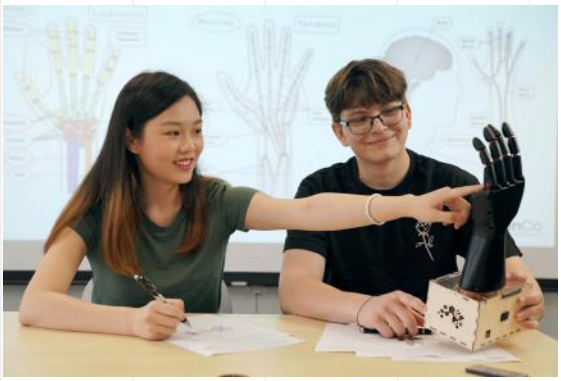
The NeuroMaker Creative Challenge

Challenge Overview

The NeuroMaker Creative Challenge is an open design competition in which middle school and high school students choose a socially conscious engineering problem they would like to solve. Students research their problem, design a solution, create a physical prototype incorporating the BrainCo NeuroMaker Kit and submit their solution virtually. BrainCo engineers review this based on a judging rubric.



Timeline

Release: Aug 10th 2020

Submission: Dec 20th 2020

Awards: Jan 2021

Team

Middle School teams High School teams

A team must have:

- 2–4 students.
- one adult mentor that is at least 18 years old at the time of project submission.

Awards

Six Finalists Awards	1st	2nd	3rd
• 3 Middle School Awards	$1500	$500	$250
• 3 High School Awards	$1500	$500	$250

Five Additional Awards

• Creativity Award • Design Award • Inspiration Award • Empathy Award • Judges Award

Contact

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Sign Up Link

https://forms.gle/j3MoAFc3Bum4ukXX9

The NeuroMaker Background

"There's technology to help these people in the U.S. but why can only 4% of the people who need these things afford them?" A group of 4 engineers sitting in the Harvard Innovation Labs mulled over this question while finishing their first AI algorithm.

Every year hundreds of thousands of people around the USA learn to live their lives with different forms of amputations that require serious rehabilitation and sacrifice. While some are fortunate to afford often very expensive high tech solutions, the vast majority struggle with different forms of mechanical devices that are no more complicated than a metallic hook. Comfortably shaking another's hand, performing household tasks and regaining essential pieces of the human experience require giving technology in a way these people can receive it.

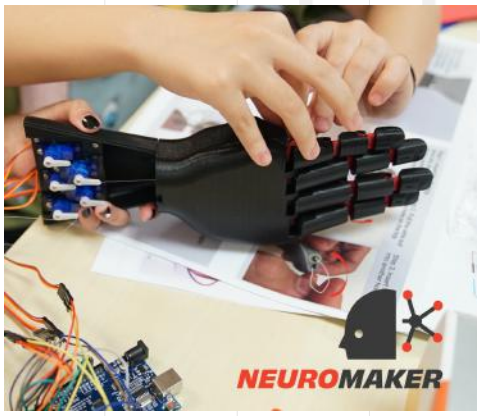
After years of research and development facing this issue, BrainCo engineers created the BrainRobotics AI Dexus Prosthetic, which gives an accessible way for amputees to use cutting edge artificial intelligence and neuroscience to naturally control a prosthetic with muscle and brain signals. Since then, amputees using this technology have played the piano for the first time, regained their ability to write calligraphy, and finally given a firm handshake. For these results and more, the BrainRobotics Prosthetic Hand was awarded the Time Magazine Top Inventions of 2019, multiple Consumer Electronics Show awards and has been featured on CNBC, the Today Show and more.

This first innovation was because a group of committed engineers asked themselves how an issue they discovered could be solved. Now, we wish to ask our next question: "How do we inspire and educate the next generation of students to take on more problems in our society?"

