animation, tutorials, & design

tutorial-2 : walk cycle

Posted on November 26, 2010 by dermot

So, you want to follow along some of my Flash lessons?
Get 7 days of free unlimited access to lynda.com.
Follow that link and get 1 week of access, see how you like it.

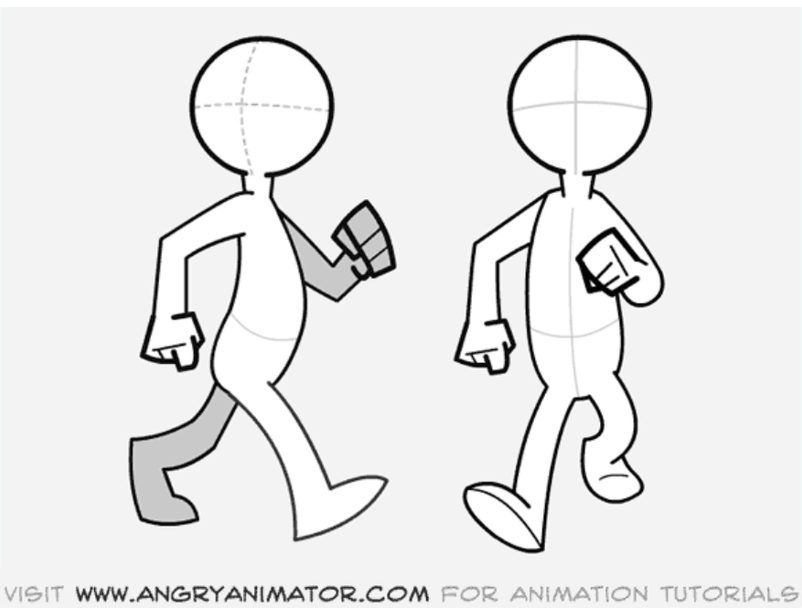
Most sane people have a fear of animating walk cycles. Many events are happening at the same time, and it can seem overwhelming. A single mistake on your first drawing can wreck the rest of the scene. However, the process can be broken down into a series of steps which can go some distance in simplifying the process.

A walk cycle can be described by four distinct poses:

CONTACT, RECOIL, PASSING and **HIGH-POINT.**

These four poses and a handful of inbetween drawings constitute a walk cycle. The single most important frame of the four is the contact pose. Once you draw it you have already determined 80% of the rest of your walk. If you make a mistake on your contact pose, it can be very difficult to correct later on. Therefore: pay close attention now and save yourself a world of pain.

Here is the contact pose in front and side view.

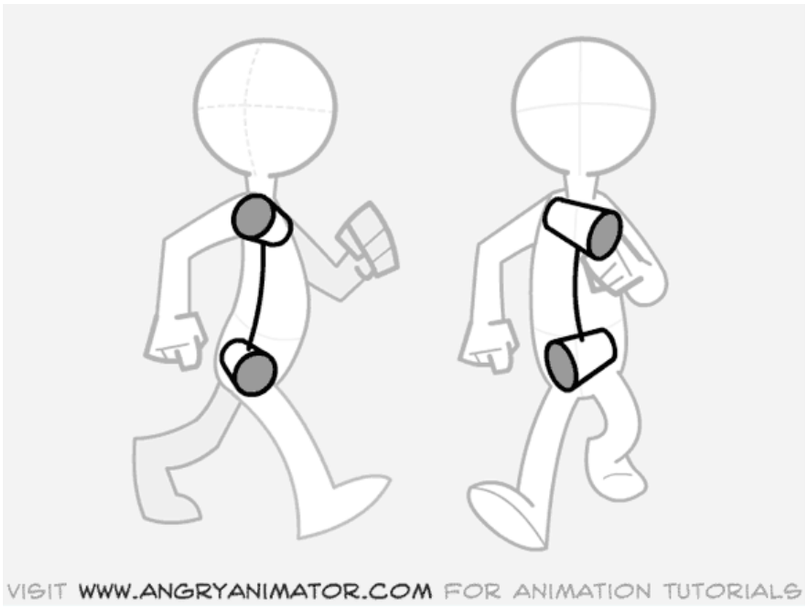


Look at the pose carefully. You will notice some very important details: The feet are at their furthest extension in the walk. That is their most extreme

position in the cycle. That alone makes this the most critical pose in the sequence. You can plan an entire walk sequence just by laying out all the contact poses as they work into one another.

Some animators think that the recoil and high points are the most important poses because the head is at its highest and lowest positions. This is wrong. The contact pose is the fundamental building block of a walk cycle. If you do not start your cycle with this pose, then you are doomed. It's as simple as that.

When the right foot is forward, the right arm is back, and vice versa. This is called "counterpose". This is how nature keeps everything in balance when you move: one side of the body "opposes" the other. Good animation has these "opposing actions" all the time. If animation seems weak or unnatural to you, it is frequently because it lack opposing action. You can think of a walk as a series of "falls". The character propels himself forward by leaning into the walk as he moves forward. His trailing foot constantly swings forward to catch himself before he moves on to the next "fall" in the sequence. It shares many attributes with the bouncing ball in tutorial 1. Look at the front on view.

