Experiential Learning in the Makerspace
Who I am

- Manager of the Columbia Makerspace,
- Manager of fabrication in the Mechanical Engineering Department
- Advise the Columbia Space Initiative Rocketry and Formula SAE Car teams.
- Arab spring participant, Tahrir Square
- Social and Economic Justice through equal access
Columbia Makerspace

The Columbia MakerSpace (CMS) is a Columbia University affiliated and student-run workshop. We provide a wide variety of tools and for students, artists, makers, creatives, programmers, scientists, and engineers to use and space in which they can work, share ideas and collaborate.
We strongly believe in *learning through recreation*
How it operates

• Who can be involved: must be an active student, faculty, and staff of Columbia to join. Safety training is mandatory for all users.

• Students may volunteer to be super users by meeting the criteria and being approved by the super user committee

• Super users must follow responsibilities in promoting a safe space, providing training to users, hold office hours, hold seminars, and attend meetings

• Users may use the space in the presence of a super user and receive training on specific tools
2014 - 2015:

- Founded by group of students backed by the SEAS Dean’s Office and Associate Professor Ioanniss (John) Kymissis
- Established super user volunteer model and requirements
- Established general user guidelines and card swipe system
2016:
• Mohamed Haroun hired to manage CMS
• All super users required to teach seminars

2017:
• Casual Makery established in partnership with the Science & Engineering Library
• Won the NRHH “Organization of the Month” award in February
• 30 super users
• Active social media engagement
  2k Facebook page likes
• Achieve Safe Space Designation for the Makerspace to make it more welcoming
• Open a new MakerSpace of 3000 ft²
• Open a full wood and metal shop available to all users
Student led Seminars

- **3D Printer** - Architecture Model Joint Making
- **Arts/Crafts** - Acrylic Painting Techniques
- **Electronics** - LED Name Tag
- **Laser Cutter** - DIY Clock
- **Soldering** - Jewelry/Crafts
- **Woodworking** - Dovetails
- **Vinyl Cutter** - Glass Plaque
- **Sewing Machine** - Bow Tie Sewing
- *... and many more!*
Student Testimonials
The MakerSpace brings together incredibly smart people at Columbia and compels them to learn more collaboratively. If I’m ever stuck with something, I know I can depend on others at the space for help and I feel encouraged to help those in need as well.

- Adrian John Lasrado, SEAS (Masters) ’18
Everyone is keen on helping others at the MakerSpace. People would take time out of their projects to assist me. I learned more by being next to people and observing how they did things. If the people at the Makerspace weren’t there, I would not have gotten much out of it.

- Haeyeon Jang, SEAS ’19
The MakerSpace has enabled me, a student in Columbia College, to engage with engineers in a substantive cross-disciplinary way. By offering me the tools to explore more traditionally artistic pursuits in the context of a more scientific manner, my work has been taken further than I could have ever imagined.

- Scott Alex Sonnenberg, CC ’18
Being able to master a skill and spread knowledge is empowering, especially in an intense academic environment like Columbia that can make its students, especially minority students like myself, feel intellectually inferior. So for me, not only has the Makerspace given me skills in making and teaching but also self confidence to get me through the week.

– Christian Joseph, SEAS ’19
Student Projects
I love industrial design and woodworking. I purchased a vintage Thorens TD145 turntable with the goal of rebuilding it. I chose the Corian for the base because it's massive and inert which are both good qualities for a turntable. I built the record queue to be a companion to the turntable. The leather was sewn around a bent sheet of 16 gauge steel and then dyed. CMS has been invaluable by providing space to work, access to tools, and students who can teach me new skills.

Ted Scoufis
(GS ‘18)
A crystal radio is a passive (meaning unpowered) device that can capture, demodulate, and allow you to listen to AM radio waves. My design used a laser cut enclosure, various electronic bits, a large (red) spider inductor coil (hand wound), and a crystal radio earpiece.
A CNC mill was used to cut and engrave the Hamilton Musical logo out of 1/2" aluminum. The base is hand-shaped cherry wood, finished with a dark walnut stain and glossy polyurethane. The plaque was made from acrylic using the laser cutter.
Integration w/ Curriculum
Integration with the Curriculum

• Art of Engineering (AoE) students encouraged to use the CMS to build their projects. CMS helped improve AoE course specifications, requirements, and what students needed from CMS to succeed.

• Additional courses that utilize CMS: Robotics, architecture, sculpting, and visual arts courses.

