



Stop Motion Animation

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<https://learn.adafruit.com/stop-motion-animation>

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Overview



Stop motion animation is lots of fun to watch, and maybe even more fun to make! Using a tablet or smartphone with inexpensive or even free software, it's very easy to make your own stop motion films.

This guide covers the basics to get you started, and includes resources and links for further learning.

Since Halloween is a terrific subject for stop motion animation (go watch **The Nightmare Before Christmas** if you've never seen it!) we'll create a Halloween-themed shot using our beloved Adafruit characters!

Parts

You can use nearly anything you like to create sets and characters for stop motion! A cardboard box and a couple of LEGO figures or a lump of clay are more than enough materials to begin!

Here are some simple accessories to use if you want to make an Adafruit-themed Halloween stop motion animation.



1 x Adafruit #ElectricHalloween Cards
set of 5

<https://www.adafruit.com/product/3912>

1 x Adafruit #ElectricHalloween Sticker Sheet
Set 1 of 2

<https://www.adafruit.com/product/3913>

1 x Adafruit #ElectricHalloween Sticker Sheet
Set 2 of 2

<https://www.adafruit.com/product/3914>



Tools and Materials

In addition to cardboard or foam core to act as a set, plus some figures, blocks, clay, stickers, or other materials for characters, you'll also need:

- iOS or Android tablet or smart phone
- Stop motion app, such as [Stop Motion Studio \(https://adafru.it/CGx\)](https://adafru.it/CGx)
- Tripod or other tablet/phone holder to keep it steady
- Many devices can use the inline button on a pair of earbuds to trigger the camera shutter without touching the screen, so if you happen to have a set of those, great!
- A lamp or two for even, controlled lighting

Optional Upgrades

If you want to bump up the quality of your stop motion animation at some point, consider getting dedicated lighting and helping hands to hold set pieces and characters:

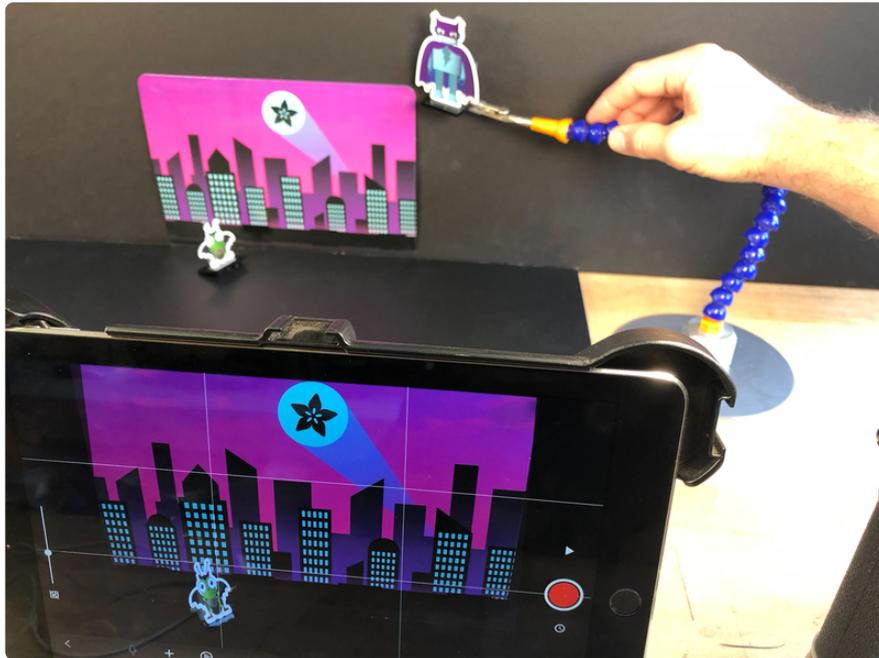
1 x [Camera-Mount LED Photography Light](https://www.adafruit.com/product/2894) <https://www.adafruit.com/product/2894>
CIE Ra 95 - 3200K to 5600K

1 x [Hobby Creek Magnetic Helper Hand](https://www.adafruit.com/product/3373) <https://www.adafruit.com/product/3373>
Two arms on one magnetic base

1 x [Hobby Creek Magnetic Mag Hand Professional Workstation](https://www.adafruit.com/product/3529) <https://www.adafruit.com/product/3529>
with four arms and heavy steel base

Let's get started!

