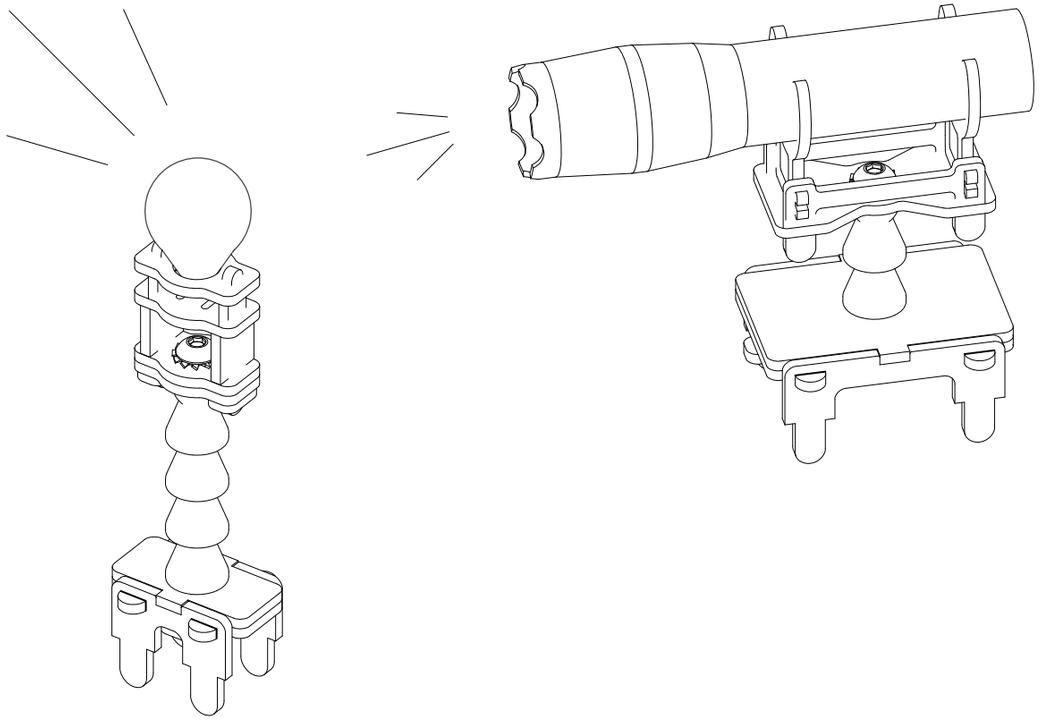




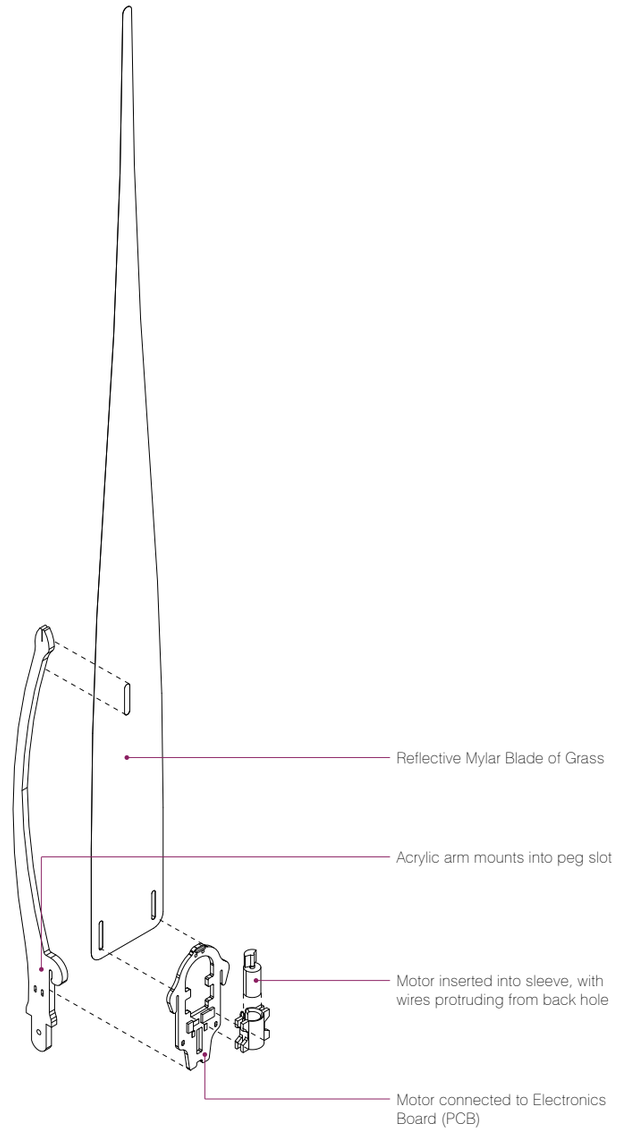
Exploded Component Modules



Turntable Module & DC Motor Module



Flashlight & Crystal Modules



Blade of Grass Module

Kit Contents

Geometry Exploration Kit
(ref. pg. 14)
- Flexible Connectors (Uniform & Alternating)
- Bamboo Skewers
- Instructional Brochure

Scaffold Components
- Bamboo Skewers
- Tubing
- Cable Ties

Electronics Module Type A (x2)
- Acrylic Mounting Tray
- Microcomputer (Raspberry Pi)
- Data Interface (Node Controller)
- Power Injection Unit (High Current Device Module - HCDM) (x2)