• Various student groups actively engaged with CMS, including Columbia FSAE Formula 1 race-car team, Columbia Space Initiative, Robotics Club.
Partnerships & NYC MakerSpace

- SHAPE (Summer High School Academic Program for Engineers) through Columbia Outreach Programs
- Barnard IMATS (Instructional Media and Technology Services)
- Columbia Science & Engineering Library
- NY Bioforce
- HK Makerlab
- NYC MakerSpace
What makes CMS special

• We are entirely student-run, which is based on a volunteer model
• We bring together students across all disciplines and schools
• We are a space for students to create better projects for classes and hackathons (E.g. Art of Engineering, MakeCU)
• All of our tools and resources are free for use
• However... opening up to the public is impossible due to insurance and availability...
However, opening up to the public is impossible due to insurance and availability...
NYC Makerspace Mission

• Establish a non-profit entity responsible for creating a sustainable system of spaces where learning and innovation is a form of recreation, providing equal access to advanced resources and education.

• Forge partnerships between institutions and local communities

• Create a foundation for social, scientific, technological, and artistic innovation that originates in the local neighborhood
NYC Makerspace In Action

Columbia University and NYC Universities & Institutions

Grants and External Funding

Local Schools and Community Developed Organizations

NYC Makerspace Nonprofit:
Workshops, Classes, Projects, Leadership, Community

NYC Parks and Recreation
NYC Makerspace at Other NYC Parks and Rec Centers
Pelham Fritz Pilot NYC Makerspace
How we Benefit Parks [Actions]

- Expand and diversify Rec Center programming
- Empower people to imagine and develop ideas for recreational & entrepreneurial projects
- Increase Rec Center visitation and membership
- Provide youth job opportunities in the makerspaces
- Inspire creative methods for parks maintenance and beautification
How we Benefit Parks [Outcomes]

• Greater access to skills-based programming and resources typically inaccessible to the public

• More funding opportunities, from state, federal, and private sources

• Opportunity for community members to engage in innovative problem solving that promote sustainability
Implementation Plan

1. Develop pilot classes for Pelham Fritz
2. NYC Makerspace becomes official entity
3. Expand & diversify programming
4. Implementation in other rec centers in NYC
5. Created dedicated space within Rec enter
Implementation Plan: Final Stages

6. Open hours established for users who have completed the required workshops and safety trainings. Hours are managed by specially trained employees called superusers.

7. After significant growth, funds can be dedicated for the creation of a separate Rec Center building specifically for Makerspace use. NYC Makerspace will assist in finding donors.
Past and Current Classes

- Robotics and Programming
- Introduction to 3D Modeling
- 3D Maker Experience
- Drone Night
- Model Glider Workshop
- Build a 3D Printer Workshop
- Intermediate 3D Modeling and Machine Design
Case Study: Making Space

• Title: Making Space: Digital Fabrication, Art, and Community Building

• 12 week course designed for high school juniors & seniors

• Goal: expose students to interdisciplinary nature of “maker” environment; specifically, how digital fabrication technologies cross realms of engineering, art & design
Case Study: Making Space

• Students explore “maker” processes that allow for them to gain exposure to 3D printing, 3D modeling, vector based graphic design, laser cutting & vinyl cutting.

• Students explore painting, drawing, and sculpture as artistic mechanisms to express and build ideas. Students are challenged to make use of the digital fabrication and artmaking techniques to build devices and objects for Pelham Fritz Community Center.
Case Study: Making Space

Student 3D Modeling Submissions

*Dazzling Gear*
Sincere Jenkins
10th Grade, Democracy Prep

*Workspace City*
Jason Hutchinson
11th Grade, Democracy Prep
Case Study: Making Space
[Testimonials]

• “I enjoyed 3D printing the most because you can make what you want without having to conform to a normal template!”

• “Makerspaces are important because they allow people to be constructive and develop new ideas.”

• “3D printing can be used to print propaganda and social liberation banners!” (Response to “Can makerspaces be used for social justice?”)
Case Study: Making Space
[Testimonials]

• “I became more aware of the opportunities for all people of minority gaps.”

• “I learned to think outside the box and think creatively.”

• “Yes, because it provides ways to walk around to those born with disabilities” (Response to “Can makerspaces be used for social justice?”)

• “Makerspaces allow minorities to enter STEM fields”
NYC Makerspace: Learning through recreation *in action*
Effectiveness

Inclusive Multidisciplinary Community Atmosphere
Learning through recreation
Available Resources