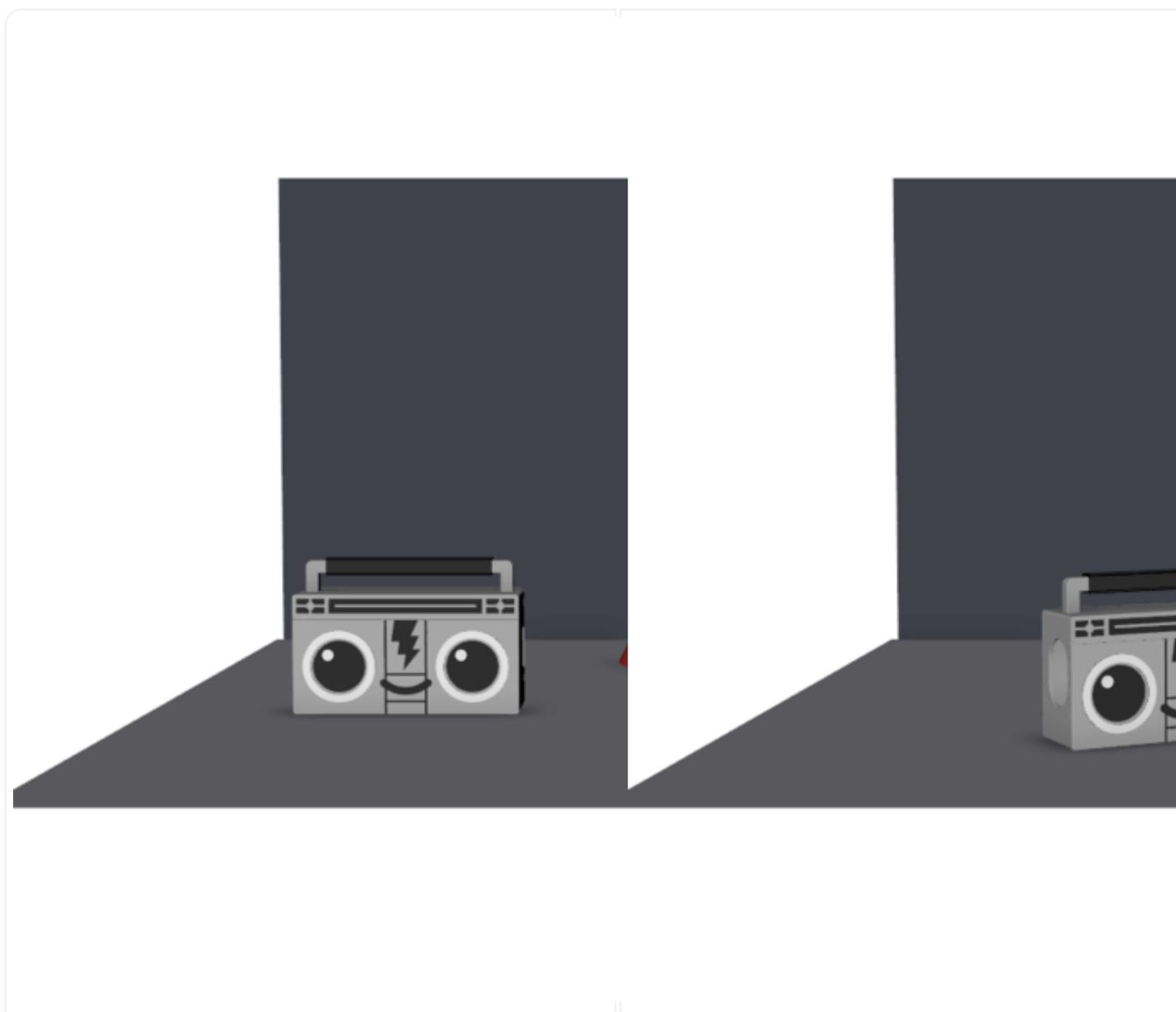
Stop Motion Animation Basics

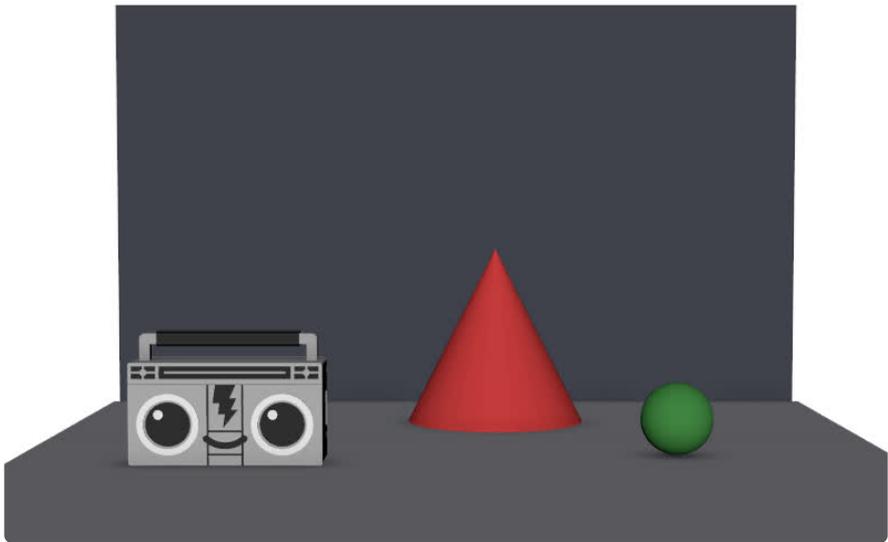
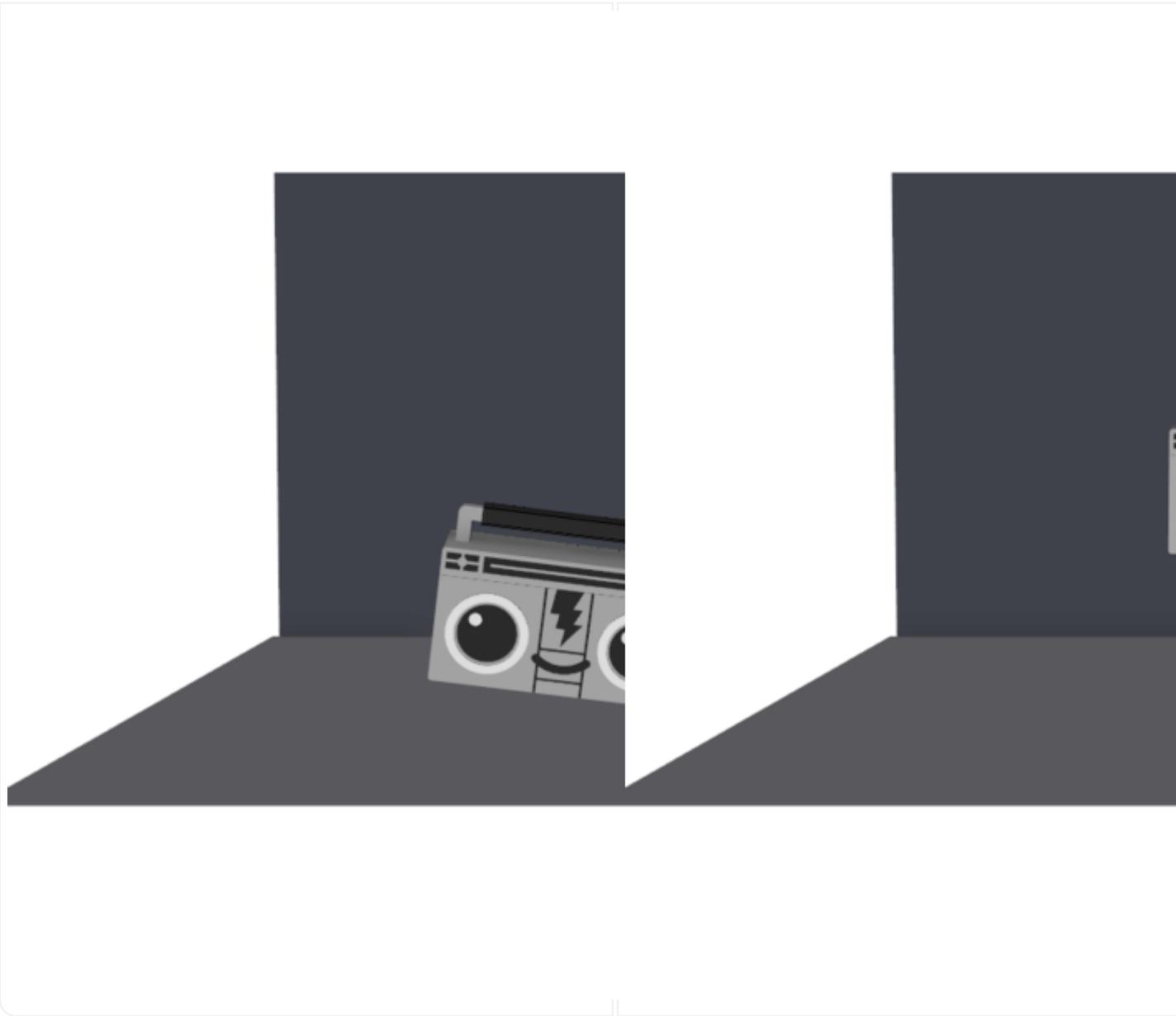


The key principal to understand for any kind of animation, including stop motion, is persistence of vision. Our brains are very good at filling in the blanks and imagining continuous motion when we see a series of still images displayed in quick succession.

This is how motion pictures/film/movies/videos work, as well as mechanical illusions, such as zoetropes and flipbooks. Traditional animation methods such as hand drawn animation, and puppet- or clay-based stop motion animation work the same way. Create a single frame by drawing a pose, or posing a figure, and then shoot a frame of the image onto film, or, more likely these days, a digital photograph. Then, create a new pose, shoot a second frame, and repeat this on and on.

When you then rapidly review those images you photographed, suddenly your subject starts moving and comes to life!





Frame Rates

Motion picture films and digital projections you see at the local cinema are most commonly played at a frame rate of 24 frames-per-second (FPS). Video displayed on NTSC televisions in the U.S. and Japan runs at 29.97 FPS while the PAL standard in much of the rest of the world is 25 FPS. Most videos online run at 30 FPS.

Does this mean you need to pose and shoot 24 individual frames per second of animation? Thankfully, the answer is: No!

While the highest quality hand drawn and CG animated features are typically animated on ones (one pose per frame), plenty of animation is shot on twos, which means you pose the characters, then shoot two frames of film, and then repeat, meaning you only create 12 unique frames of animation per second. These are then played back at 24 FPS and our brains do enough "smoothing" that things still look great, even though each pose is being held for two frames.

