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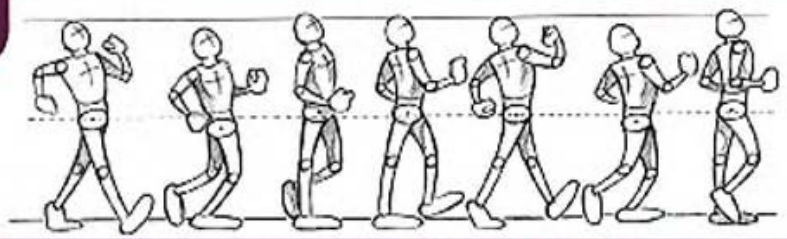

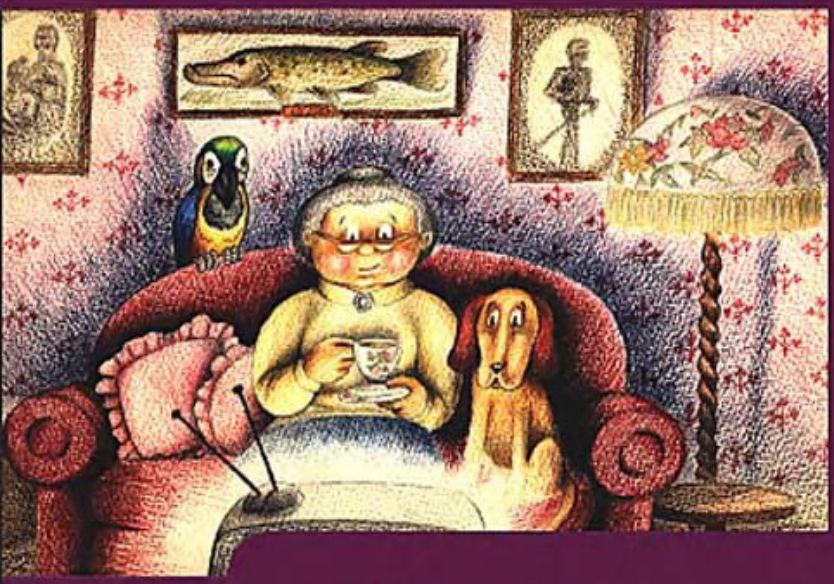

Animation
The Mechanics of Motion

Chris Webster

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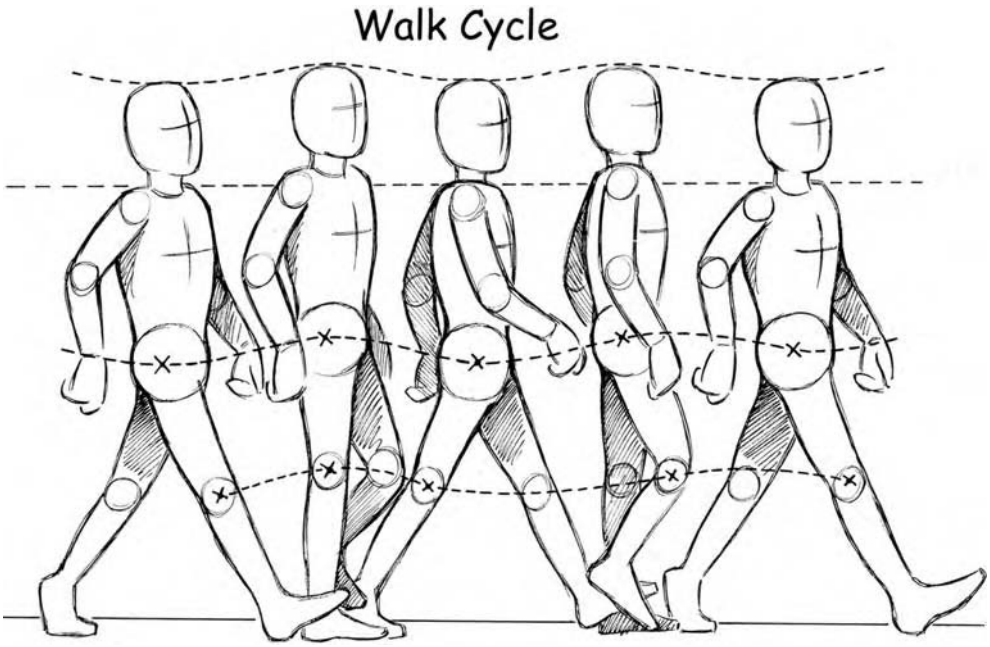
Chapter 2

Figurative Animation



When animating you need look no further than the human figure for inspiration and challenge. If you can master the human figure in all its forms you can master anything.

BEFORE WE BEGIN

In the first chapter we covered some of the basic principles of animation which we will be dealing with during this chapter on figurative animation. At this point it might be useful to place these into context before going further by looking at the nature of animation. I have broken animation down into four categories of movement in an attempt to understand animated movement more fully.

THE FOUR 'A'S OF ANIMATION

- Acting
- Animation
- Action
- Activity.

This hierarchical system describes the various levels of animation that can be achieved with the lowest at the bottom and the highest at the top. I have set out below an explanation of each of these categories, starting with the lowest, activity, and moving to the highest, acting.