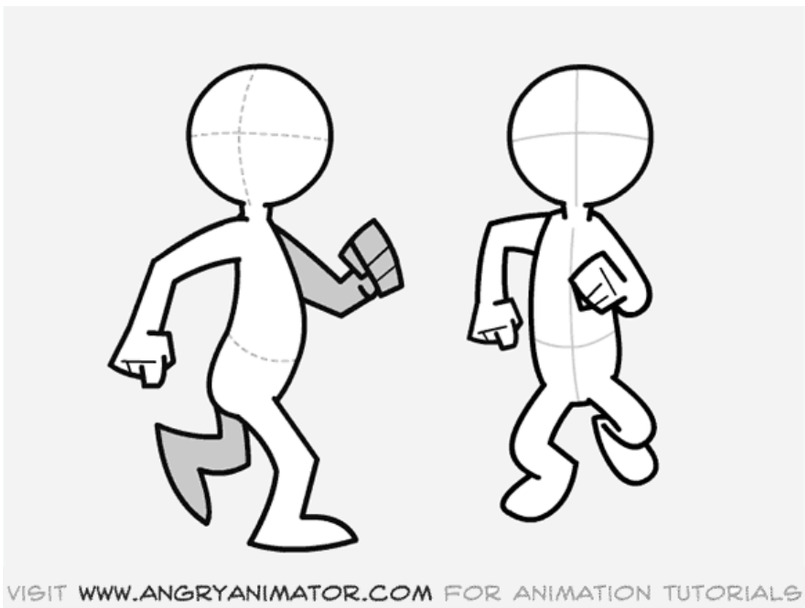


I have drawn in imaginary cylinders to illustrate the orientation of the shoulders and hips. Again, as one is thrust forward, the other is thrust back. As one tilts up, the other tilts down.

Another name for this is "Torque". It is a fundamental principle of good posing. It should be an element of almost every figure drawing that you do. Michelangelo always used torque in his sculptures, creating dynamic poses, even in ones that were standing still. One hip takes the weight, while the other passively provides the balance.

The body is very rarely symmetrical: indeed, symmetry can be your enemy.

Now look at the recoil pose, the second main pose in the cycle.

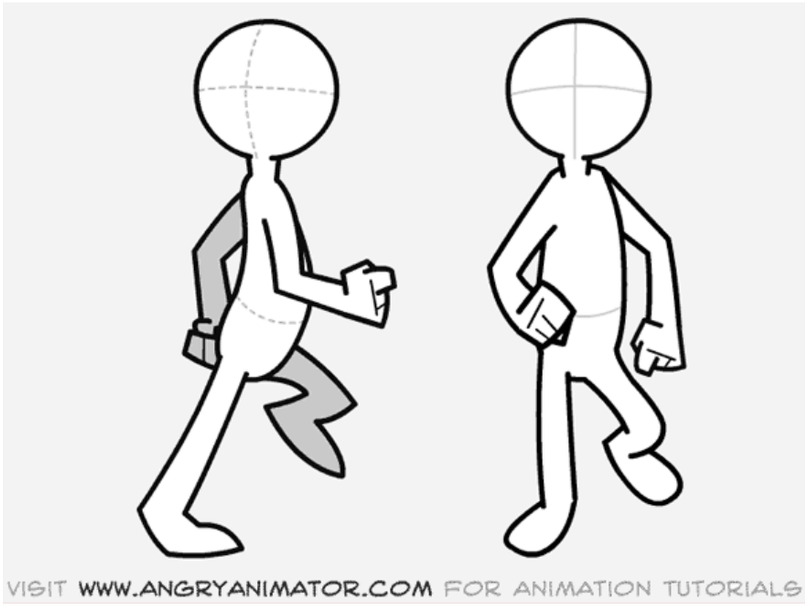


This is the frame where the character impacts the ground. It is also the lowest point in the cycle. The characters arms are furthest from the body as a result of the force of hitting the ground. The front foot is fully in contact with

the ground; the rear foot has just lifted up from it.

Note that the leading foot is directly beneath the body, supporting the weight above it. Too many beginners produce recoil poses where the foot is not beneath the body, but several inches ahead of it. Try to avoid this.

To keep things simple, let's skip the passing pose…it's closer to being an inbetween. Let's look at the high point.



This is the highest point in the cycle. The character's body is stretched to the maximum as he lifts his leading leg forward to reach the next contact position. The heel of the trailing foot is just beginning to leave the ground.

Those are the three most important poses to remember when creating a walk animation. If you can wrap your head around them, you will have a much better chance of completing a satisfactory walk cycle.

There are two basic ways to animate a walk cycle. You can animate the cycle "in place" or across the screen. Here is the same scene shown in each style.

Why animate in place? There is one main advantage:

You only have to draw a single stepping cycle, then you can reposition it across the screen, saving time and paper.