It doesn't stop there, either. Lower budget Saturday morning cartoon animation and much anime is shot on threes, so only 6 poses are required per second.

We'll work at low frame rates, which really helps speed things along, especially when you're first learning. Typical stop motion apps will let you choose your working frame rate, such as 5 FPS, and will preview your animation for you and export movies at 30 FPS.

You can move to higher frame rates later on if you like, but to start we'll work at 5 FPS.

Capture and Edit

Besides a set and characters, the most important thing you'll need is a device to capture and edit your frames. There's a wide range of options here -- tablets/smart phones, laptops with web cams, full DSLRs tethered to computers with remote shutter releases, automated lighting, and motion controlled platforms!

We'll focus on using tablets or smart phones because they are inexpensive, small, simple, and do a great job when paired with the right app!

Professional stop motion animators working in commercials and film generally use DSLR cameras connected to a computer, and controlled with Dragonframe software. They often use motion controlled rigs for their cameras --

Dragonframe's motion system can even control DIY Arduino-based motion control rigs and sliders!



Stop Motion Apps

It's certainly possible to create stop motion animation using only the regular camera app on your device, and then separate editing software, but there are some huge advantages to using a dedicated app.

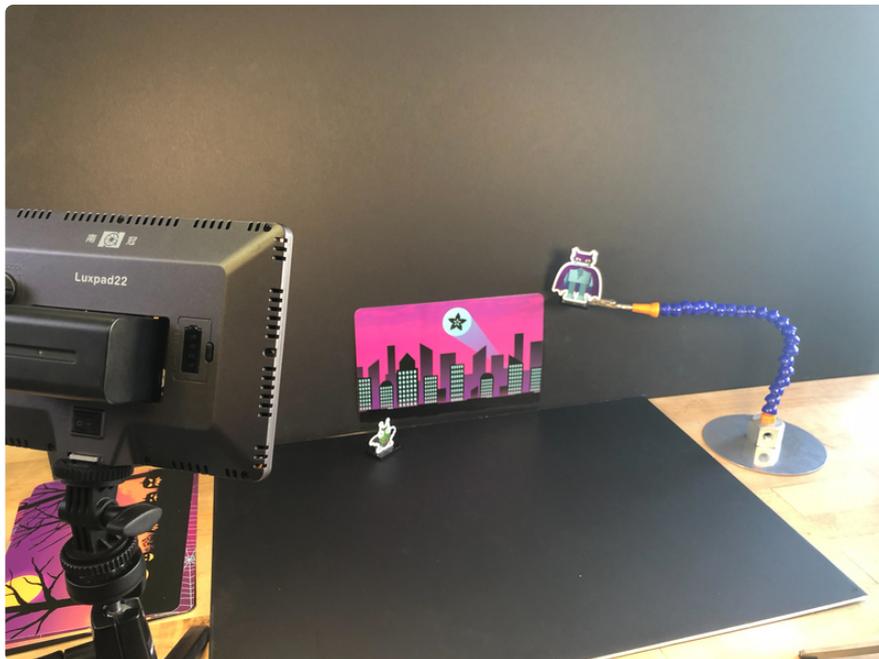
Three key features to look for in a stop motion app include:

- Separate capture vs. playback frame rates
- Onion skinning
- Manual camera controls

I found that everything I need is in the free **Stop Motion Studio** app on [iOS \(https://adafru.it/CGy\)](https://adafru.it/CGy) and [Android \(https://adafru.it/CGz\)](https://adafru.it/CGz) (they also have Windows and mac os versions). [iStopMotion \(https://adafru.it/CGA\)](https://adafru.it/CGA) is another very popular app on iOS for iPad and mac os.

Animate a Shot

It's time to animate a shot! First, we need to build our set, and add lighting and characters.



Set Build

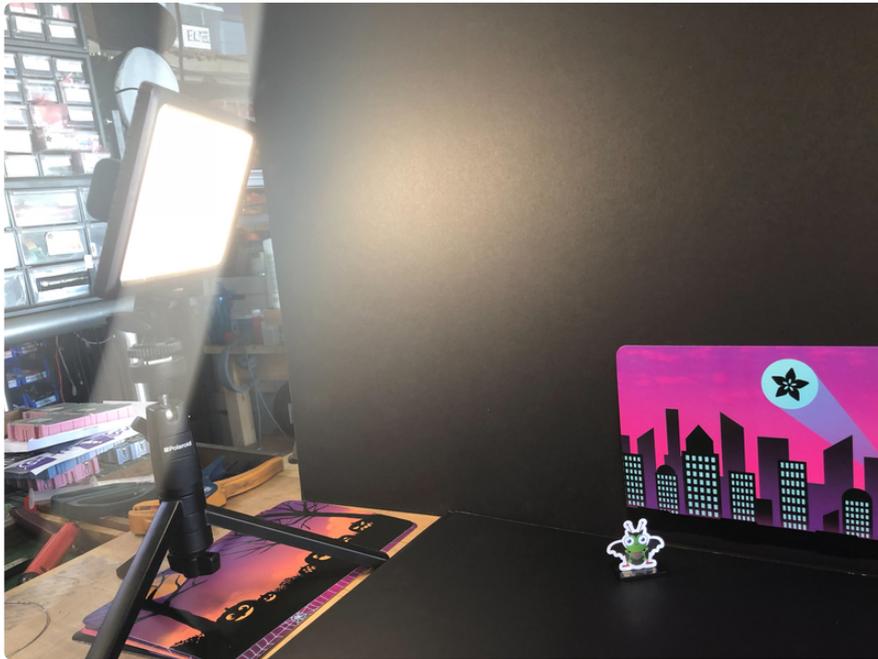
Find a good spot to create your set -- a big table or workbench is best, especially if you can put it up against a wall to serve as your backdrop.

