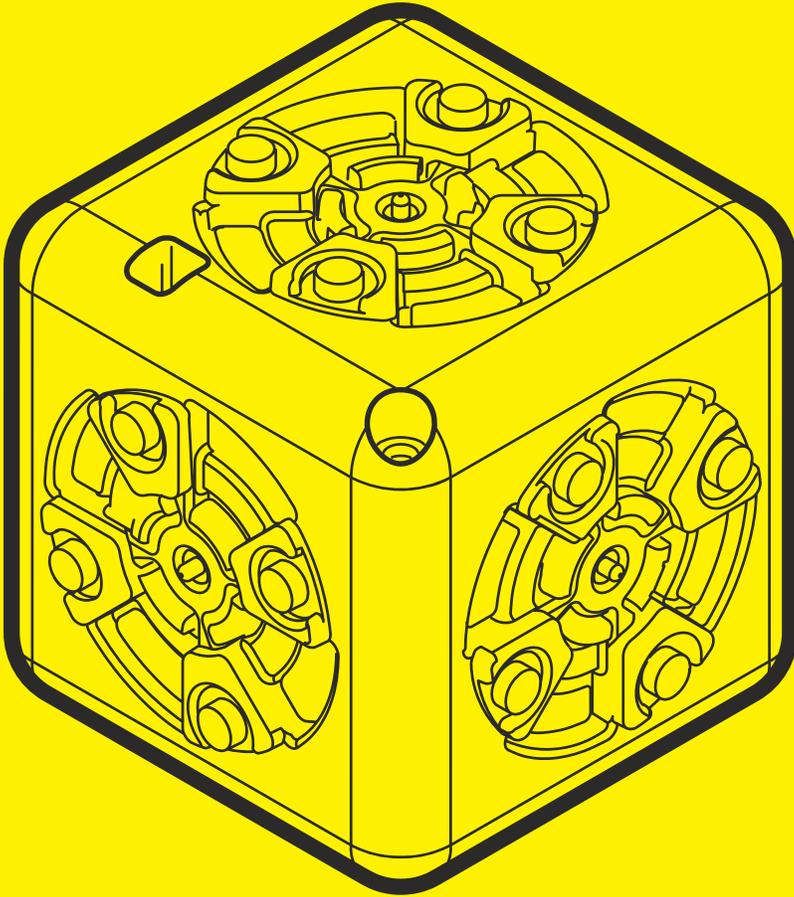


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# Introduction to Cubelets.

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**cubelets**  
ROBOT BLOCKS

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Modular Robotics 

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There are **three** types of Cubelets.