Activity

This category simply describes the most basic form of movement we may witness and is the lowest form of animation. These movements are not associated with anything in nature at all and in this regard are completely abstract. An example of this would be of an image being at a particular point on the screen at any given moment and subsequently at another point on the screen the following moment. We can see examples of this in text rolling across a screen in a title sequence. Even though some of the objects that move in such a manner may display variable dynamics (they may move faster or slower at various points), they remain abstract and are not associated with any particular object that we recognize as being capable of independent movement.

Action

This category describes movement that can be attributed to specific objects such as we have covered in the previous

chapter. The animation you made in the exercises there described the *action* of a bouncing ball or the *action* of a paper aeroplane. The fundamental difference between Action and simple Activity is that in an object's *action* we understand that a type of movement may be associated with certain *known* objects, under certain *known* conditions and subject to the *known* laws of nature. For instance, we recognize the action of wind blowing through the leaves of a tree, the waves on the sea or the fall through the sky of a shooting star. These things do not *intend* to move this way, they simply do so as a result of the natural laws of nature and their own particular properties.

Animation

This describes the kind of dynamics that arise from *within* the subject matter. This can be seen in such things as a salmon leaping out of the water as it heads upstream to spawn, a humming bird collecting nectar from a flower or a dog scratching for fleas. All of these examples intend to undertake these actions. The key to this categorization is that the motivation for such actions comes from within the subject itself. While the humming bird, the fish and the dog are all still subject to the laws of physics and external forces, the manner in which they move is determined by their physiognomy and the particular motivations that instigate the action. Motivation for these separate dynamics may be as varied as the type of movements themselves; migration in order to breed, the search for food, or simple irritation. Whatever the motive for the movement, it has been an *internal* motivation; animation comes from *within* the subject – they *intend* to move that way.

Acting

This describes the highest level of animated movement. Not only are the movements subject to the laws of nature, with the route of the movement coming from within the subject (the subject intends to move), there are clear psychological reasons for these movements. It's called performance! In this type of movement we experience the inner feelings of the subject of the animation. We can not only see what the characters are doing, but experience what they are thinking and feeling. This level of animation not only deals with variable dynamics, but the variations in mood and temperament necessary to build characters with personality.

This is the most difficult task that faces any animator and is central to creating engaging narratives.

Before we begin to tackle figurative animation we need to understand the task that is ahead of us. Naturalistic figurative animation is perhaps the most challenging and demanding aspect of animation. The development of your animation skills should continue throughout your career as an animator, no matter how high you rise in the industry or how respected you become as an independent film-maker. It's through naturalistic, figurative animation that these skills will be most severely tested. Why is this? Naturalistic animation of recognizable animals and humans is difficult to achieve because we all understand how people, dogs, cats, horses and the like are supposed to move, as we witness such movements first hand on a regular basis. As a result, our expectations are high and as such audiences are much more difficult to convince. Most of us can tell if a naturalistic figurative animation looks 'right' or not, you don't need to be an animator to do that; however, it's only through serious study that we can dissect the movement in detail and determine *why* things look right or wrong. It's learning how to dissect such actions and discover the animation principles within them that is the purpose of this chapter.

As kids we may have developed the skills necessary to draw a funny cartoon horse or to draw figures in a particular cartoon style, perhaps slavishly copied from superhero comics. This is OK and I imagine that's how many of us got started on the long road to art college, but it doesn't help us much to develop the necessary skills to become a creative animator. At that stage it's rather like seeing a dog balancing a ball on its nose – not a great trick, but you are amazed it can do it at all. If you are going to develop the skills of an animator you are going to have to learn more than simple tricks in order to get by. Figurative animation and the exercises set out in this chapter give ample opportunity to explore and practise all those basic principles covered in the earlier chapter.

Let's start with the basic animation of a walk cycle, though we will see how even this most fundamental action can be a complex issue, before we progress onto various types of runs and then move on to cover in some detail the use of weight and balance in animation.

WALKS AND RUNS

In the previous chapter we looked at creating the first two levels in the four As of animation: activity and action. We are now going to tackle the next level – animation itself. We are going to make movements that involve the illusion of intent; the figures we make move should look as though they possess the motivation for the action and that purpose instigated the action.

Walks

The approach to creating a believable walk cycle is wrapped up in a wide range of issues related to physical and psychological conditions, and we will be looking into some of these later. There are simple step-by-step processes that you can undertake in order to achieve a fairly naturalist walk cycle and we will see that a fairly straightforward mechanical approach to a walk cycle will give you satisfactory results if all you require is to get a character from A to B. However, you should bear in mind that any naturalistic animation, no matter how simple, will demand a great deal of skill and observation on the part of the animator.