You can lay down some cardstock or foamcore board as your ground plane and back wall in the set.

We'll use some poster putty or tape to place one of the Adafruit Halloween cards in the background of our set.

Characters

A couple of Adafruit Halloween character stickers seem just right for this! You can peel them off of the backing and stick them to a small stack of LEGO bricks so they'll stand upright.



Lighting

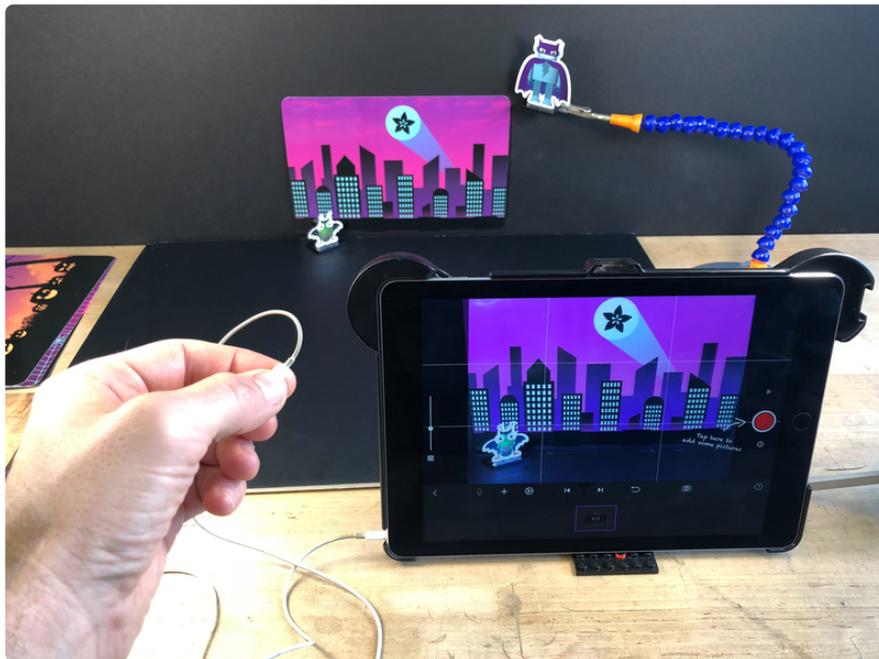
You may notice that natural shifts in lighting while you're creating your film become very noticeable when playing back the shot at speed. To minimize this, try to control your lighting by placing a couple of lights above and to either side of your set.



Camera Setup

We want to avoid any wiggle in our frames by locking down the camera. You can use a tripod mounting case for your device or simply wedge it in place with rubber bands

and some hard back books! Anything that works so long as the lens is clear, you can see and use the screen, and it isn't going to move around while you're animating!



Pose the Characters

Pose the first frame of your shot. We'll start with a very simple setup, using our Crickit trick-or-treater near the center of the frame, and our Bat-AdaBot flying in from off frame upper right using a support of some kind. I am using a helping hand arm.

App Setup

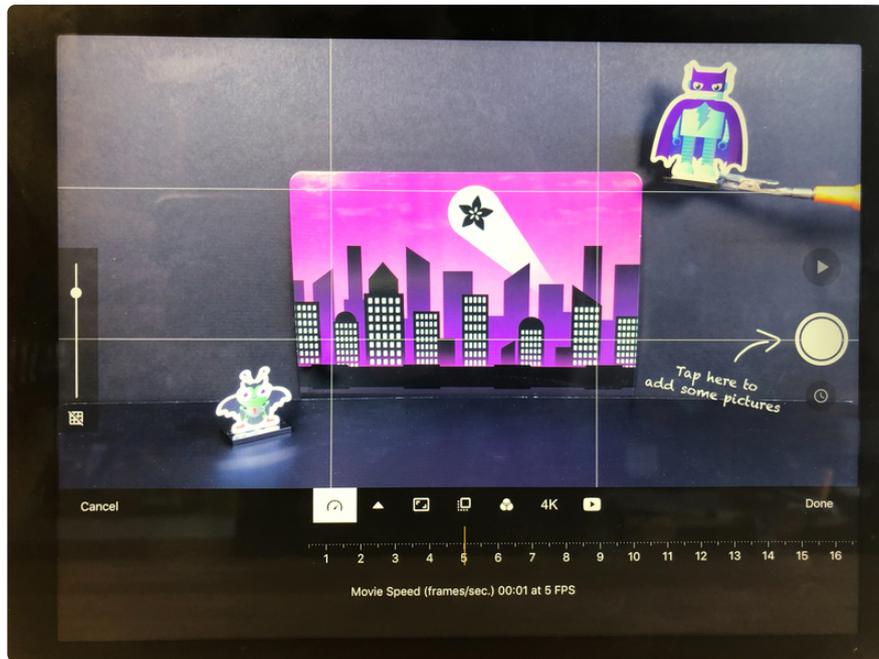
Specific steps will vary depending on the software you use. In Stop Motion Studio, we'll first create a new project by pressing the plus sign.