And thus, the NeuroMaker STEM kit and Creative Challenge were born! Using the NeuroMaker kit as a baseline, students around the world are likewise challenged to research real world issues they can solve with their own creations. Join us and work with our engineers to design your own solution to a real world problem that YOU want to solve!

What is the NeuroMaker Creative Challenge?

Introduction The NeuroMaker Creative Challenge is an annual, open design competition in which middle school and high school students choose a socially conscious engineering problem they would like to solve and present a prototype on how they would solve it. Students research their problem, design a solution, create a physical prototype incorporating the BrainCo NeuroMaker Kit and then submit their solution virtually for BrainCo engineers to review based on a judging rubric.



Awards BrainCo engineers select six finalists, three from middle school submissions and three from high school submissions. Each group of first, second and third place finalists respectively receive $1,500, $500 and $250 and recognition from BrainCo's prosthetic engineering team. Five additional awards will be presented to teams that recognize important engineering and personal growth traits such as empathy, creativity and perseverance.

The NeuroMaker Creative Challenge is free for any student team that has purchased a NeuroMaker STEM kit from an approved sales channel.

In this guide you will find all of the specific competition rules, description of awards, educational methodology, resources to get started and contacts for additional information.

BrainCo itself was created through awards from start–up accelerators and open design competitions such as the Harvard iLab and Mass Challenge. In this way, we hope to invigorate the next generation of learners to find their passion in solving real world problems with STEM.

NeuroMaker Challenge

1. Competition Challenge Released — On August 10th, the BrainCo NeuroMaker Committee releases a topic area which students will investigate.

2. Form a Team — Participants will form a team of at least 1 mentor 18 years or older and 2–4 participants in either middle school or high school.

3. Teams Research — Working as a team, students will research their topic area and identify one problem they would like to solve.

4. Build a Prototype — Students build a creative prototype to solve their identified problem. Students are encouraged to follow and document their progress using the engineering design process and to test their solution.

5. Create a Video and Report — Students write a written report of their solution and create a short video to submit virtually prior to the December 20th deadline.

6. BrainCo Engineers Review — BrainCo's NeuroMaker Judging Committee reviews each project according to our competition rubric and selects finalists and award winners.

7. Results Announced — Competition results are announced virtually in January within an online awards ceremony.

The 2020 Creative Challenge Theme

Improving Life for Amputees

There are millions of people around the world that face challenges surrounding limb amputations resulting from traumatic accidents, cardiovascular disease, nerve injury and others. Each year there are more than 50,000 new amputations in the United States alone and this community must navigate a series of adjustments to a new lifestyle. Some examples of these potential challenges include:

- **Communication:** Typical body language using a hand can be a difficult transition for those using a prosthetic.
- **Ergonomics:** The fit and user experience of an amputee adjusting to a prosthetic requires detailed knowledge of biomechanics to employ correctly.
- **Financial:** Differing levels of prosthetic technology can cost beyond $100,000 which incurs large burdens on users and the organizations that help pay for them.

Your NeuroMaker Challenge:

- **Research:** Discover issues facing amputees around the world and imagine what methods we can take to improve their life with technology. Use different learning resources to empathize with the issues facing people in this community.
- **Define:** Out of these discovered issues, choose one to focus your efforts. Identify the user, their needs and any insights that can provide design opportunities.
- **Ideate and Prototype:**
  Brainstorm different solutions to the issue you have identified. Using your NeuroMaker STEM Kit and other resources at your disposal, create material prototypes that demonstrate the effectiveness of your solution.
- **Refine and Present:**
  Test your prototypes and document your learning and design process. When ready, create a video and written summary of your solution and submit these to BrainCo engineers for review.
- **Recognition and Development:**
  Attend our January virtual awards ceremony and learn how others have solved the issues they have defined. Win cash prizes to further refine your solution and gain recognition from real prosthetics engineers!