I was once on my way to discuss this very problem with the talented group of animators who created the *Walking With Dinosaurs* animation and the whole notion of characterization through a walk was going through my mind. As I made my way through the London underground system at rush hour, I observed the very thing I was going to discuss that day. Three people with very different types of walk just happened to appear as if on cue. A young woman walked quickly past me, obviously in a hurry to get to work. She walked confidently through the crowds, though she wore ill-fitting fashion shoes which had the double effect of throwing her body forward slightly and making her very flat-footed. Immediately on passing me, we were both delayed by the slow progress of a couple of commuters, one a rather large lady who rolled from side to side as her bulk shifted over the supporting leg. Her arms extending out at her side in an exaggerated manner only enhanced the effect. Her head pivoted slightly from side to side to counter the quite extreme to and fro action of her body. Her partner happened to be a rather tall and slender gentleman who had the appearance of being in ill health. He tried not to move too much, looking as though any extra vibration would disturb his already perturbed internal organs. He stooped slightly and held his head down to stare at the

floor, as if uncertain of his footing. He almost shuffled along in a very stiff manner. Each of these actions had their own distinct qualities and were a result of different conditions, some external (the shoes), others physical (weight), still others psychological (uncertainty). The girl bobbed up and down, the large lady wobbled from side to side and the frail man moved stiffly with very little up or down movement at all.

It is easy to see evidence of all kinds of characterization through a walk. Consider for a moment the very famous and stylized walks of Groucho Marx, Charlie Chaplin, Mae West and Frankenstein's monster. These are all instantly recognizable to the audience and clearly demonstrate the character within the figure.

Basic walk cycle

Simply standing up in a balanced manner demonstrates what a wonderful piece of engineering the human body is. Supported on relatively tiny feet, a tall figure is continuously balanced against the forces of gravity that would overbalance

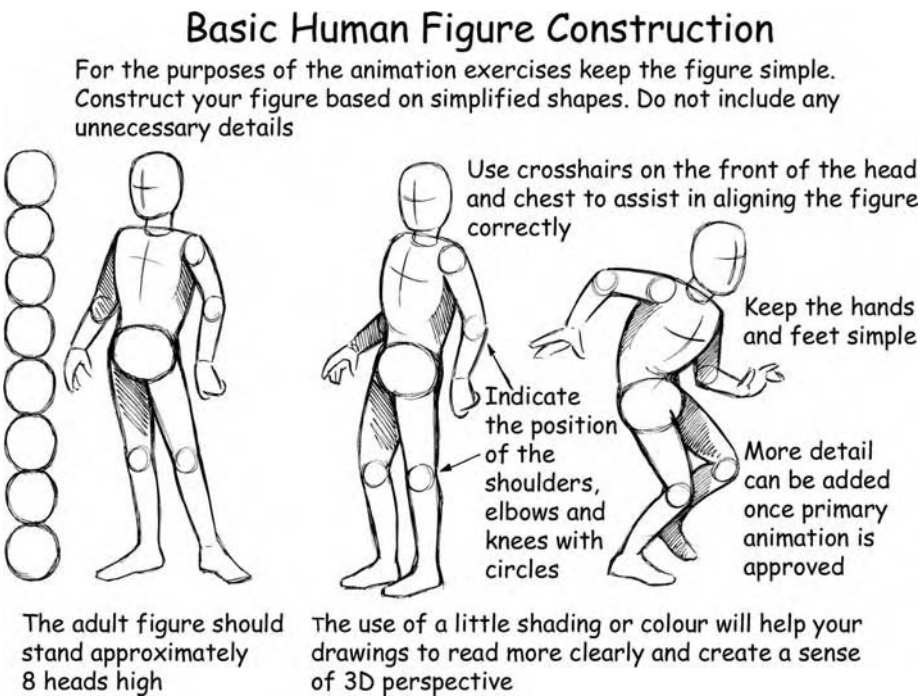


Figure 2.1 Keep the design of your characters fairly simple and add no unnecessary details. Remember, the exercises are about animation, *not* design. If you base your drawings on a naturalistic figure and try to keep the proportions correct, you will find it easier to complete believable animation.

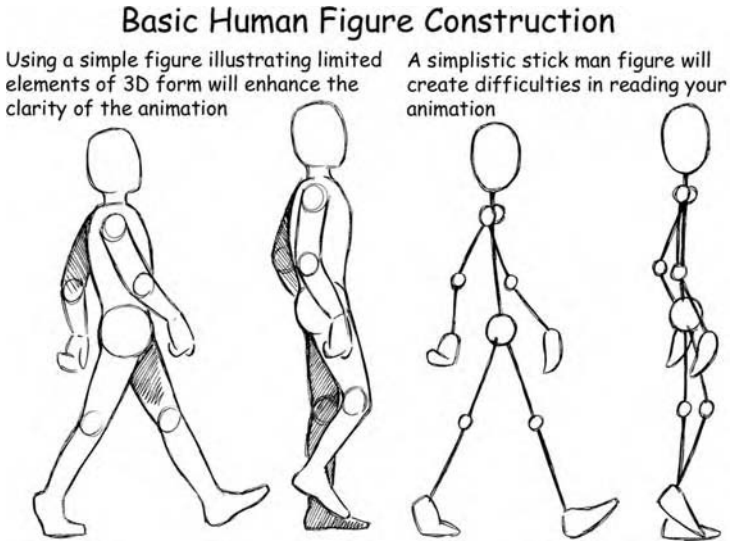


Figure 2.2 Your figures will be more easily read as animation if they possess some volume. Analysing stick-men type characters can become a little difficult once the lines are seen in motion, particularly in complex movements or actions where elements of the figure cross one another.