Electronics B Module Type B
- Acrylic Mounting Tray
- Microcomputer (Raspberry Pi)
- Data Interface (Node Controller)
- Power Injection Unit (High Current Device Module - HCDM) (x2)
- 8-way Splitter

Blade of Grass Module
- Blade of Grass Vibrator
- Motion Sensor (Passive Infrared Sensor - PIR)
- Cardboard Peg Disk
- Flexible Arm

Clothesline Module
- Clothesline
- Servo Motor
- Cardboard Peg Disk (x2)
- Chain Link

Shape on Servo Module
- Servo Motor
- Flexible Connector Shape
- Motion Sensor (Passive Infrared Sensor - PIR)
- Cardboard Peg Disk
- Flexible Arm

Projector Screen Module
- Projector Screen
- Cardboard Peg Disks (x2)
- Saplings (x2)
- String / Wire

Turntable Module
- Turntable Body
- Servo Motor
- Object of choice
- Outrigging Wire

Flashlight Module (x2)
- Modified Flashlight
- Light Sensor (Photoresistor - PR)
- Cardboard Peg Disk
- Flexible Arm

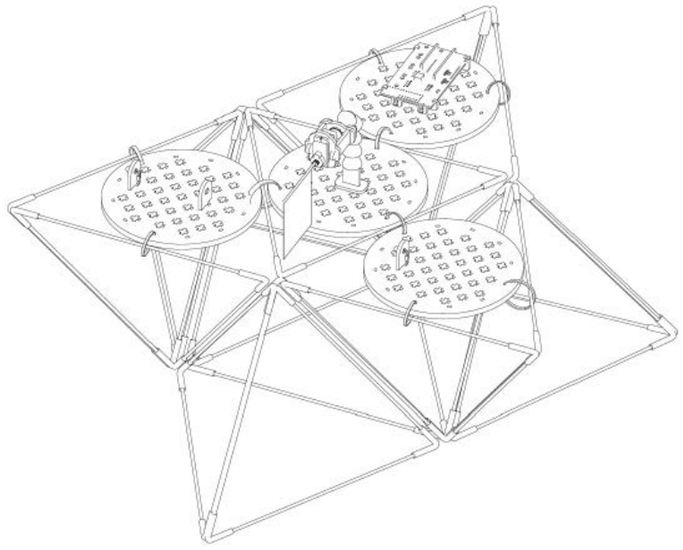
Crystal Module
- Crystal
- Flexible Arm

Sound Sampler WAV Module
- Sound Sampler (WAV Player)
- Speaker & Tube Housing
- Amplifier
- Cardboard Peg Disk (x2)

Voice Recorder Module
- Voice Recorder
- Motion Sensor (Passive Infrared Sensor - PIR)
- Speaker & Tube Housing
- Amplifier
- Cardboard Peg Disk (x2)

Rotating Clicker Module
- Rotating Clicker
- Servo Motor
- Flexible Connector with
- Sticks
- Paper Sheet
- Motion Sensor (Passive Infrared Sensor - PIR)
- Cardboard Peg Disk (x2)
- Flexible Arm (x2)

Interactive Array Exploration Kit



Inexpensive materials including corrugated cardboard, thin sheets of plywood and fasteners available from hardware stores were integrated into these kits, supporting personal open-source fabrication explorations and attempting to foster wide participation and access to the interactive control technologies featured within the workshop programs. A slotted tray design is included that accommodates a range of component mounts employing simple pegs, securable with locking washers. This mount system includes cable-tie attachments that support precisely angled locations within the skeletal scaffold. This flexible mounting system can support individual development of composite mechanisms, creating a diverse range of actuator and sensor components.

The component designs within this kit were used to support a series of four workshops during the years 2021 and 2022. Two of these workshops were staged as retreats attended by students and professionals from diverse centres within Europe and North America, while two more workshops were hosted by the School of Architecture at the University of Waterloo, integrated within their undergraduate professional architecture curriculum.

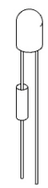
Within the kit, scaffold designs support minimal material use and compliant structures that are capable of accommodating multiple components and evolving functions. The structures that are documented here include filamentary triangulated skeletal frameworks for highly efficient waffle, shell and spherical envelopes.

Raw Construction Materials & Cables

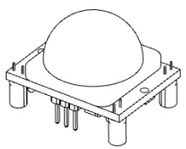
1 Bolt 2 Wing Nut 3 Zip Ties (Small) 4 Zip Ties (Large) 5 Tubing (Thin) 6 Tubing (Thick) 7 Skewers
8 Straws 9 Pipe Cleaners 10 Jumper Wire (Long) 11 Jumper Wires (Short) 12 USB Cable 13 Nippers

Reactor Cells: Sensors, Actuators and Mounts

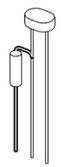
A. Actuators & Sensors



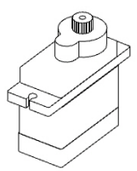
A1. LED



A2. Passive Infrared Sensor (PIR)



A3. Photoresistor (PR)



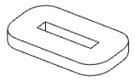
A4. Servo Motor

B. Hardware

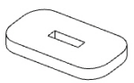
B1. Bolt (1/4" - 20 - 1/2)