The main disadvantages of animating in place:

1.It can be confusing.

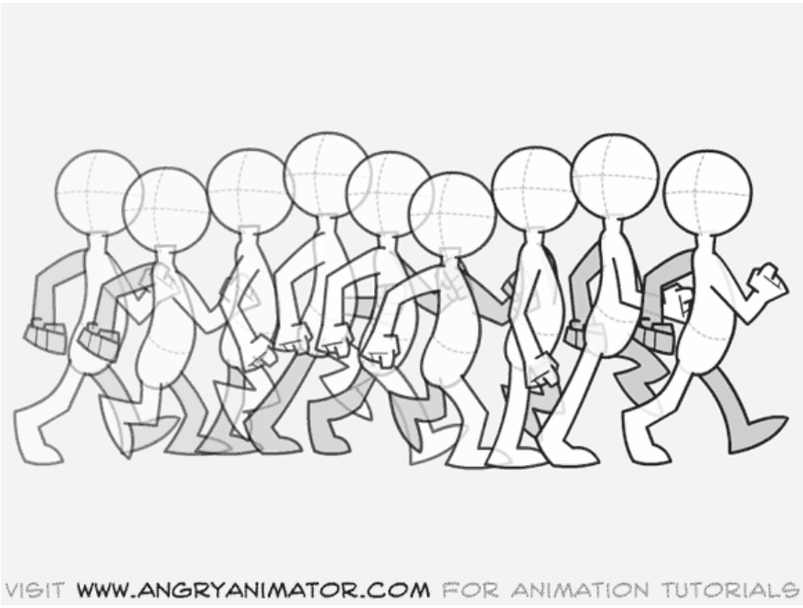
2.The “arcs” on the character can look weird when the character is moved across the screen.

3.It can be difficult to match the character properly to the background, if he has to register to something on it.

I am going to show you how to animate a character walking across the page. Once you feel comfortable with that, an in-place walk cycle should be slightly less intimidating.

Let’s begin.

Look at this image:



This shows the keyframes of a walk cycle moving across the screen. The most important pose is the contact pose. Use this image as an overall guide to your scene.

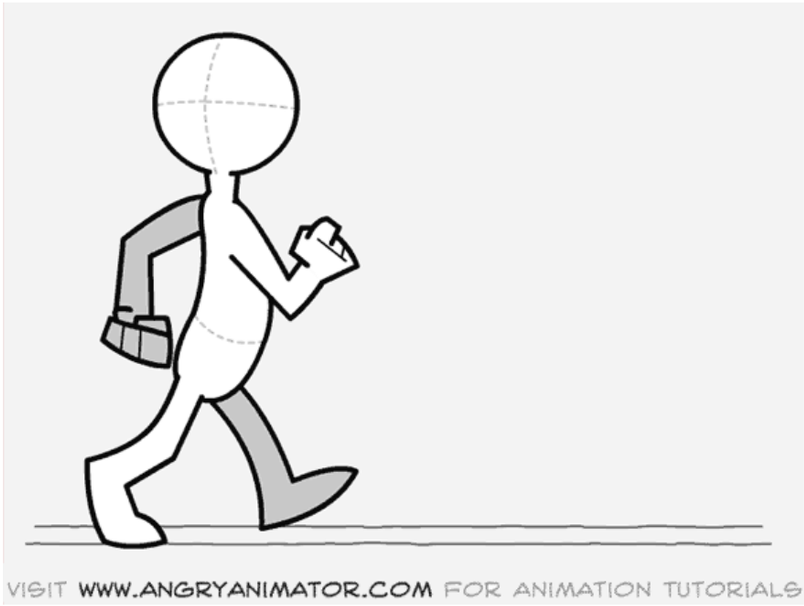
1.Guideline.

On a clean sheet of paper, draw two parallel horizontal lines moving across the bottom of the page.

These are the lines that the feet will follow as they walk across the page. Without these lines to guide you, your character can drift either too high or too low on the page.

2.Draw the first contact pose.

Put a clean sheet of paper down over the guideline drawing. You are going to draw the first contact drawing.



Position the heel of the right foot on the lower line; position the toes of the left foot on the upper line. Name this drawing #1, and since it is a contact pose I usually write the letter “c” in the top right of the page, above and away from the frame number. (This is a habit of mine, I don’t know if anyone else does it….you will find that it helps to reduce confusion when you have 12 drawings flying all over your drawing board.) Don’t forget to circle the drawing number, since it is a key.

3. Draw the second contact pose, drawing 7.

If you have a backlight then switch it on. Put down a clean sheet. Number it #7. Circle the number, as this is a key frame. Write the letter “C” above the frame number, to remind you that it’s a contact pose.