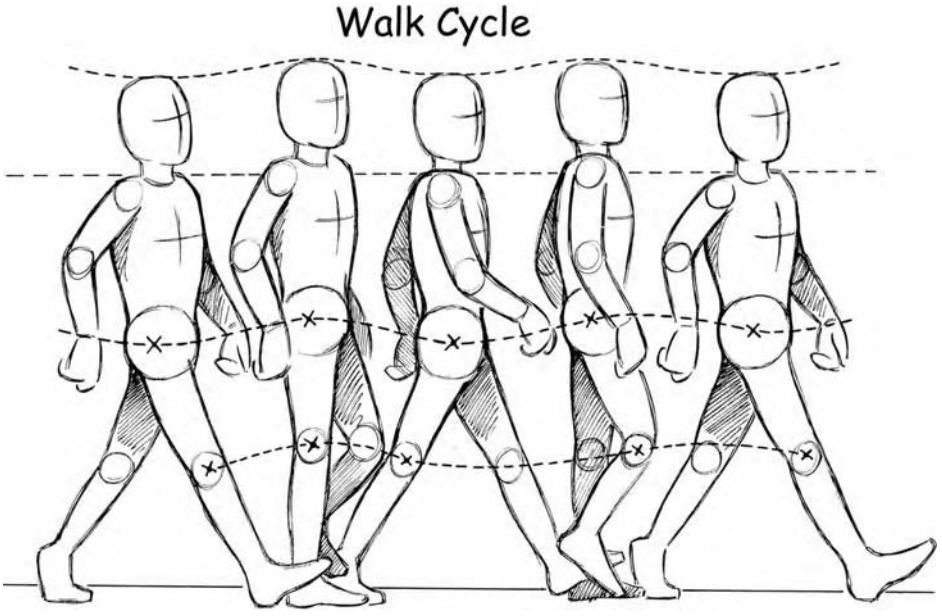


Figure 2.3 Notice how, in these drawings, we have the full set of movements that go to make up a full walk cycle. We can see how the body rises and dips at certain points throughout the action. As the leg swings forward and the figure is supported on one leg (the passing position), the body rises; as the leading leg makes contact with the ground (the stride), the body is lower. There are very few instances throughout a walk cycle where the body achieves complete balance. For the most part the figure is in a state of controlled 'unbalance'. A mistake I have noticed many inexperienced animators make (particularly when animating models in 3D stop-fame animation) is to attempt to create a balanced figure for each of the drawings or model positions throughout the action. This results in some very strange actions, with the weight of the figure moving backwards and forwards in an exaggerated manner throughout the walk.

us and leave us in a heap on the ground. We constantly shift our weight on these two very small feet to stay upright; not only that, but we can do this on one leg (hopping), on the move (running and walking), on slippery surfaces (ice skating), in a strict rhythmical coordination with others (dancing) and while moving objects with the feet (playing football). These activities, based on our ability to balance, make the human body seem almost miraculous, but it's the very act of unbalance that we exploit in order to do all of these. Walking has been described as controlled falling and when we analyse a simple walk we can see it's exactly that. From a very early age we learn how to throw our weight forward (or backwards) in a controlled manner and purposefully become unbalanced. It's this unbalance, driven by the forces of gravity, that provides the momentum for such elaborate movements. If we were to take no action at the moment of unbalance we would simply end up face down on the floor. However, we have learned the trick that if we swing a leg forward timed to coincide with the forward movement we can not only stop ourselves falling flat on our face, but we actually take a step forward. If we then use the energy from the controlled fall, we can go on to make a second controlled fall, and then a third and a fourth – it's called walking.

We can break the basic walk cycle down into two key positions: the stride and the passing position. From these, we

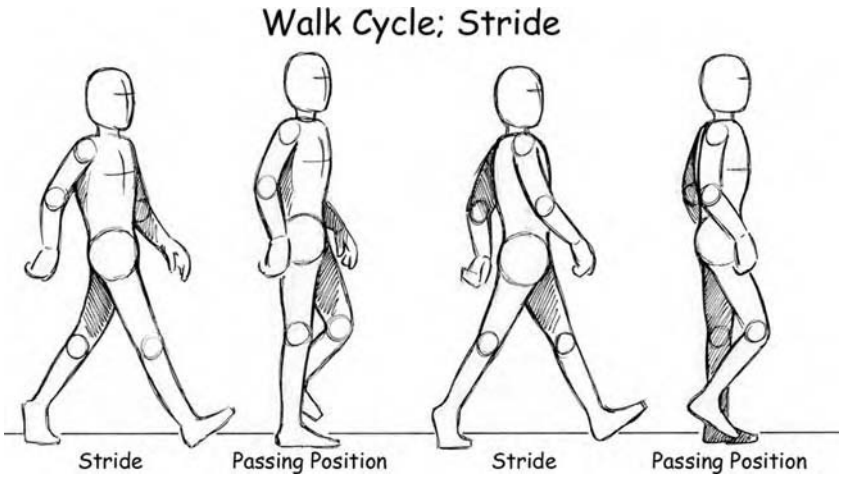


Figure 2.4 The stride is the position that demonstrates the leg outstretched as the leading foot makes contact with the ground and the trailing foot moves upwards onto the toes. The length of the stride will vary between walks and will be determined by various factors, as we shall cover in other examples. Notice how, when the left leg is forward, the left arm is placed backwards to achieve balance. This creates a counter-rotation of the hips and the shoulders.