B2. Locking Washer

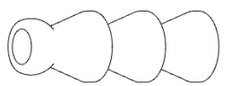
B3. Locking Clip



B4. Flexible Arm Locking Top Clip

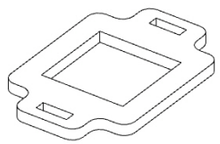


B5. Flexible Arm Locking Bottom Clip

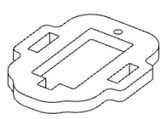


B6. Flexible Arm

C. Mounting Plates



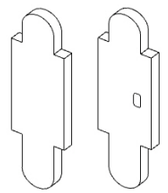
C1. PIR Sensor Mounting Plate



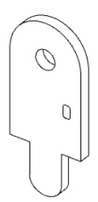
C2. Servo Top Mounting Plate

C3. Servo Bottom Mounting Plate

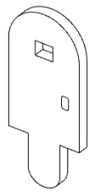
D. Mounting Pegs



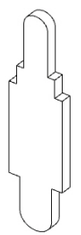
D1. Generic Mounting Peg



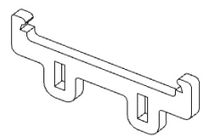
D2. LED Mounting Peg



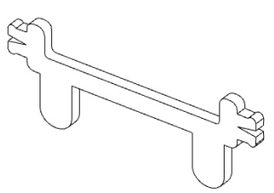
D3. PR Mounting Peg



D4. Flexible Arm Mounting Peg

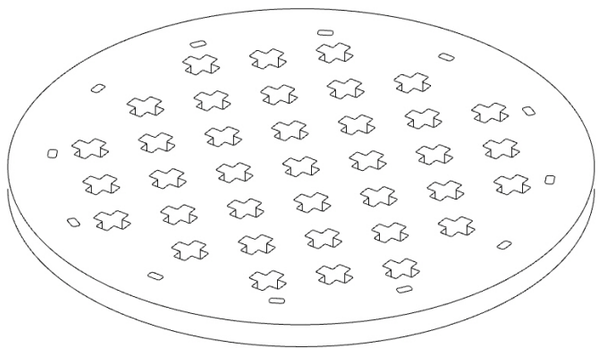


D5. PCB Top Mounting Peg