01

SENSE



Brightness



Distance



Knob



Temperature

02

THINK



Battery



Blocker



Bluetooth Hat



Inverse



Maximum



Minimum



Passive



Threshold

03

ACT



Bar Graph



Drive



Flashlight



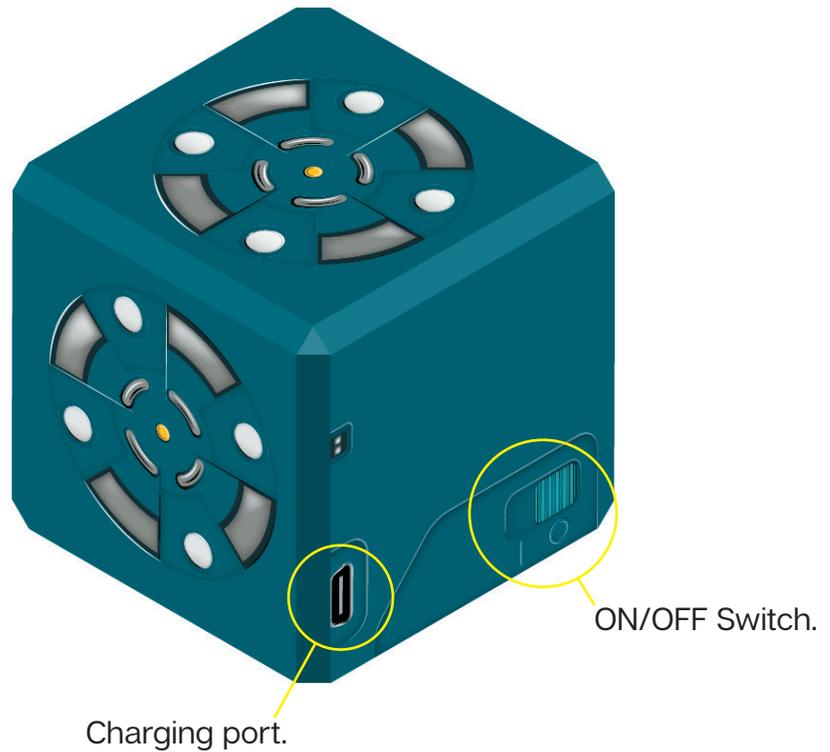
Rotate



Speaker

---

# Let's start with your Battery!



Your Battery Cubelet is the navy blue Think Cubelet with one flat face. The flat face will have an on/off switch and a charging port.

**You will need a Battery for every robot construction – they won't work without a Battery!**

As a best practice, you should not leave your Cubelets connected to the charger overnight.



**Pro Tip:**

When distributing Cubelets in class, you may find that holding the Battery Cubelets back until it is time to begin building is an effective tactic for classroom management.

# 01

## Build your first robot.

### Gather supplies.



Battery



Brightness



Flashlight



Rotate



Inverse\*

\*For BONUS activity!

### 01

Stack the Brightness Cubelet on top of the Battery Cubelet.



When building, keep your Battery OFF to make constructing your robot easier.

### 02

Stack the Rotate and Flashlight Cubelets on top of the Brightness Cubelet.



Make sure the black face of the Rotate Cubelet is facing up.

### 03

Power on the Battery Cubelet.



Once your Battery is on your flashlight robot should spin and light up.

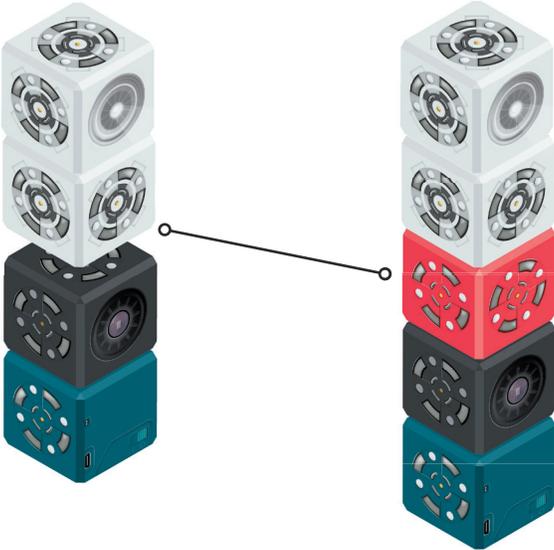


Continue to bonus activity...

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04

**Add the Inverse Cubelet between the Brightness and Rotate Cubelets.**



**This one spins and lights up when the room gets dark!** You can also cover the Brightness Sensor if you don't want to turn out the lights.

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### Why the lighthouse?

### The lighthouse illustrates many of the basics behind how Cubelets work!

After building the lighthouse...

Do you feel you can explain to your students what the Battery, Brightness, Flashlight, and Rotate Cubelets do?

What about the Inverse Cubelet? How can you encourage your students to explore the Inverse Cubelet further?





## For the curious... Your robot constructions explained in detail.

Every Cubelet has a default behavior – think of it as a Cubelet’s Personality! The behavior of your robot construction is determined by the interaction of the individual Cubelets’ Personalities.

Cubelets communicate by sending block values to each other. Block values are created by the SENSE Cubelets after they gather information from the environment. For instance, the Brightness Cubelet in your robot detects how bright it is. When there is lots of light, the Brightness Cubelet sends a high block value, and when it is darker, the Brightness Cubelet sends a low block value.