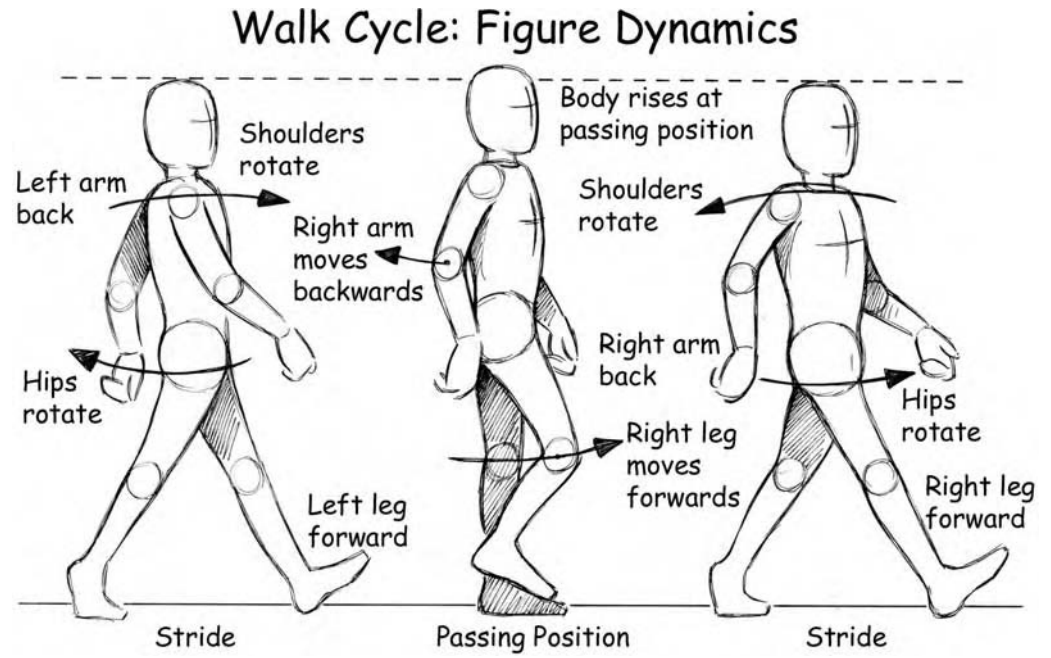


Figure 2.5 The passing position is the frame whereby the leg moving forward in the cycle passes the leg that supports the body. When the figure is at the passing position the figure is balanced on one leg only. Notice how, when the left leg is thrown forward, the left arm moves backwards and the right arm is thrown forwards. When the figure is in the passing position the figure raises slightly as the supporting leg moves toward the fully upright position. These two positions alone, the stride and the passing position, form the basis for the walk cycle.

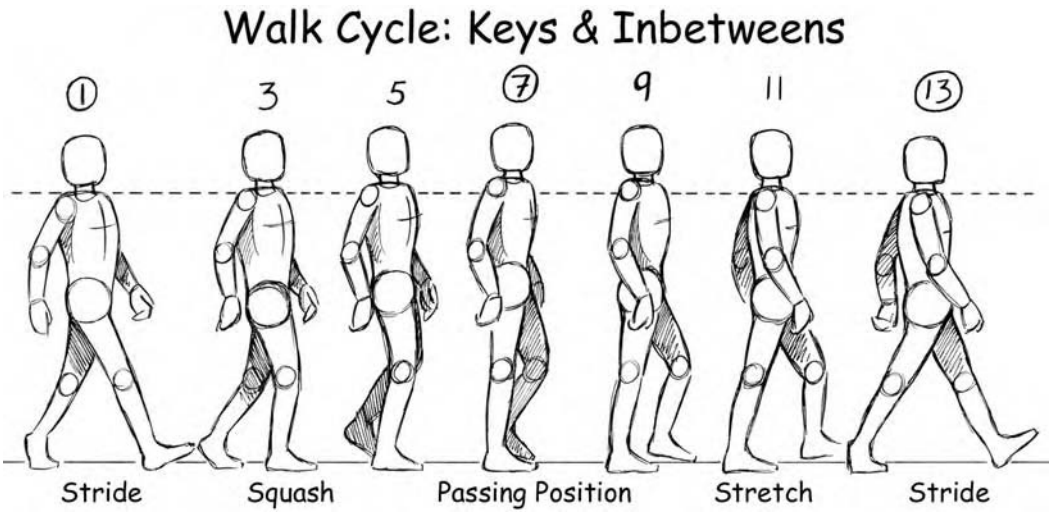


Figure 2.6 Once you have all the drawings completed for the cycle, it is easy to notice how the body rises and falls throughout the cycle. We can see how the head and the hips rise at the passing position as the supporting leg is straightened. The figure then moves downwards during the stride, due to the angle of the legs.