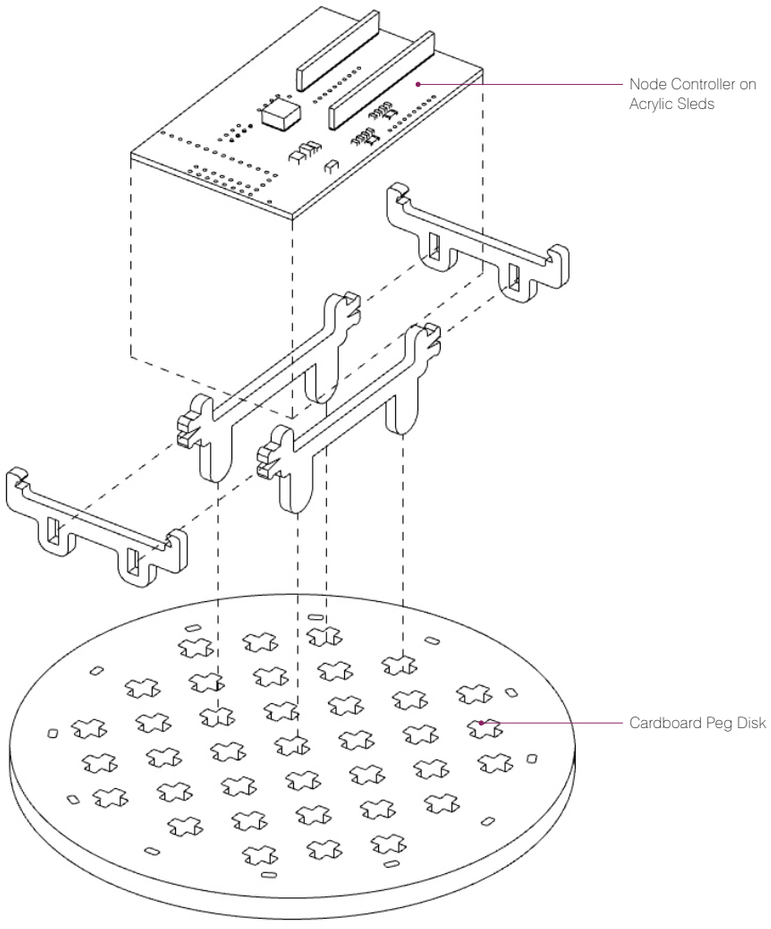


D6. PCB Bottom Mounting Peg

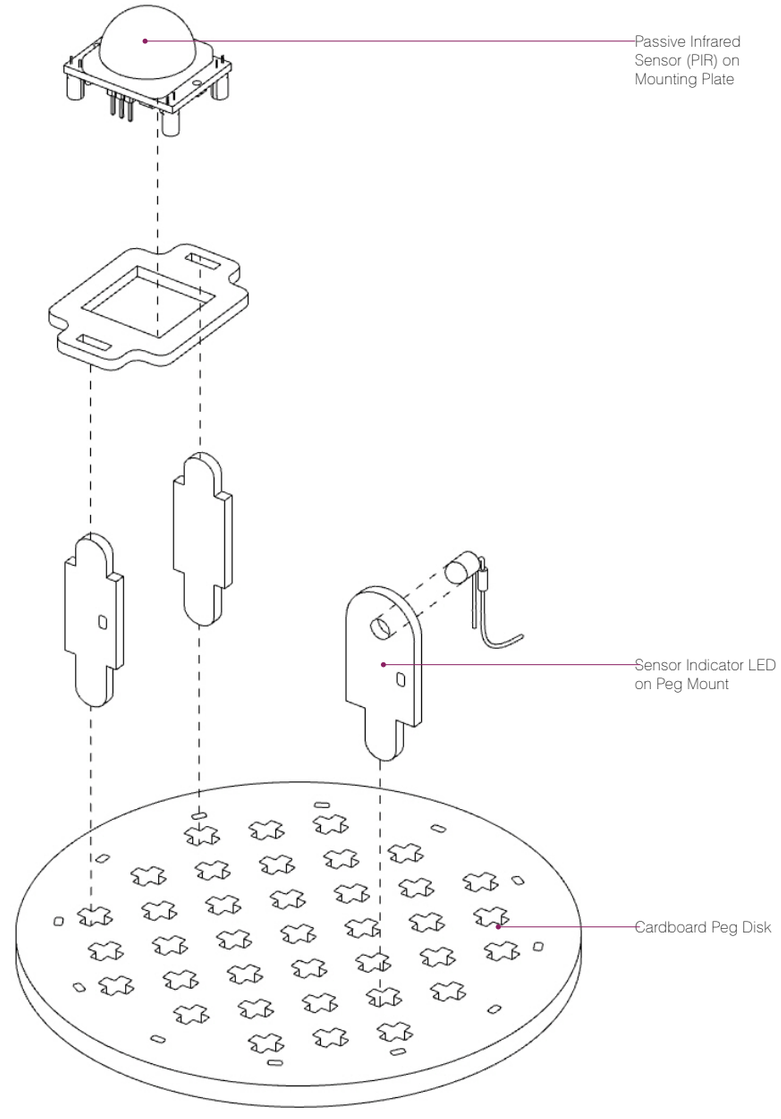
E. Mounting Trays



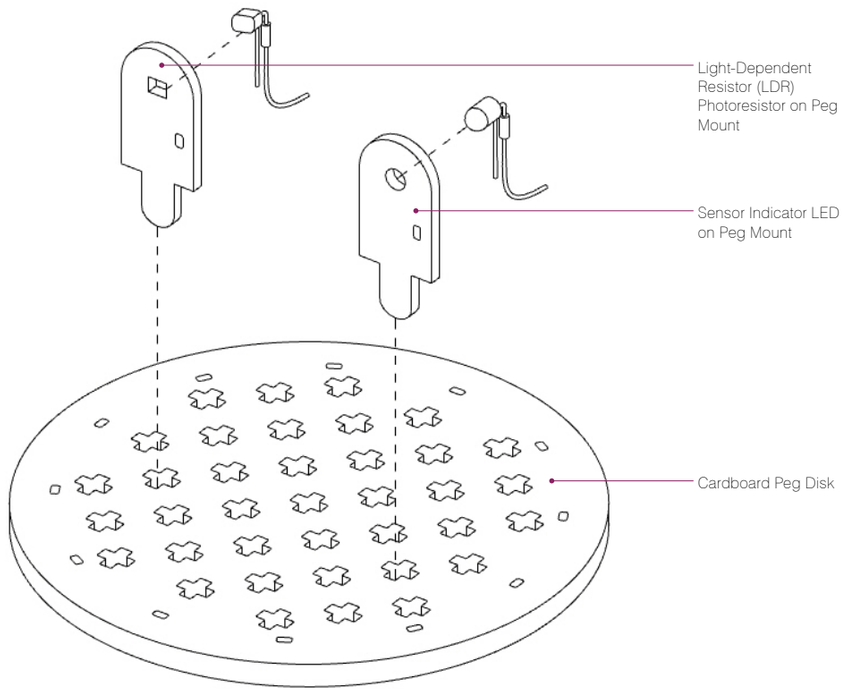
E1. Cardboard Peg Disk



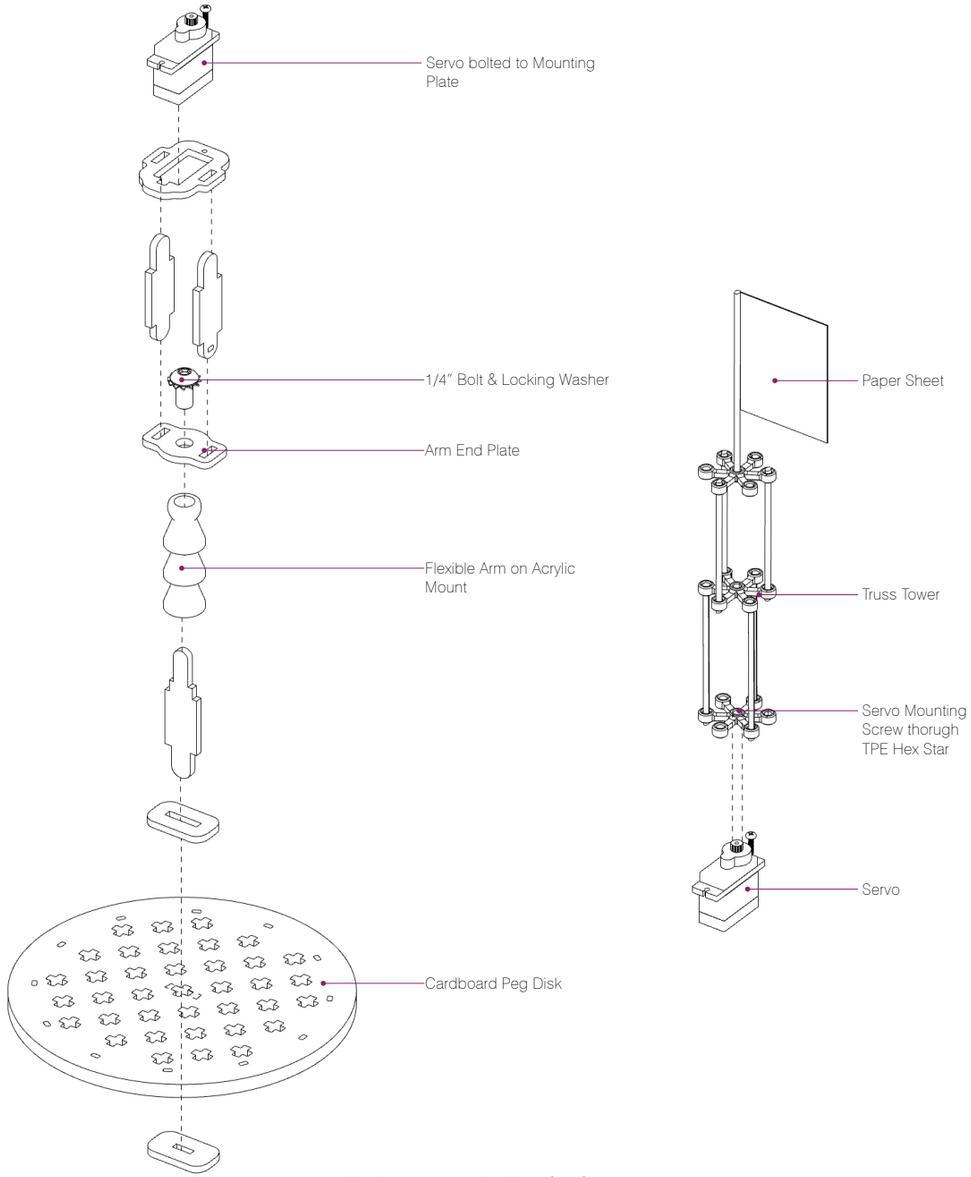
Microcontroller Module



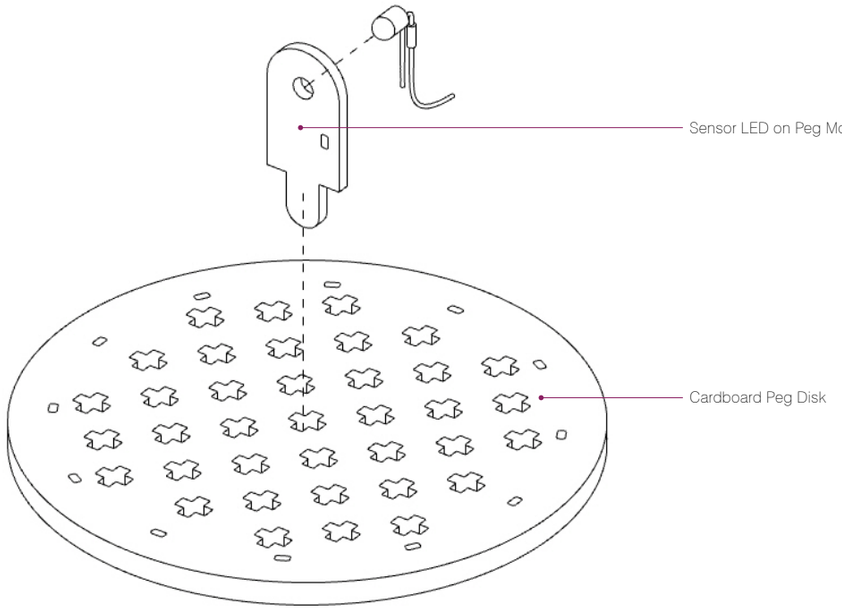
PIR Sensor Module



LDR-Photoresistor Sensor Module



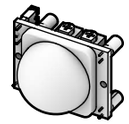
Motion Module



Light Module

A3 Photoresister with resister

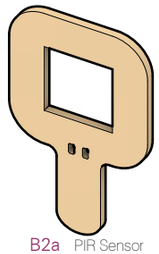
A1 LED Light



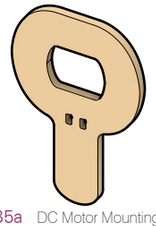
A2 PIR Sensor

A5 DC Motor

B1a Light Mounting Plate



B2a PIR Sensor Mounting Plate

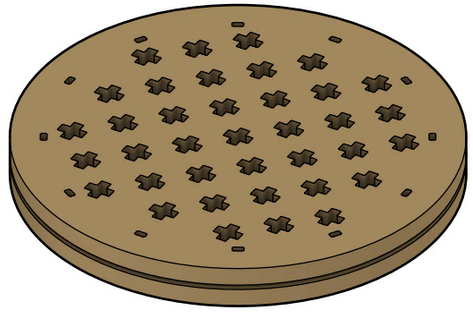


B5a DC Motor Mounting Plate

C1a Arm Mounting Plate

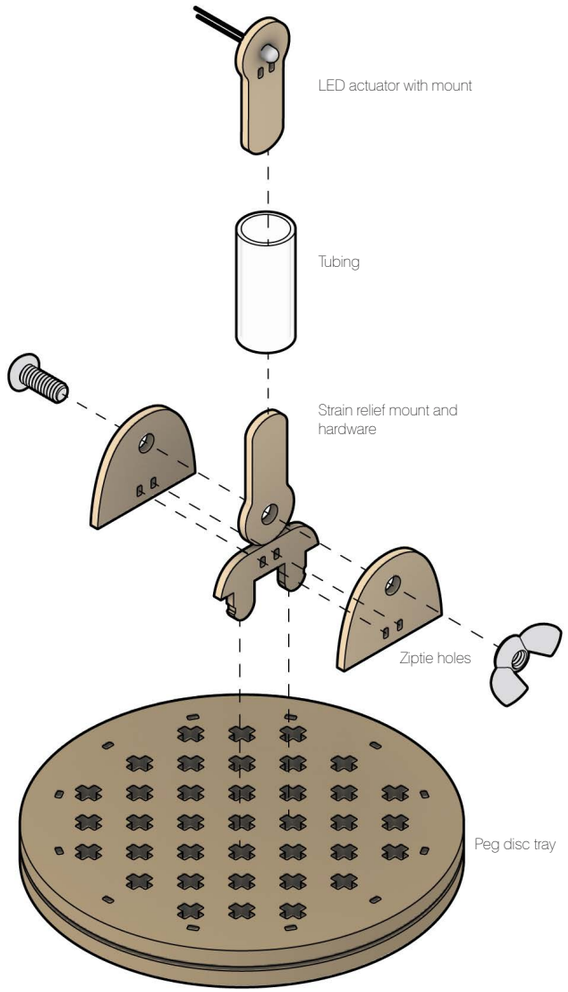
C2a Arm Base Plate

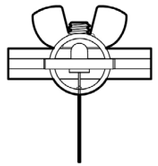