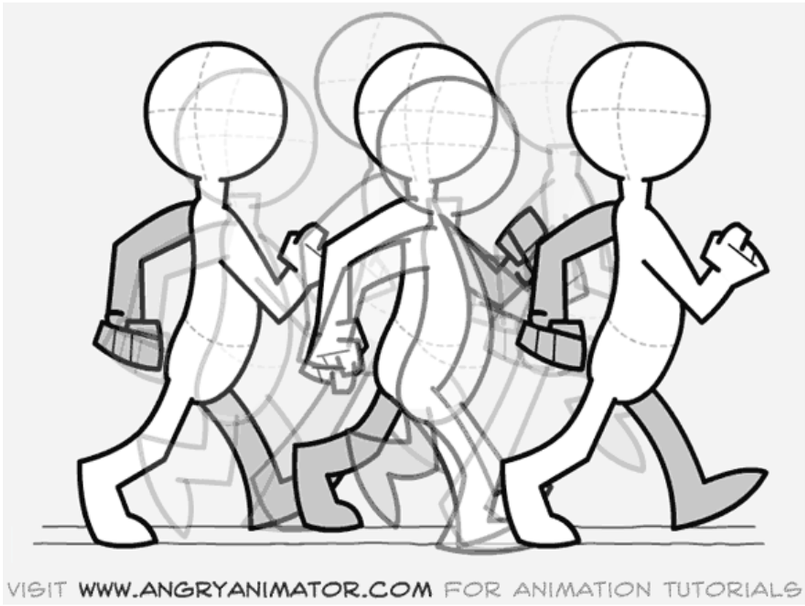
Note that the second contact pose occurs about half a second after the first. Here’s how you position the second contact relative to the first: The leading foot on #1 will be the trailing foot on #7. In this case the right foot is about to contact the ground on #1. In frames #1 through #7 it is going to hit the ground and more or less stay there. By frame #7 it will have begun to lift off the ground. Look at the picture below to see how #1 works into #7:

The right foot (the leading one) has touched the ground and the entire body has moved forward. The left foot (the far one) has now swung forward and is now about to contact the ground.

Lightly sketch it in, keeping the overall attitude as similar to #1 as possible. The only differences will be the arms, legs and orientation of the hips, all of which will be reversals of #1.

After you have roughly sketched in the second contact pose, you’ll have to check it against the first. Lift #7 off the pegs, and position it over #1. Flip #1 against #7 to see that both drawings have the same volume and attitude. You don’t want either to look bigger or smaller than the other. Also, both should be leaning forward into the walk at the same angle. If not, your walk will look more like a limp.

Now that you have drawn these two poses, you can begin to block in the main keys between them. First, an overview of what is going to happen.



Here are the main keys. The contact, recoil and high point drawings. Remember these positions when you begin to draw them in on their own sheets of paper. If you were to positon #2 too high for example, it would make #5 very difficult to draw properly: the overall action would be too “tight”…not enough bounce in the walk.

This would feel like a very stiff cycle, unnatural for a cartoony character. See what I mean below:

The opposite is also dangerous: moving the recoil too far down can result in a wildly exagerrated action, too unbelievable for all but the weirdest characters:

Just bear in mind that after the first contact, the character works down into the recoil, then up into the high point, then back into the next contact where the pattern is repeated:

4. Draw the recoil pose

(Bear in mind my rant in the previous paragraph). Put down a clean sheet, number it #2 in the top right of the page, write the letter "R" beside that, and draw the character as his foot hits the ground. The character will be at his lowest point in the cycle. Don't move the head and body too far forward or you can inadvertently cause any number of arcing problems later on.

I find as a general rule of thumb that the body should fall by half a head to one head in height to keep the walk "bouncy" enough. (It's a common beginner's mistake to keep the figure at the same height throughout the entire walk.)

Remember…the recoil position will be almost identical later in the walk, on the subsequent step:

This is what will determine the overall arc pattern, and the positions of all the poses inbetween the recoil and the following contact pose. On the recoil pose the character impacts the ground. The rear foot lifts off, and the arms are extended to their maximum from the body because of the force of hitting the ground.

Now a brief note on the overall timing of a walk.

The most general type of walk cycle is completed over the course of one second. This means that the character makes a single step every half second. This is known as hitting beats, and luckily two beats a second is a typical musical pattern, or so I'm told. We're animating this scene on the typical 12 frames per second, therefore the overall sequence of drawings so far will look like this:

#01:contact

#02:recoil

#03:

#04:

#05:

#06:

#07:contact (much like #1, but for the reversal of the legs and arms).

#08:recoil

#09:

#10:

#11:

#12:

#13:contact (a duplicate of #1, only further to the right).

As you can see, a complete cycle works from #01 to #12, beginning its repeat on#13. I put the recoil immediately following the contact without an inbetween between them because an inbetween frame would make it look "mushy". The contact should usually snap into the recoil immediately, without an intervening drawing.

I have not named the frame that the high point will go on. I could assign it as #4 #05 or #06. A different frame number will make quite a difference to the properties of the character. Here is why:

If #04 is the high point the walk will look like this:

As you can see above, this makes the character “bounce off the ground very quickly, making him light footed.