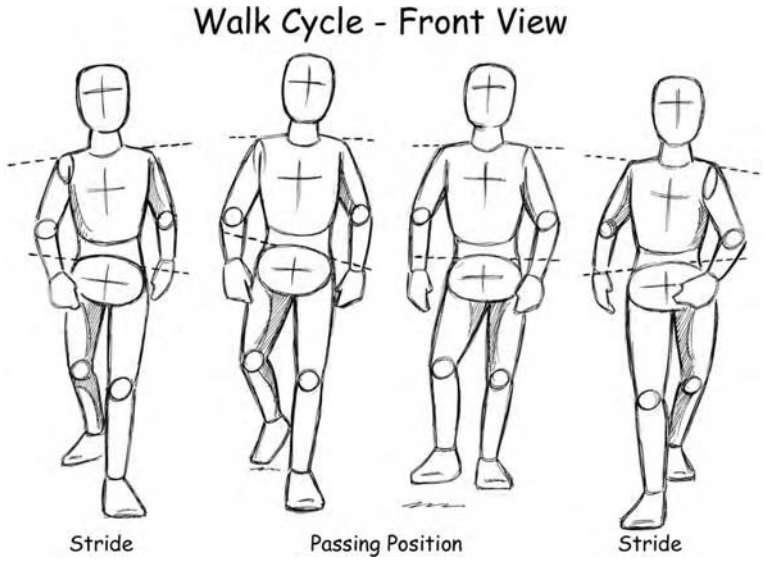


Figure 2.7 We can see in this illustration of the figure viewed head-on that the figure twists at the hips and the shoulders throughout the walk cycle and the counter-rotation of the hips and shoulders. The right shoulder is in a forward position when the right side of the hip is in a backward position.

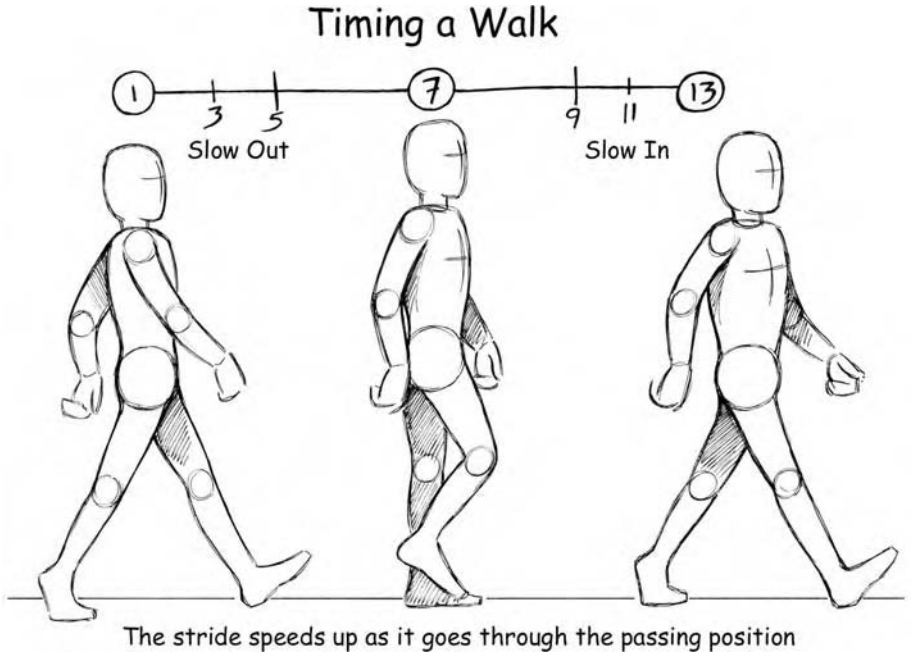


Figure 2.8 The more drawings or frames you have within the walk cycle, the slower the walk will be. As the walk becomes slower, the length of stride will shorten. Conversely, if the length of the stride remains short and the speed of the walk becomes fast, you will get a very strange kind of fluttering or shuffling type of walk.

can develop the other frames that are needed to complete the cycle.

Once the stride and passing position have been created, it is a simple matter of flipping these two drawings or positions to create the next two needed for a complete cycle. Notice how, in the last illustration, the two stride drawings are fundamentally the same, though the one on the left has the left leg thrown forward while the right-hand drawing has the right leg thrown forward. You can make the second passing position drawing in the same manner.

The number of inbetweens needed to complete the cycle will be determined by the type and speed of walk you wish to achieve.

ANIMATION EXERCISE 2.1 – BASIC WALK CYCLE

Aims

The aim of this short exercise is to extend your understanding of animation timing and to develop an understanding of the basic principles as they apply to a walk cycle.

Objective

On completion of the exercise you should be able to create a short animated sequence of a basic walk that works within a repeatable animated cycle.