C3a Arm Mounting Peg



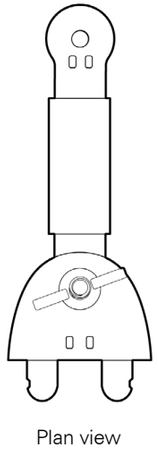
E1 Peg Disc Tray

Expansion: Adjustable Tube Arm Components

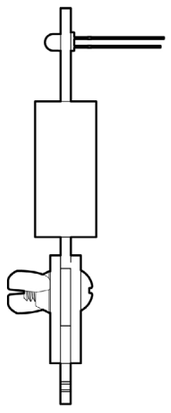




Front view

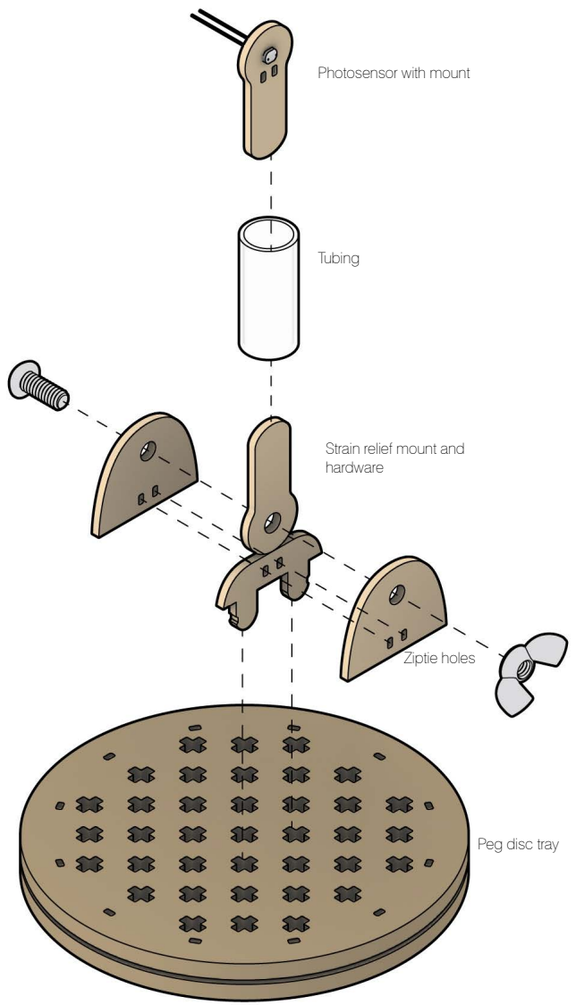


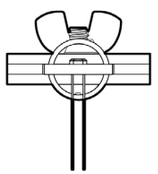
Plan view



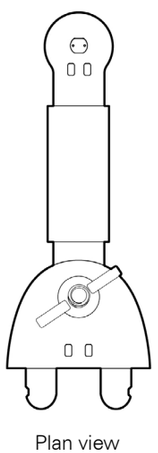
Side view

Adjustable Tube Light Module

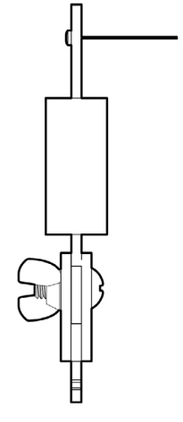




Front view

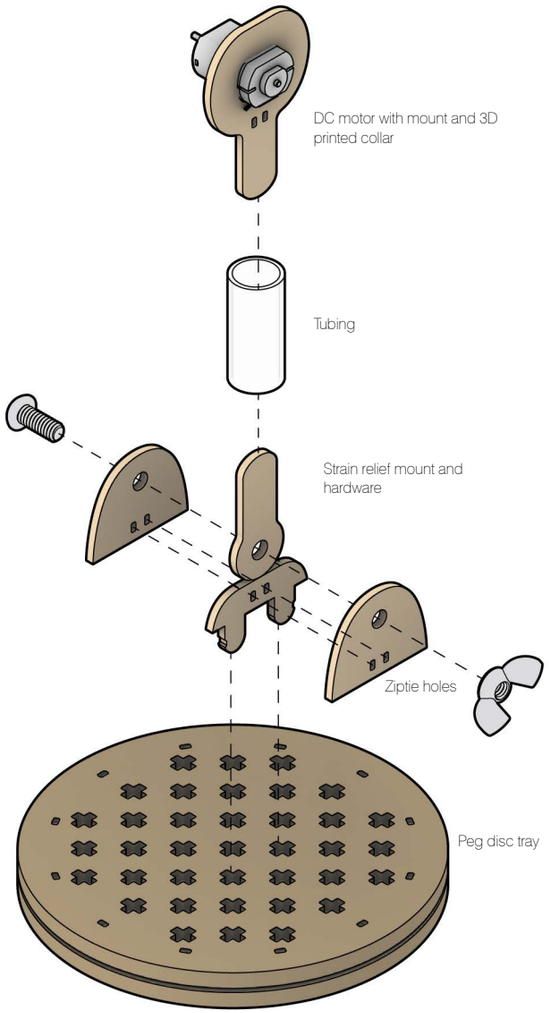


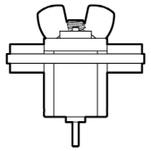
Plan view



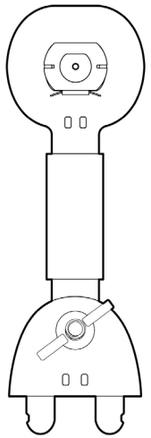
Side view

Adjustable Tube Light Detecting Module

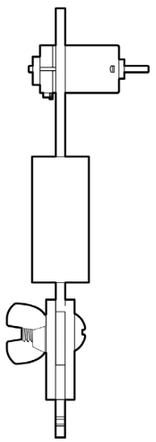




Front view

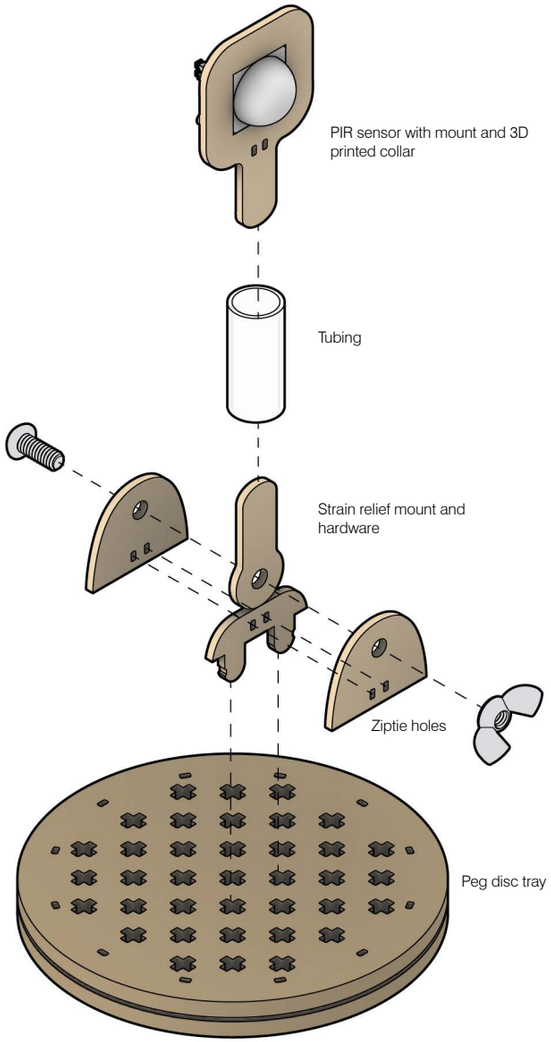


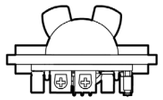
Plan view



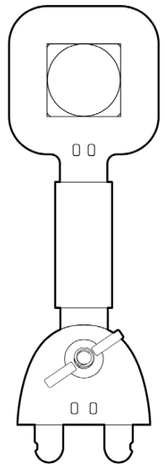