Resources to Get Started

There are numerous ways you can research ideas for your prototype! We recommend using online resources, consulting members of your community and interviewing real life experts in the field. To get you started we have compiled a list of resources below:

Common Problems that Amputees Experience from London Prosthetics
https://www.thelondonprosthetics.com/prosthetic-solutions/patient-information/after-care/common-problems/

Amputation: Prosthetic Hand and Fingers--Hand Care
https://www.assh.org/handcare/condition/amputation-prosthetic-hand-and-fingers

People with Amputation Speak Out--Amputee Coalition of America
https://www.amputee-coalition.org/wp-content/uploads/2014/11/lsp_people-speak-out_120115-113243.pdf

Living with Amputation--The War Amps
https://www.waramps.ca/ways-we-help/living-with-amputation/

Helping People Transition to Life after Amputation--Edge
https://opedge.com/Articles/ViewArticle/2016-06_01

What to expect after an Amputation--UPMC Life Changing Medicine
https://www.upmc.com/services/rehab/rehab-institute/conditions/trauma/after-amputation

The Prevalence and Impact of Pain associated with Upper-Limb Amputation--Edge
https://opedge.com/Articles/ViewArticle/2016-09-22/2016-10_02

What to Know Before Getting a Prosthetic Leg: Hopkins Medicine
https://www.hopkinsmedicine.org/health/wellness-and-prevention/what-to-know-before-getting-prosthetic-leg

Inspiration

Need Some More Inspiration?

There is a large active community of students and educators seeking to improve life for human beings facing a myriad of different issues. Here is a list of college level projects that students have designed for multiple different kinds of challenges around concepts you can find in this theme:

MIT Assistive Tech Hackathon: An annual, MIT sponsored hackathon in which college students from around the country design solutions for assistive living technology.
http://assistivetech.mit.edu/

Principles and Practice of Assistive Technology: An MIT course in which students must create an assistive technology for a user group they have identified.
http://ppat.mit.edu/fall2019/index.html

California Polytechnic State University Quality of Life Plus Club: A university level student club which challenges students to develop technologies to improve the quality of life for people around the world.
https://cpqlplus.com/

Awards and Judging Description

The NeuroMaker Creative Challenge is designed to engage students with the design thinking process within a defined problem space. In order to recognize the many kinds of talent that our participants have, the NeuroMaker Creative Challenge Awards are separated into two categories: Finalist and Judged Awards.

Finalist Awards are scored according to the rubric below based on the submitted video and report. Judges review both of these items together and create one score for the entire team submission.

Judged Awards are intended to recognize achievement in areas that deserve special recognition from our judging team. Judges will select submissions that best fit the award description.

NeuroMaker Finalists One set of awards will be given respectively to the middle school and high school groups, creating 6 total finalists.	
Middle School 1st Place	Presented to the Middle School team with the highest received points
Middle School 2nd Place	Presented to the Middle School team with the second highest points
Middle School 3rd Place	Presented to the Middle School team with the third highest points
High School 1st Place	Presented to the High School team with the highest received points
High School 2nd Place	Presented to the High School team with the second highest points
High School 3rd Place	Presented to the High School team with the third highest points

Judged Awards	
Creativity Award	Present to a team with the most creative solution to their chosen challenge. Judges will look for the creative idea in the team's design process and final prototype.
Design Award	Present to a team with the best technical design. Judges will determine the effectiveness and efficiency of the team's design and prototype.
Inspiration Award	Present to a team with the most inspiring idea. Judges will look for a team which develops an unique and unusual solution to an existing problem.
Empathy Award	Present to a team with the most thoughtful design. Judges will look for the team's consideration of practical use and feasibility in the design process and final prototype.
Judges Award	Present to a team that deserves a special recognition. The winning team shows great efforts and impresses the judges for more than one aspect.