If #06 is the high point the walk will look like this:

This timing above slows down the character as he rises from the recoil pose, making him seem a lot heavier.

I will take the middle path and name the high point #05, resulting in this:

This is a more even timing: it should make the character seem like an average weight, without any extreme attributes. These are the kinds of decisions that you should make before you begin animating. Now we can look at our overall exposure sequence again:

#01:contact

#02:recoil

#03:

#04:

#05:high point.

#06:

#07:contact (much like #1, but for the reversal of the legs and arms).

#08:recoil (like #02, arms and legs reversed).

#09:

#10:

#11:high point. (like #05, arms and legs reversed).

#12:

#13:contact (a duplicate of #1, only further to the right).

Now we have our 3 main key frames, #1 #2 and #5, and their near twins #7 #8 and #11. The empty spaces in the sequence above will all be inbetweens. Don't worry about them yet.

For now we will focus on #1 thru # 07, finishing a single step.

5. Draw the high point.

Put down a clean sheet. As explained above, this will be drawing number #5. Write the number in the top right of the page. Circle it. Write a small letter "H" above the number. Now begin the drawing:

You have a little more freedom when drawing the limbs on the high point than on the recoil, as the leading foot is up in the air, and the arms are swinging over a pretty wide space. That gives you a number of different possibilities. The example frame that I have included is fairly typical.

The most important thing to get right with this drawing is the arc path of the head and body. A mistake on this one frame will effect all the inbetween frames around it.

Once that is finished, you are ready to move on.

6.Add the timing charts.

Before you do anything else, you should add the timing charts to describe the correct positions of the inbetweens. Here are the drawings we have finished so far:

#01:contact

#02:recoil

#03:

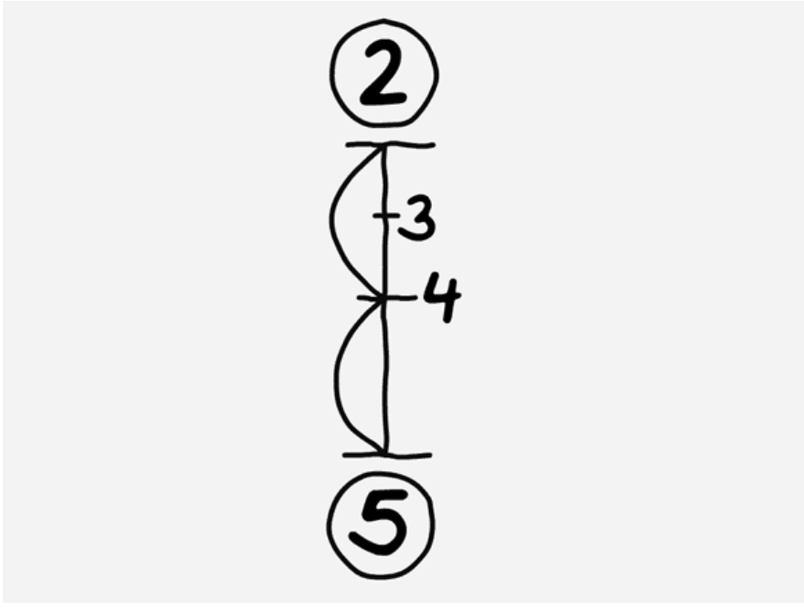
#04:

#05:high point.

#07:contact (much like #1, but for the reversal of the legs and arms).

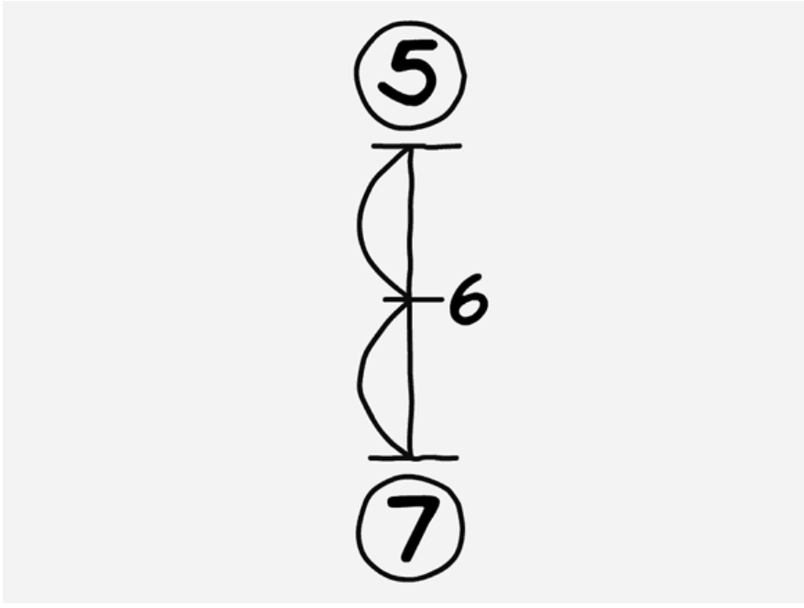
Timing charts need to be added to #2 and #5. The timing chart on #2 will describe the positions of #3 and #4 as they work into #5. The chart on #5 will describe the position of #6.