Next, point the camera at your subject and tap the camera icon to lock in the setting we want. If we don't do so, the focus, exposure, shutter speed, and white balance will tend to vary from frame to frame.

Use the manual mode and pick the settings you want to lock in for the shot.

Frame Rate

Choose your frame rate for the shot -- I am using 5 FPS, which means for every frame I shoot it will be played for 1/6th of a second.



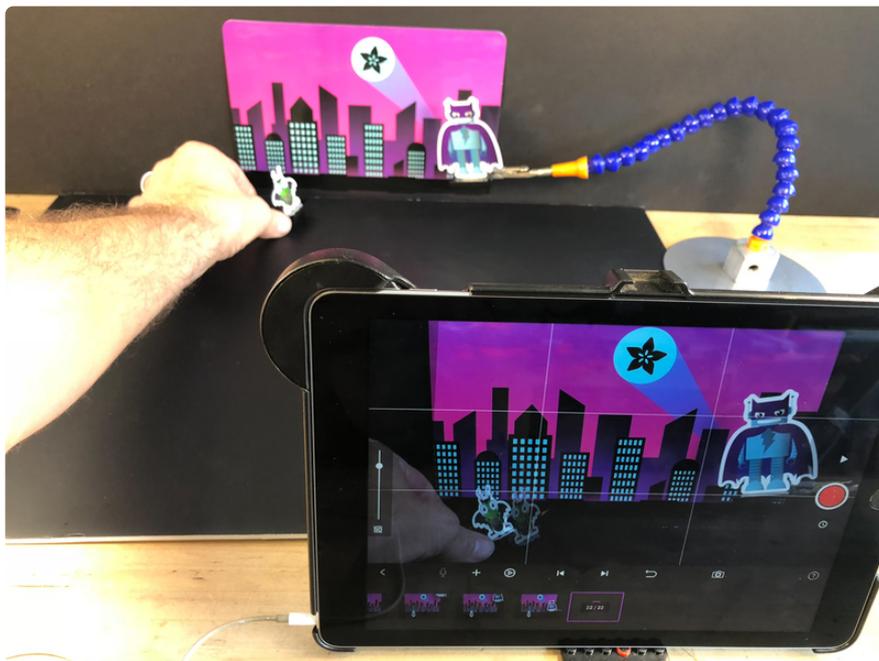
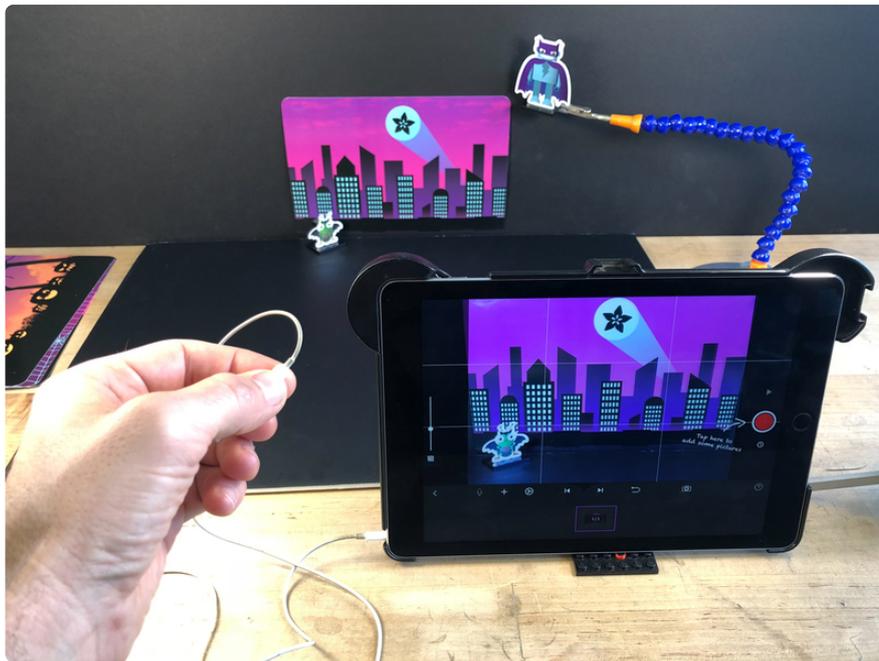
Shoot the Frame

Now, press the record frame button (or use the button on a pair of earbuds plugged into the headphone port). Your first frame is in the can!