NeuroMaker Grading Rubric

Category	Criteria	Description	Points
Engineering Design Process	Introduction & Background Research	Clearly introduces the chosen challenge to the reader with adequate background knowledge.	10
	Analysis	Provides a comprehensive technical analysis of the chosen challenge, includes the key issues, potential solutions, solution constraints, etc.	10
	Design Methodology	Describes why the team decided on the design and how the team implements the design.	15
	Test & Result	Tests the prototype for its identified use. Evaluates the performance and effectiveness of the solution.	5
	Reflection & Discussion	Reflects on the problems the team encountered. Discusses the potential solutions and improvements.	5
Presentation	Practical Value	The practical value of the solution in the real world. The societal needs and wants surrounding this challenge are identified and described	15
	Supporting Materials / Appendices	The supporting materials(eg. tables, figures) are related and easy to understand.	5
	Video Quality	The provided video meets time limits, presents the challenge, solution and students. Transitions are smooth. All sound and visual elements are balanced and clear. Professional video editing is not required.	5
	Communication	Team members can clearly express their ideas and use appropriate scientific and technical information to convey key points in video and writing.	10
General	Overall Design	The overall design of the solution is elegant. The prototype works towards accomplishing the mission goals.	10
	Creativity	The solution is original and unique. The prototype shows the creative thinking and innovative ideas of the team.	5
	Reliability	The mechanical and control program are reliable. The prototype is solidly made and the motion of the prototype is stable and consistent.	5
Total Maximum Score			100

NeuroMaker Rules

These rules have been selected by the NeuroMaker Judging Committee.

Team Makeup:

A NeuroMaker team must be classified as either a middle school team or high school team.

Middle School teams	High School teams
Defined by those that have started sixth grade and have not yet begun ninth grade.	Defined by those having started ninth grade but have not yet reached September 1st of their high school graduation year.

Team Requirements

- Must have 2–4 students.
- Must have one adult mentor that is at least 18 years old at the time of project submission.

* Only one adult mentor may be formally registered to one individual team.
* An adult mentor may be registered to multiple teams, however student members may only be registered to one team.

In case your team is located outside of the United States, please contact your local partner for specific instructions.

Prototype Materials:

- Teams must use at least one NeuroMaker STEM kit in the creation of their final prototype. Teams are allowed and encouraged to modify kit materials as they see fit.
- There is no limitation to outside materials used in the creation of their prototypes so long as at least one NeuroMaker STEM kit is utilized.
- There is no limitation to the programming software or controllers used in the creation of the team's final prototype.

Submissions

Submission Deadline:

All submitted materials must be received by the BrainCo NeuroMaker judging committee by 11:59 PM on December 20th, 2020. Any late submissions will not be accepted.

Submission Materials:

Each team is required to submit one written report and one video which conveys the required information in the NeuroMaker Grading Rubric.

Written report

- Must be presented in PDF format
- May be no longer than 2,000 characters
- Illustrations, graphs and other supplemental materials are encouraged
- Sources must be cited appropriately
- Educators are encouraged to follow grade appropriate Common Core Science and Technical Writing Standards available here: http://www.corestandards.org/ELA-Literacy/RST/introduction/
- If programming is a key portion of your submission, please provide your program file or a description of it in your report.

Video report

- The video report may not exceed 2 minutes and 30 seconds of time.
- Acceptable formats are avi, mpeg, wmv and mp4.
- All submitted videos and reports must be provided in English.

Learner Video

- Each team must also provide a separate video casually describing what the students learned, their experience during the competition and encouragement for other students to pursue designing solutions in this problem space.

Updates and Sign Ups

Updates

The NeuroMaker judging committee reserves the right to make any adjustments or changes to competition rules. Updates will be posted on https://www.brainco.tech/neuromaker-challenge/

Sign Ups

Please use this form to sign up for the competition:
2020 NeuroMaker Creative Challenge Sign Up Form

Team will only be officially signed into the program after they have received written email confirmation of their participation from a BrainCo representative.

Questions?

We welcome any questions you may have about the challenge. Please contact NeuroMaker Challenge Manager Andrew Bannish at andrew.bannish@brainco.tech with any inquiries you may have.