Side view

Adjustable Tube DC Motor Module

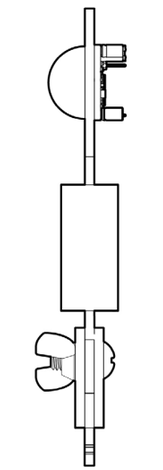




Front view



Plan view



Side view

Adjustable Tube Motion Detecting Module

Kit Contents	Quantity
Node controller PCB	1
SP32 Feather	1
NC through hole components	1
USB A to USB B mini cable	1
Push buttons	1
Vibration motors	1
White LEDs with assembled resistor	5
Servo motor	1
DC motor with mount and 3D printed collar	1
PIR sensors	1
Photoresistors with assembled resistor	1
Bamboo struts	100
PVC tubing	10
Large Vinyl Tubing	25cm
Flexible arm	0.33
B1. Bolt (1/4" -20 - 1/2)	1
B2. Locking Washer	1
Bulldog clip mount	3
B3. Locking Clip	10
B4. Flexible Arm Locking Top Clip	1
B5. Flexible Arm Locking Bottom Clip	1
B6. Flexible Arm	1
C1. PIR Sensor Mounting Plate	1
C2. Servo Top Mounting Plate	1
C3. Servo Bottom Mounting Plate	1