Next, adjust the characters slightly to they'll meet up in a couple of seconds. You can see by the overlaid onion skin transparency what the positions were for each character on the previous frame. If these are very nearly overlapping, you'll make slower final movements in the animation; if these are farther apart, the motion will be rapid.

We want Bat-AdaBot to move quickly, so you'll want bigger spacing between frames. Shoot your next frame of animation.

Here's a section from my John Park's Workshop livestream where I added some animation to a shot. Also note how I've oriented the whole scene as a down shot, which really helps your characters to defy gravity!

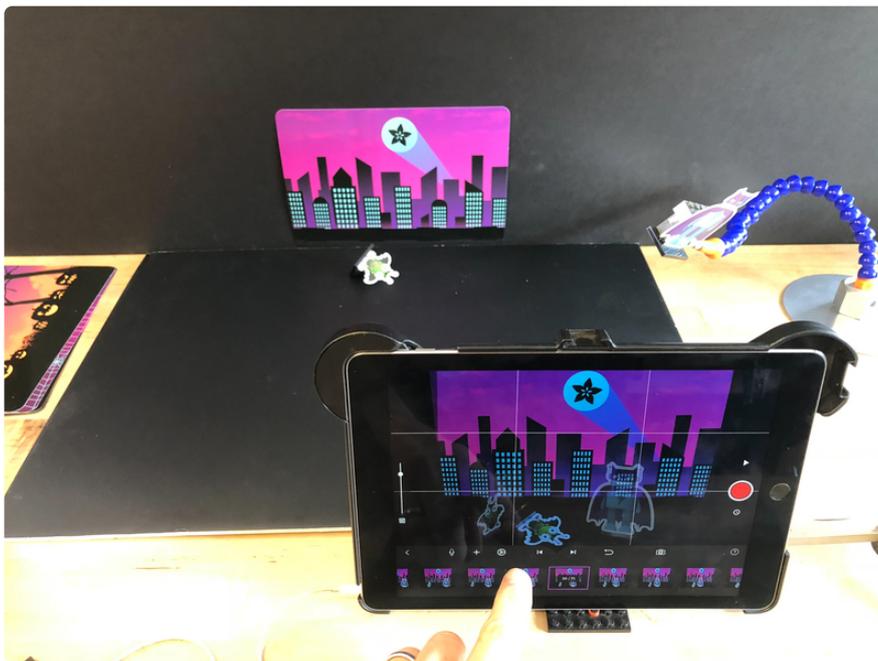


Repeat until Finished!

Keep posing and shooting each frame of animation until you're done! You can use these images as a guide.



At any time you can scrub the timeline images left and right to get a sense of the motion, or press play to preview the shot at full speed.



Exporting and Share Your Movie

You can now choose the back button in the app to complete your shooting and then export the animation. You'll have choices for exporting still frames (great if you want to do more editing) or a movie file. Export the movie file and share it with your friends!

Full Body Posing



In our previous example, we posed our characters as one unit each. Using a LEGO minifig or typical action figure/doll will give you a few more parts to work with and you can then explore arm moves, head turns, and walking.

If you use clay, wire, or a jointed figure with a high degree of freedom, you can do more elaborate posing of the character itself. This is a great time to study how things move in real life!

Here's a test I did using a StickyBones posing figure. You can see how the emphasis here isn't on moving the character around a set as much as it is rotating the character's joints in place to convey a certain pose or attitude.

This is a stop motion armature that uses hinge joints, ball joints, and wire fingers. It's highly poseable, yet holds poses well. Typically, a foam puppet is built around this type of armature.



Tie Downs

One thing you'll notice with larger poseable characters is that it can become important to tie down one or both feet to prevent the character from falling over in more extreme poses! Some armatures have threaded or smooth holes for attaching them to the set with tie down screws. Other's may have magnets. Here you can see my straps forward shrug animation test where the feet are attached to the metal base plate with magnets to prevent the character from falling over (the straps aren't actually supporting the figure much, it's mostly the foot magnet strength).

Rigging

In some cases, a character simply cannot hold a pose without extra help. Jumping into the air, for example, is impossible without some kind of support rigging. Here you can see an animation done using a flying rig, as well as the shot after roughly matting out the rig using post-production software, in this case Premiere Pro.

As you can imagine, it's possible to layer on more and more layers of detail and complexity as we consider facial animation, secondary animation of clothing and props, and so on! With practice, it's possible to achieve incredibly complex, dynamic, nuanced, and emotional performances with stop motion.