Put #2 on the drawing board. Underneath the frame number in the top right corner of the page, you will add the chart. Here's what it should look like:



As you can see, #4 is the main inbetween halfway between the two keyframes. #3 is a smaller inbetween which will completely smooth out the motion.

The next timing chart to be added is on #5. Put #5 on the drawing board and write a timing chart beneath the drawing number in the top right corner of the page. It should look like this:

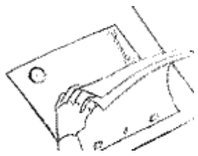


This shows that #6 will be a single inbetween halfway between #5 and #7. Now it's time to draw the inbetweens.

7.Draw #4: the main inbetween.

Be sure that you have the guideline drawing on the drawing board.Put #2 on the pegs. Now put #5 above that. Put a clean sheet on top of all three. Switch on the backlight. Now you must draw #4, also known as the "passing position". Some treat it as a key also, but to simplify things, I'm treating it as an inbetween. I've never really found it to be as critical as contact, recoil or high point poses.

You have to flip between #4 and the two key frames beneath it. You should remember that from the bouncing ball tutorial:



Again, be sure that your character follows the arc path as he walks. When you're finished the drawing, remove the drawings from the pegs and place #2, #4 and #5 back on the pegs in that sequence. Now you can roll them to see if they move properly. You'll also remember that from the bouncing ball tutorial.

If you see any errors in your inbetween, then you must lift the drawings off the pegs again, then place #2 on the bottom, #5 above it, and #4 on the top. Then you can flip again, correcting any errors that may have crept in. It's tedious, but it's the only way to do it.

8.Draw the remaining inbetweens.

Repeat step 7 with #3 and #6. If you do them right then you should be finished with the first half of the walk cycle. I hope you had fun, but I doubt it.

You should be looking at a stack of paper, numbered #1 through #7. If you put all those drawings on the pegs, you should be able to roll them and have a rough idea of what your scene will look like when it's shot. If anything catches your eye, chances are it's wrong. Go back in, repeating the process described in step 7, until you're happy with it.

9.Finish the rest of the cycle (or else).

Repeat the steps above to complete the rest of the walk cycle. You'll have to draw #13 (the third contact pose) to work into. Simply trace off the pose on #1 onto #13 in its new position, further to the right. If it took 2 inches to make a single step from #1 to#7, then slide #13 over 4 inches to the left and start tracing…

I hope that makes sense.

The second half of the walk is identical to the first, except that the arms and legs will be on the opposite sides of the body.

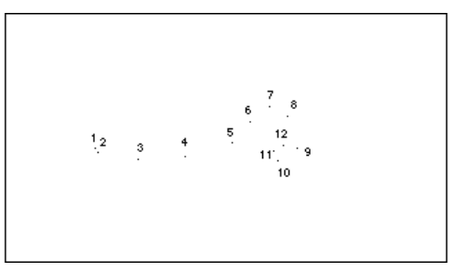
Indeed, you can refer to the first half of your scene to help you with the second. The recoil pose on #8 should be as similar to the recoil pose on #2 as possible, otherwise the walk may seem uneven, or even more like a limp.

10. A general note about arcs.

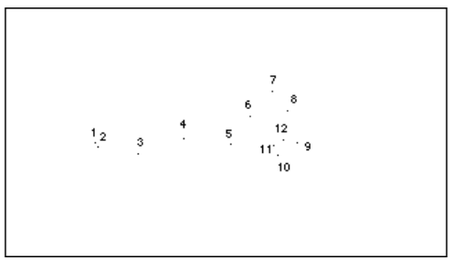
Every joint of the body has its own arc path. It's a good idea to check them all. Here's how.

Place all your drawings on the board. If you have a backlight switch it on. Pick a body part, e.g. the right wrist. Place a clean sheet over the drawings and draw a small dot on it at the position of the right wrist on frame 1. On the same sheet draw a dot for the position fof the wrist for #2…and so on.

By the time you're finished you'll have a sheet of paper that looks like this:



That's what it looks like if it's done properly. If you've made an arc mistake, it'll look like this:



If your walk is to look smooth and natural, your arc paths must also be smooth, curved, natural shapes. You should repeat this process for every part of the body to make sure they all move properly.

If you're new to this: draw simple cartoony characters at first. Don't even think of attempting anatomical designs until you've gotten comfortable with the simple ones first.

That's all for now!

This entry was posted in traditional, tutorial. Bookmark the permalink.

61 Responses to *tutorial-2 : walk cycle*

ags *says:*
January 5, 2011 at 9:29 am

tutorials are nice and interesting, thanks for sharing

Reply

allen ray *says:*
January 6, 2011 at 1:47 pm

very good

Reply

Dozza *says:*
January 20, 2011 at 12:10 pm

Bloody Brilliant! Just the tutorial I was after, thank you so much for shareing and providing it for free!