D1. Generic Mounting Peg	2
D1. Generic Mounting Peg (top hole)	1
D1. Generic Mounting Peg (side hole)	1
D2. LED Mounting Peg	2
D3. PR Mounting Peg	1
D4. Flexible Arm Mounting Peg	1
D5.Snap-fit PCB Rails	2
D6. PCB Double-Peg Mounts	2
E1. Cardboard Peg Disk	5
Zip ties	100
Mylar Sheets	8.5 x 11 sheet
Nippers	1

References

Bullivant, Lucy. *4dsocial: Interactive Design Environments*. London: AD/John Wiley & Sons, 2007.

Fox, Michael and Miles Kemp. *Interactive Architecture*. Princeton: Princeton Architectural Press, 2009.

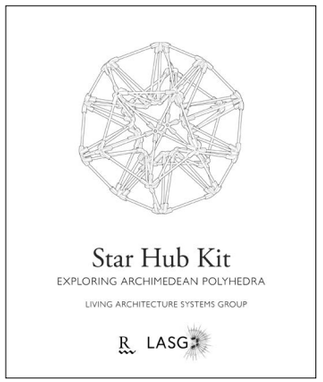
"Living Architecture LIAR," accessed February 2, 2022, https://livingarchitecture-h2020.eu/.

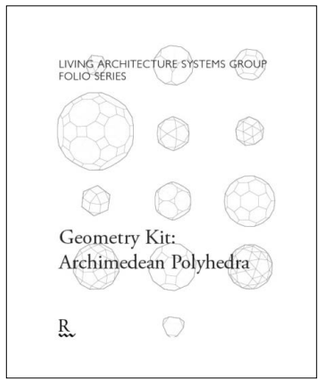
Nicholas Negroponte, *Being Digital*. New York: Vintage Books, 1995.

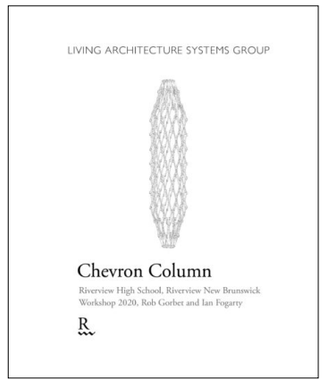