The ACT Cubelets, like the Rotate and Flashlight receive the block values that are shared from neighboring Cubelets and translate them into action. High block values cause more action – example a more luminous shine. Low block values cause less action – example a less luminous shine.

### In a dark environment...



When you added the Inverse Cubelet between the SENSE and the ACT Cubelets, it changed the block values.

The Inverse Cubelet flips data values. It turns high values into low values and vice versa!

This is why your second robot only activates when it is dark. When it is bright the Brightness sends a high value, which the Inverse turns into a low value. The Inverse Cubelet caused the new behavior by flipping the data values it received from the Brightness Cubelet before they reached the Rotate and Flashlight.

For a deeper dive into how Cubelets work, check out the [Getting Started Guide in the Hub: www.modrobotics.com/thehub](http://www.modrobotics.com/thehub)

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02

## Alarm clock.

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### Gather supplies.



Battery



Brightness



Threshold



Speaker

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01

**Connect the Battery, Brightness, Threshold, and Speaker Cubelets.**

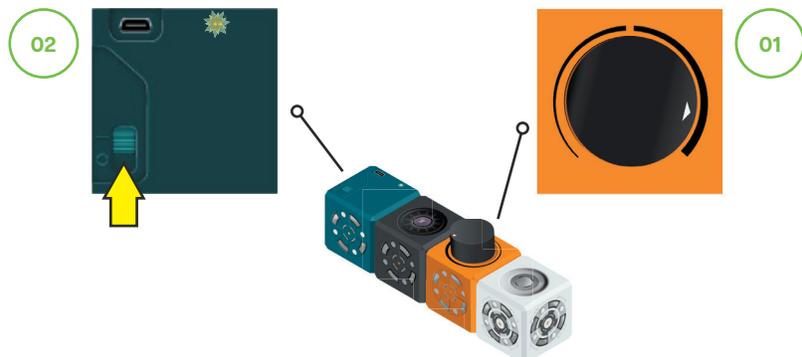


It is important to place the Threshold between the SENSE and ACT Cubelet for it to function as intended.

---

02

**Set the Threshold knob close to its maximum value. Then, power on the Battery.**



### So what's happening?

The amount of light in the robot's environment will determine whether the Speaker Cubelet is beeping or not. First, try covering your Brightness Cubelet with your hand. When you decrease the amount of light reaching the Brightness sensor, the block value drops to a low number and the beeping will stop. If you gradually allow a bit more light to reach the sensor, you'll notice that the beeping is still stopped. This is because the Threshold is blocking data values below its threshold, which is determined by the position of the knob.

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When the amount of light reaching the sensor exceeds the value set by the knob, the beeping will begin. Try turning the knob to see how the amount of light needed to cause beeping changes.



To put it all another way... think of the Threshold as a conditional statement that says something like "IF the sensor value is less than threshold value, stop all data. ELSE, allow data to pass normally. "



Tip: Try placing your robot in the window as the sun is coming up. Your speaker will start beeping once enough light comes through your window.

### Why the alarm clock?

The alarm clock illustrates the basic functions of the Speaker and Threshold Cubelets, as well as a robot construction with real-world applications. Example: "Wake me up when it's bright out!"

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## Alarm Clock Extensions.

### Questions to ask your learners after they have built the basic alarm clock.

- If you wanted the alarm clock to wake you up earlier, which way should you turn the Threshold knob?
- How can we use the Threshold Cubelet with the Distance Cubelet?
- What do you think the difference is between the black Knob Cubelet and the orange Threshold Cubelet? – How could you test that theory?
- What other "alarms" can we make with our Speaker Cubelets?
- Expert question: what happens to your alarm if you add an Inverse Cubelet to your robot?

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# Threshold vs. Knob.

The questions in the alarm clock extensions section can guide your students' exploration.

For your own pre-teaching knowledge:



### **Threshold Cubelet:**

The orange Threshold Cubelet does what the name suggests. It sets a threshold and functions as a conditional statement. Example: Your alarm clock will chirp when the Brightness Cubelet senses enough light.