☺

Reply

ekuemoah *says:*
February 4, 2011 at 1:41 am

How many seconds does it take each pose take?How do I space out the time.
For example, pose 2 occurs how many seconds after pose 1?

thanks

Reply

dermot *says:*
February 4, 2011 at 2:16 am

An average walk (two full steps) can be timed as 1 second….so if you're on 24 frames per second, the first contact is on #1, the second on #13, and you work back into the first contact pose on #25. Two beats per second, it works out as. You'd vary depending on frame rate, of course. 30fps is common now, so your contacts would be #1, #16, #31, etc.

Reply

den *says:*
February 7, 2011 at 12:12 pm

Awesome!!! Really helpfull! Thanks a lot!

Reply

Dave Rosenberg *says:*
February 9, 2011 at 8:46 am

These tutorials sure are helpful! Thanks for sharing with us!

Reply

---

meetraj *says:*
March 3, 2011 at 1:54 pm

IT IS GOOD FOR NEW STUDENT WHO IS JUST LEARNING THE ANIMATION FOR THE BETTER ENHANCEMENT

Reply

Cybta *says:*
March 14, 2011 at 11:56 am

Man this tutorial is gr8 (Chapeau Bas)... I respect those who share their knowledge with others... 10x

Reply

Gabriel Hasbun-Comandari *says:*
May 4, 2011 at 12:21 am

Great tutorials. Thanks for sharing. You should take donations so that we can help you out to create even more advanced tutorials!

Reply

Nelson *says:*
July 8, 2011 at 2:07 pm

Very good!! Thanks for sharing 😀

Reply

---

web solutions in india *says:*
August 3, 2011 at 5:45 am

simply superb tutorial, very inspirational tuts, I enjoyed it a lot.

Reply

Parisa *says:*
August 26, 2011 at 4:34 pm

Thank you for this exact walking cycle. Could you please sent more cycles to my email? I'll be thankful.

Reply

---

vaibhav *says:*
October 21, 2011 at 4:59 am

It is very helpful for me and others.This is great tuts with explanation.I always recommended this tuts to my animator friends.

Reply

Pingback: *tutorial-2 : walk cycle | angry animator » 3d*

Nick Furlano *says:*
November 1, 2011 at 7:03 pm

Your tutorials have been more than welcome. Your Flash tutorials on Lynda.com are fantastic. I notice how many folks out there are putting out animation instruction (going on the internet) packages ever since your Angry Animator site and Richard Williams' Animator's Survival Kit. I believe the biggest challenge is having to separate drawing skills from the technical User Interface of all the competing software programs.

2D animation is still very important to me. You are a great teacher!

Thanks.

Reply

Angela Entzminger *says:*

March 10, 2012 at 5:27 pm

This is one of the best tutorials I've ever seen on walk cycles, hands down. Thank you for your insight!

Reply

Pingback: *On Me and Animations | de.vo.na.zu.re*

pencil drawings of ships *says:*
April 12, 2012 at 1:58 pm

This is really fascinating, You are a very skilled blogger. I have joined your rss feed and sit up for in search of more of your excellent post. Additionally, I have shared your website in my social networks

Reply

Tata *says:*
April 30, 2012 at 2:06 pm

Hi.
Can I use your drawn little men? I hope that you understand me))))

Reply

dermot *says:*
June 9, 2012 at 4:48 am

Sure.

Reply

Pingback: *Human walking cycles are HARD | Ravenhorse Mansion*

Pingback: *Animation | Pearltrees*

Lucas Santos *says:*
September 5, 2012 at 11:34 pm

This is indeed, a very interesting tutorial!

It's so nice to understand how the Bouncing Ball is truly connected to the way the animation flows. At first, I thought that classic animation was supposed to draw step by step, but actually it is way easier to do it in a pose-to-pose strategy.

Although this is a 2d drawing animation tutorial, it really helps folks like me, from the 3d Animation part of the game!

Thank you very much!

Reply

venkatesan *says:*
January 10, 2013 at 12:17 pm

It is very helpful tutorial .....you are great job...

Reply

Ann *says:*
April 27, 2013 at 5:53 am

Great tutorial! Very helpful! Thank you for sharing it!

Reply

parseh2020 *says:*
August 1, 2013 at 10:59 am

Much appreciated for this great article.

Reply

Taro *says:*
December 26, 2013 at 5:49 am

Sweet strut-tut. Thanx again (oc o)

Reply

Kit *says:*
June 20, 2014 at 1:02 am

Thankyou for a very helpful tutorial. Years of experience in one concise page. Equally valid for any kind of animation.
One of the points that suddenly struck me while reading this was one important reason for making the contact frame the first one to draw. As the only frame with both feet on the ground it sets (is set by) the stride length, a very important parameter when working out the timing of any shot including a walk.

Reply

dermot *says:*
June 20, 2014 at 2:08 am

Glad it's useful.

I would make one change to this tutorial today though, and that would be to do the passing position second, not the recoil. That way, you have more control over the flexibility of the walk, creating cartoony custom walks, and the like. Other than that, the general principles are the same.