Resources



Here are some resources for going into greater depth in stop motion animation, armature/puppet making, set building, and more:

Guides

- [StopMotionAnimation.com Handbook \(https://adafru.it/CGB\)](https://adafru.it/CGB)
- [Stop Motion Animator's Handbook \(https://adafru.it/CGC\)](https://adafru.it/CGC)

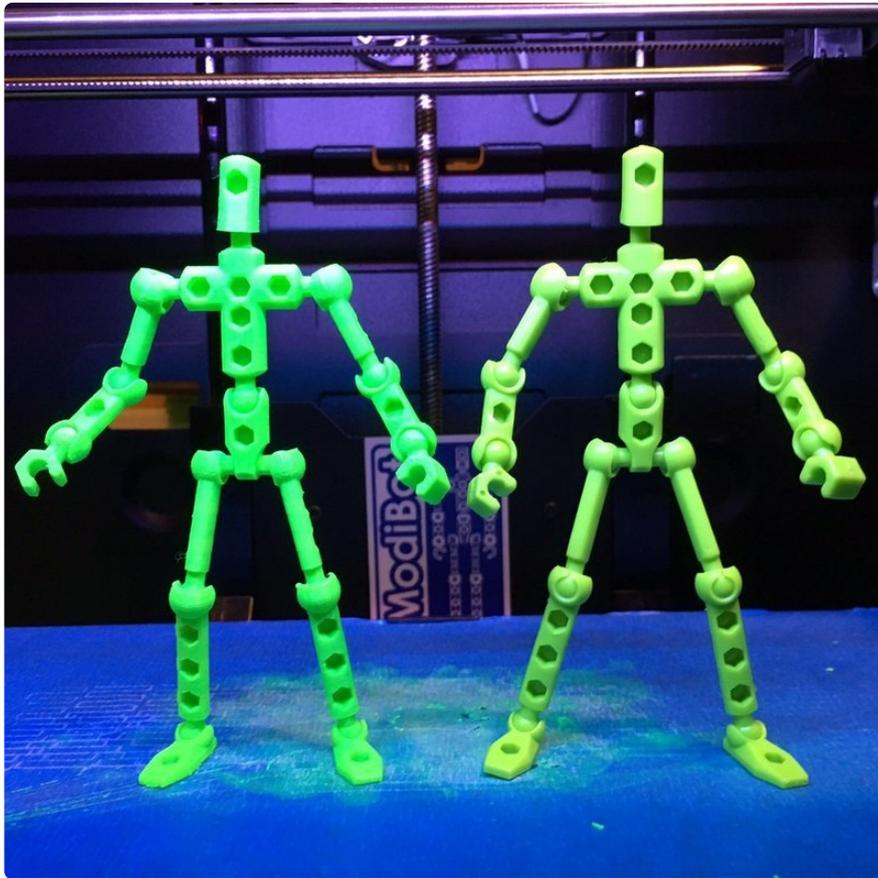
Books

- [Aardman Book of 3-D Animation \(https://adafru.it/CGM\)](https://adafru.it/CGM)
- [Stop Motion: Craft Skills for Model Animation \(https://adafru.it/CGN\)](https://adafru.it/CGN)
- [LEGO Animation Book \(https://adafru.it/CGO\)](https://adafru.it/CGO)

Puppets/Armatures/Pose Figures

You can use all kinds of things to build stop motion characters -- clay, foam and wire, LEGOs, action figures, you name it! If you want to do more dynamic or fluid animation, you'll want a character with a high degree of freedom on more joints than your average action figure.

- [ModiBot \(https://adafru.it/CGD\)](https://adafru.it/CGD) [can be purchased \(https://adafru.it/CGE\)](https://adafru.it/CGE) or [3D printed \(https://adafru.it/CGF\)](https://adafru.it/CGF)



- [StickyBones \(https://adafru.it/CGG\)](https://adafru.it/CGG) are highly poseable figures with magnetic feet and palms for extremely dynamic positions that hold their poses well (can be [pre-ordered \(https://adafru.it/CGH\)](https://adafru.it/CGH) now, shipping in December)



- [Stop Motion Store \(https://adafru.it/CGI\)](https://adafru.it/CGI) sells metal jointed and flexible wire-based armatures meant to be built inside of puppets



Software

- [Stop Motion Studio and Pro](https://adafru.it/CGx) (<https://adafru.it/CGx>) for iOS, mac os, Android, and Windows
- [iStopMotion for iPad](https://adafru.it/CGA) (<https://adafru.it/CGA>) or [mac os](https://adafru.it/CGJ) (<https://adafru.it/CGJ>)
- [Dragonframe](https://adafru.it/CGK) (<https://adafru.it/CGK>) for Windows, mac os, or Ubuntu Linux (this is pro grade software, but they offer a discounted price for students, so may be worth trying the 30 day free trial if you get really into stop motion!)

Behind the Scenes

Some of the best stop motion animation being created is from Laika Studios. Here's a wonderful look behind the scenes on one of their full-scale features, ParaNorman.

Films

Here are some places to watch examples of stop motion animation, including commercial work, TV and feature films, and fan-made LEGO brick films:

- [Aardman Short Films](https://adafru.it/CHi) (<https://adafru.it/CHi>)
- [Brickfilms](https://adafru.it/CHj) (<https://adafru.it/CHj>)
- [Bricks in Motion](https://adafru.it/CHK) (<https://adafru.it/CHK>)
- [StopMotionAnimation.com](https://adafru.it/CHI) (<https://adafru.it/CHI>)

This guide only scratches the surface of the rich, limitless world of stop motion animation. We hope it inspires you to take your first steps and start animating!