### **Knob Cubelet:**

The black Knob Cubelet senses input directly from you –when you turn the Knob up or down you set the data value it outputs. Other connected Cubelets respond to this data. Example: If you turn the knob down the speaker will chirp less.

**Look for robot number 03 in the next section to explore how to use the Knob Cubelet!**

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03

## Bucking bronco.

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01

Connect the Drive Cubelets as shown.

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## Gather supplies.



Battery

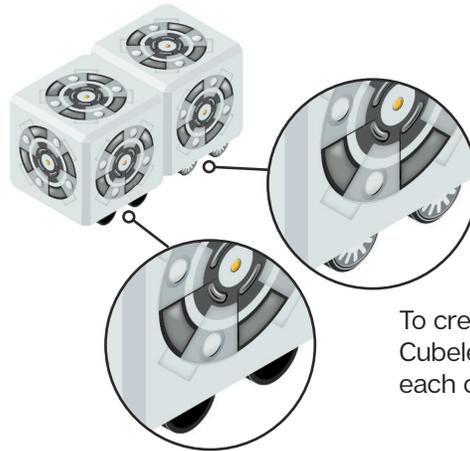


Knob



2x Drive

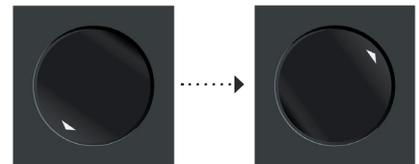
Note the direction of the Drive Cubelets' wheels. Look for the little white gears on the side of the wheels.



To create a bucking bronco, the Drive Cubelets need to face in opposition to each other.

02

Add the Knob and Battery Cubelets as shown. Then, power on your Battery Cubelet.



Turn the Knob Cubelet up slowly. Your robot should start shaking, or “bucking” back and forth. If you turn the knob up all the way, your robot may buck all the way over. If you turn the knob all the way down, the robot should simply tremble a little. Give both a try!

**Note:** If your robot is driving in one direction, your wheels are likely pointing in the same direction.

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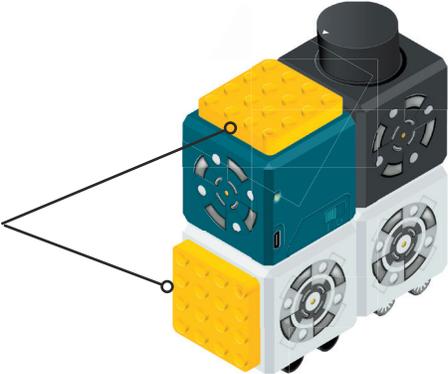
03

**Why the Bucking Bronco?**

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**The bronco introduces learners to the Knob Cubelet and different properties of the Drive Cubelet!**

**Bonus!** Introduce the Brick Adapters to your learners by creating a LEGO® rider for your Bronco or challenge them to create a wheelie-bot that can ride on only one Drive Cubelet.



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**Knowledge review.**



**Do you feel comfortable explaining how these SENSE Cubelets work?**

If not, try another lighthouse build (Robot Build 01). Or get creative, and swap the Brightness Cubelet in a lighthouse for a Knob Cubelet.



**What about these THINK Cubelets?**

Remember, EVERY robot you build with Cubelets needs a Battery Cubelet in order to function!



### Finally, are you comfortable with these ACT Cubelets?

Feel free to redo robot builds 01–03 as often as you need! Repeating these a few times can help build confidence for you and your students. You can also return to them when a more complex build is giving you trouble.

# 04

## Chase-O-Matic.

### Gather supplies.



Battery



Distance



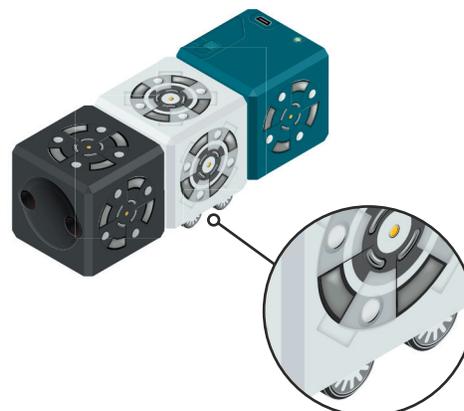
Drive

### 01

Connect the Distance, Drive, and Battery Cubelets.