Reply

Brianna *says:*
July 8, 2014 at 3:55 pm

This is exactly what i was looking for……but, does it work for animals too? thanks!

Reply

Grace *says:*
February 1, 2015 at 4:15 am

Awesome tutorials ! Very helpful for me. Thanks for sharing.

Reply

Peter Anderson *says:*
December 2, 2015 at 2:33 pm

May I use your animated walking man on a non-profit website?

Reply

dermot *says:*
December 2, 2015 at 4:23 pm

No problem; just a link back to angryanimator.com would be nice!

Reply

Peter Anderson *says:*
December 10, 2015 at 9:21 pm

You got it! Thank you!! Love your site BTW!

Reply

Pingback: *Walk Cycle Animation |*

Pingback: *Attempting to Animate: A Walk Cycle | Character Design and Animation*

Yunfei Bai *says:*
April 5, 2016 at 6:17 am

Hi,
I am Yunfei Bai, a Ph.D. from Georgia Tech. I am preparing a paper entitled: "Artist-directed dynamics for 2D animation". To be published by the Association for Computing Machinery in the print and digital editions, as well as the ACM Digital Library archive, of the title: "Proceedings of ACM SIGGRAPH 2016". I would like to modify two frames of your walking animation to use in my paper and request your permission to do so. We'll clearly identify you as the owner of the artwork. Please let me know if you approve it. Thank you so much!

Reply

dermot *says:*

April 10, 2016 at 7:21 pm

No problem.

Reply

Pingback: *CS 491 Lecture 21 – Walk Cycles | teaching machines*

Marco_105 *says:*
May 6, 2016 at 3:27 pm

It's a great tutorial to understanding motion and bouncing behaviour, so thank's for it.
However, I think that you don't speak enough about front view. Because the balance of the body in that view is also very important to customize characters in the motion and breaking symmetry, that's most a remark for 3d anyway.

Reply

dermot *says:*
May 6, 2016 at 8:24 pm

You might want to check out my Lynda course on walk cycle basics for a really indepth tutorial on walks, side & front.

http://www.lynda.com/Animation-tutorials/2D-Animation-Walk-Cycles-Basics/434462-2.html

Reply

DcBD *says:*
June 7, 2016 at 8:09 pm

Can I use your images as a sketch of my character? ☺

Reply

dermot *says:*
June 7, 2016 at 11:35 pm

All of my walk cycle images are free to use.

Reply

DcBD *says:*
June 8, 2016 at 12:25 pm

Thanks ☺

Reply

davo885 *says:*
September 27, 2016 at 11:53 am

great job tx, can u please upload the entire poses pictures files for your walk like you did in the ball tutorial , tx again

Reply

Pingback: *Learning to Walk – Megan Conlon*

Pingback: *Walk Cycle | jordanbaxteranimation*

Pingback: *Code Your Character with HTML & CSS | Joey Lane*

Tenjo City *says:*
February 6, 2017 at 11:18 pm

Thankyou for a very helpful tutorial. Years of experience in one concise page. Equally valid for any kind of animation. Thanks.....i like

Reply

Pingback: *Walk Cycle tutorial step-by-step – Digital Art and Animation*

Pingback: *Meet The Team Project- Fashionborne – brevai3d*

Pingback: *Walk Cycles – Study Blog*

Pingback: *Animation - week 4 - PCC Classes*

Pingback: *Animation – Photoshop Flipbooks and WalkCycles – Arts and Justice*

Nwogu Joshua *says:*
May 28, 2019 at 12:54 pm

Hi,
I am Joshua N. I trained in Bluechips Studio, Africa. A Physicist/animation Instructor. I am working on a book/ Project.. Titled “Physics + Animation”. I would like to acknowledge you as one of my inspirations and Mentor . Additionally I want to use some of your drawings as a reference. Quoting and identifying you as the Real owner of the artwork. Please let me know if you approve of it. Thank you so much in anticipation.

Reply

dermot *says:*
July 1, 2019 at 7:36 pm

No problem.

Reply

Zaki *says:*
September 24, 2020 at 1:10 am

Hi, Mr O’Connor!

Any chance you might “remaster” your tutorials as well as update the list & contents of every tutorial on this blog?

Reply

dermot *says:*
September 24, 2020 at 9:24 pm

I’ve wanted to do that for some time – however it would end up duplicating my actual courses on Lynda.com / Linkedin Learning!
Also, time/energy constraints. Hate to redo stuff, but I’ll take a look, see if I can get to them or even add some new. Wouldn’t hurt.

I’ve got two dedicated courses on walks (basic and personality) which go lightyears beyond the stuff here… might be of use!

https://www.lynda.com/Dermot-O-Connor/822102-1.html

Reply

Pingback: *Cliffs Notes from Making a 2D Practice Game! – Friends On Mountains*

Pingback: *Animation – week 6 | PCC Classes*

Proudly powered by WordPress.