A few tips before starting the exercise:

Design

Design should not be an issue within these exercises and you should keep your drawings simple, with little or no detail. There should be no colour or shading unless absolutely essential and only in order to allow the animation to read more clearly.

Film language

Film-making is not an issue within these exercises. Remember, you are not telling a story but are attempting to complete a short animation.

Drawing

Work quickly though not hurriedly. Try to achieve consistent volume and weight within your characters. Do not concentrate your efforts on making beautiful drawings; rather you should be attempting to achieve beautiful animation. Do not overwork your drawings. Rather than rub out mistakes you should discard your drawings; this will help you keep up the creative flow.

Animation

Map out your animation timings on your key drawings, indicating clearly the number of inbetweens you initially expect to create. Try to time out the action by going through the motions yourself using either a stopwatch or a watch with a second hand. Do not forget the basic principles of animation.

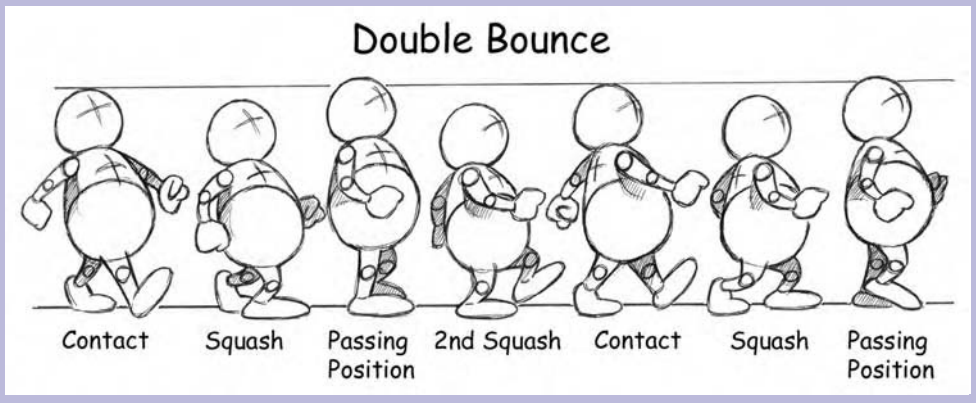


Figure 2.9 To achieve a slightly more exaggerated and comic effect, you may choose to give the figure a little extra bounce. Notice how the figure is squashed between the point of contact and the passing position, a natural response as the knees act as a kind of shock absorber. In this example there is an additional squash added at the point between the passing position and the stride (contact); this position acts as a kind of anticipation to the stride and makes the whole action rather exaggerated. It is for this reason that I have chosen a rather more cartoon-like figure to demonstrate this unnatural and more cartoon-like walk.

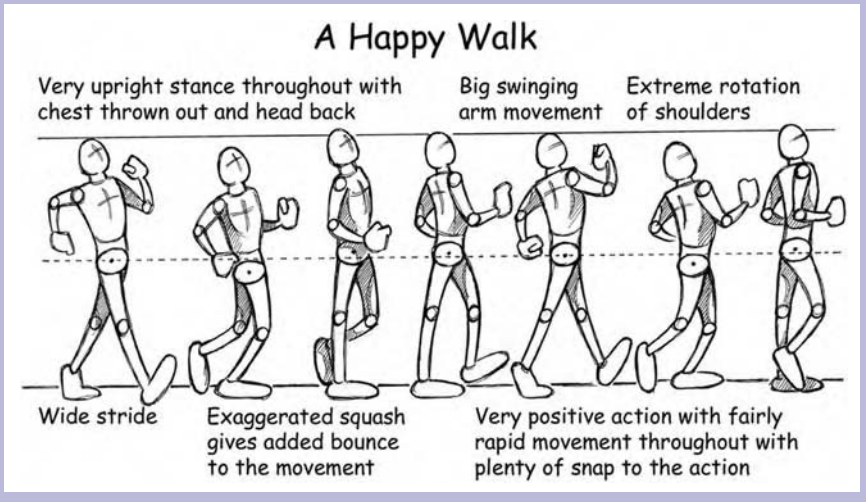


Figure 2.10 Once again I have chosen a more exaggerated character to illustrate this point. The happy walk may result in a bouncier type of movement with a longer stride and a more upright aspect. The arms may also have a more pronounced swinging action to them. In this instance I have omitted the double bounce.