Then, power on your Battery Cubelet.

Note the direction of the Drive Cubelets' wheels. Look for the little white gears on the side of the wheels.



If you place your hand about one foot in front of the Distance “eyes,” your robot should move towards your hand.

05

Green means go.

## Gather supplies.



Battery



Knob



Passive



2x Drive



Rotate



Bar Graph

Or...



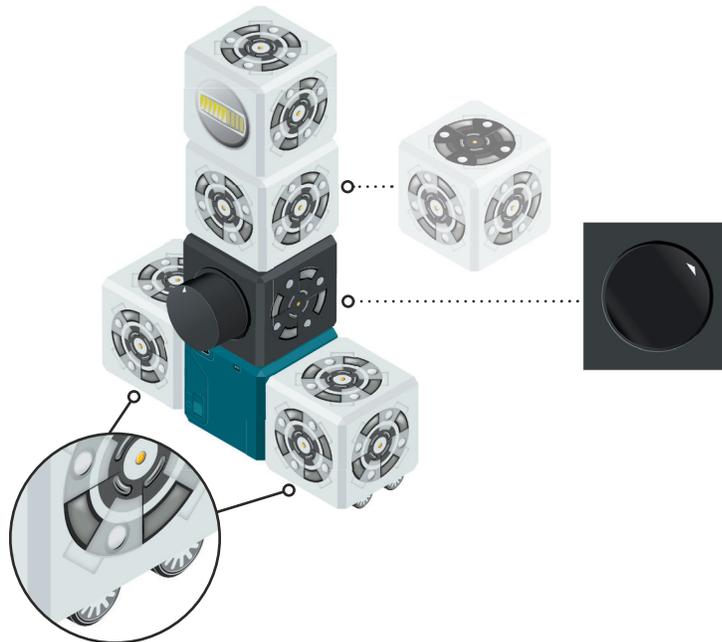
Flashlight

01

Connect the Battery, Drive, Knob, Rotate, and Bar Graph Cubelets.

Then, power on your Battery Cubelet.

Note the direction of the Drive Cubelets' wheels. Look for the little white gears on the side of the wheels. Set the Knob to about 3/4th of its maximum value.



When you power on your Battery Cubelet, your robot will likely tip over!

---

02

**Connect the Passive Cubelet to the back of your Battery Cubelet.**

**Then, try running your robot again.**



The Passive Cubelet helps balance this robot construction. Challenge your students to use the Design Thinking Process to design a robot that doesn't tip over.

---

## Meet the Blocker Cubelet.



The Blocker Cubelet is a THINK Cubelet that “blocks” data from its neighbors. It still passes power, but effectively stops block values and can insulate one side of a robot from another.

The Blocker Cubelet is featured in the next robot to steer a robot through a maze. This robot is an example of a solution that solves a challenge featured in the Cubelets Activity Cards. More advanced versions of “the steer” can self navigate mazes when you modify the behavior of your Cubelets using the Bluetooth hat. (Details in the following section.)



The dark green Blocker Cubelet differs from the bright green Passive Cubelet. The Blocker Cubelet does NOT pass data but allows power to flow. The Passive Cubelet passes BOTH power and data.

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06

## The steer.

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01

Connect the Battery, Blocker, and Drive Cubelets.

Then, power on your Battery Cubelet.

## Gather supplies.



Battery



Blocker

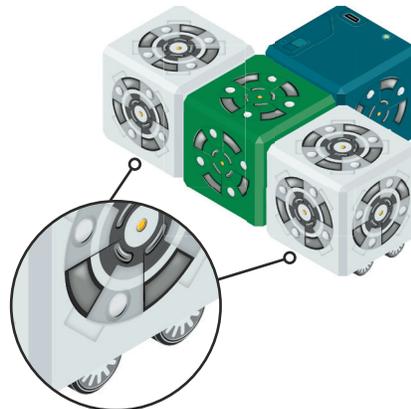


2x Drive



2 xDistance

Note the direction of the Drive Cubelets' wheels. Look for the little white gears on the side of the wheels. Powering your Battery on should not affect your robot until you add the Distance Cubelets.