Oosterhuis, Kas and Xin Xia. *iA #1, Interactive Architecture*. Rotterdam: Episode Publishers, 2007.

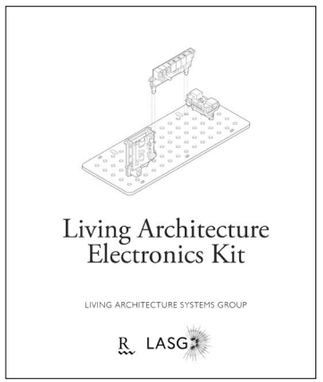
Spiller, Neil. *Digital Architecture Now: A Global Survey of Emerging Talent.* London: Thames & Hudson, 2009.

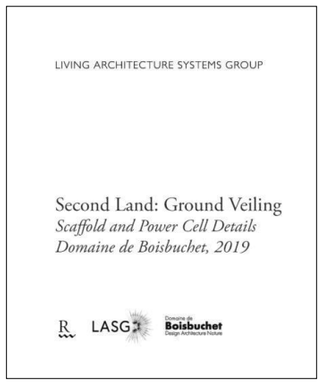
Open Access LASG Publications

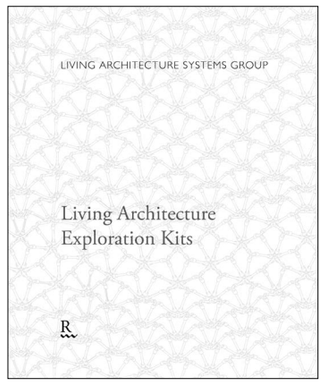












Credits

LASG Executive

Philip Beesley
Timothy Boll
Lisa Jiang
Michael Lancaster
Matt Gorbet
Rob Gorbet
Anne Paxton
Rekha Ramachandran
Alison Thompson

LASG Design & Production

Alexandros Angelidis
Jinchen Cai
Adrian Chîu
Kevan Cress
Filipe Costa
Nicolas Désilles
Sebastián González Álvarez
Simon Gorbet
Ellie Hayden
Isabella Ieraci
Chris Kang
Lucia Kempe
Chiun Lee
Glenn Lu
Bianca Weeko Martin
Mike Nopper
Abida Rahman
Severyn Romanskyy
Stephen Ru
Nathan Shakura