02

Connect the Distance Cubelets as shown.



If you place your hand in front of one of the Distance Cubelets, your robot should begin to turn. If you place your hand so that both Distance Cubelets can detect your hand your robot will drive forward.

Reposition the distance Cubelets to face up, and you'll have a robot that's great for steering through mazes.

---

# Meet the Bluetooth Hat.



The Bluetooth Hat is your gateway to doing more with Cubelets robot blocks. Connect your robots with free web app, Console, to change what your Cubelets can do. Swap Cubelet behaviors with Personality Swap – or create your own Cubelet Personalities with Blockly and C coding.

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## Meet Cubelets Console.

Cubelets Console is a free to use web application that requires no background coding knowledge! There's no installation necessary – all you need is Google Chrome or Microsoft Edge and a Bluetooth enabled Mac, PC, or Chromebook. There, learners of any age can use it for many purposes, including:



Cubelets are little robots, programmed to behave a certain way. Personality Swap lets you change your Cubelet's programming with the touch of a button. It's no-code, tactile, computational thinking for builders 4 and up. Available in the Cubelets App or in Cubelets Console.



Explore how 256 numbers create every Cubelets robot behavior you see. Use Data Logger in Cubelets Console to visualize your robot's data in real-time. Log the data for deeper analysis.



Every Cubelet is a little robot you can program. Use Cubelets Console (a free web app) to build your own Cubelet behaviors with simple drag-and-drop coding.



Get complex. Cubelets Console also includes a C programming environment. So you can code teams of robots that behave like bigger robots. Meta robots.



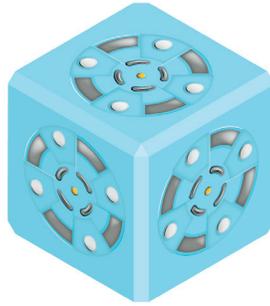
[console.modrobotics.com](https://console.modrobotics.com)



To access Cubelets Console simply visit: [console.modrobotics.com](https://console.modrobotics.com) using a Google Chrome or Microsoft Edge browser.

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# A note on the Bluetooth Cubelet.



Depending on the when you purchased your Cubelets set, you may have the older Bluetooth Cubelet. Despite being part of the previous generation of Bluetooth technology, the Bluetooth Cubelet can still help your learners.

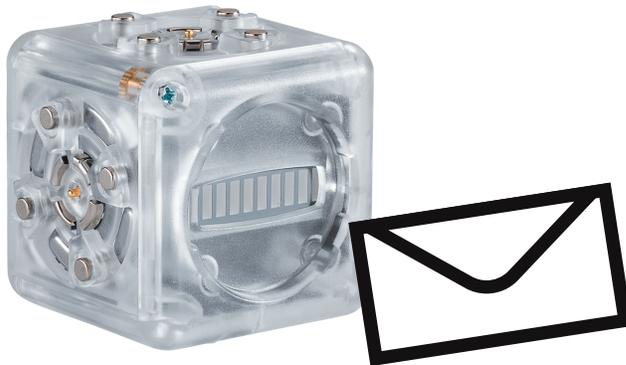


The Bluetooth Cubelet can be used to swap Personalities, create remote control construction, and read block values using the free Cubelets Mobile App. You can also program your Cubelets using the legacy versions of Cubelets Blockly or Cubelets Flash.

Access the Cubelets mobile app and more at:  
<https://modrobotics.com/cubelets-apps/>

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# Need help? We're here!



As you explore Cubelets, questions are bound to arise. We're here to help!  
Simply email us to get started:

[support@modrobotics.com](mailto:support@modrobotics.com)