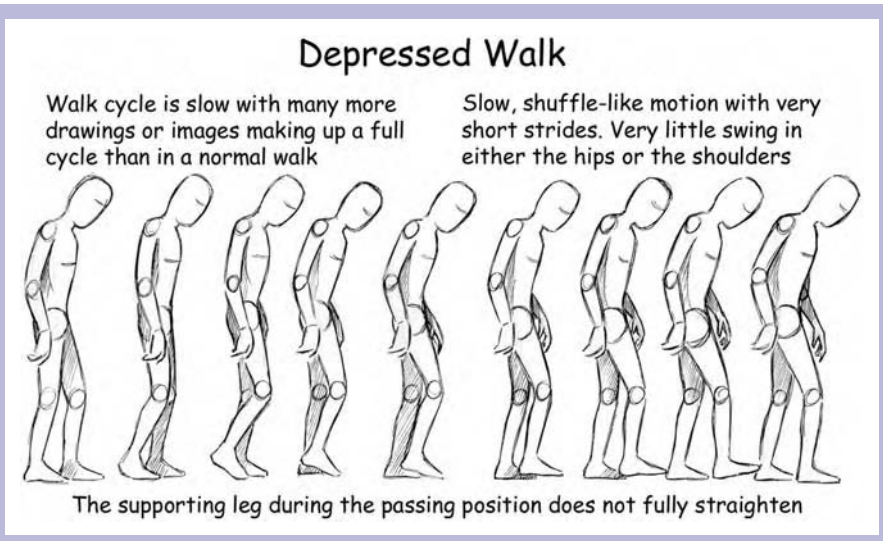


Figure 2.11 Such a walk will typically show the figure having a slumped posture. The much slower pace of this type of walk will affect the timing of all the separate elements. The stride will be much shorter and the timing far slower than within a standard walk cycle, though the dynamic progression (timing breakdown) may have a similar profile, with the slow ins and outs being in the same place. There may also be much less rotation of the shoulders, which will result in less exaggerative movement on the arms. Notice also how the foot barely leaves the ground through the passing position.

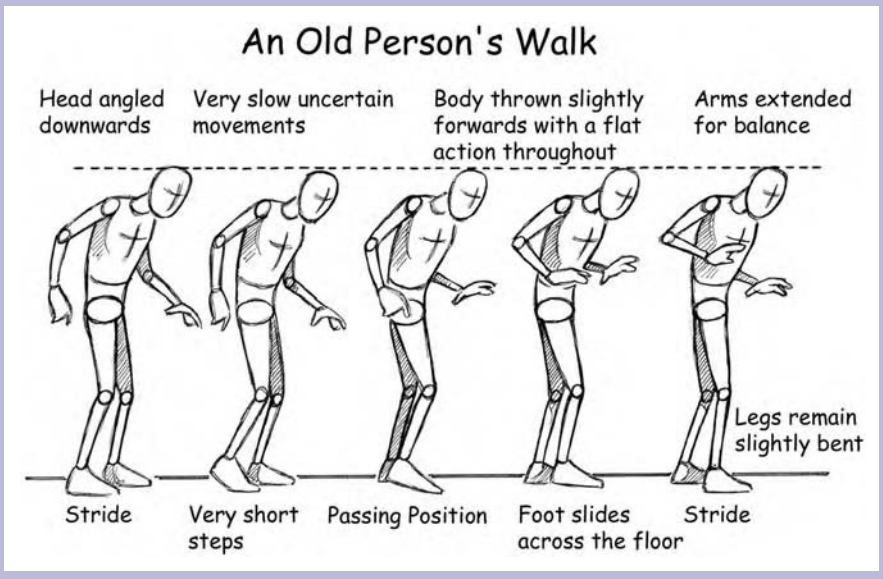


Figure 2.12 An old person's walk may appear to be a lot more uncertain than a younger person, possibly as a result of unsteadiness on the feet. The overall timing will be noticeably slower and there will be very little bounce or up and down movement throughout. Consider how people that are uncertain on their feet use their arms during a walk; they may no longer be used as a secondary action swinging backwards and forwards, but may be outstretched slightly, perhaps to assist balance or to give additional confidence in anticipation of a fall.

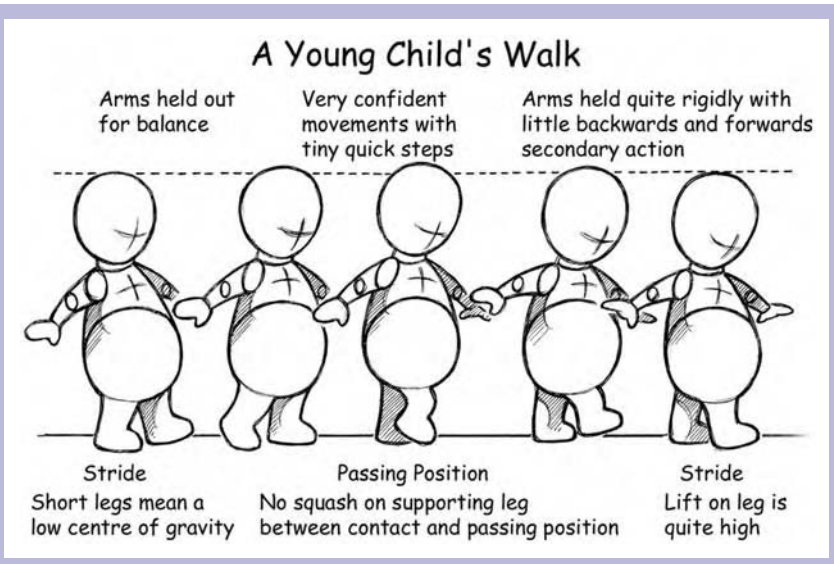


Figure 2.13 A very young child's walk may also demonstrate uncertainty, though this is more likely to be from lack of experience. When children walk at speed you may notice that they move with their arms outstretched as an aid to balance. There will be no evidence of the swinging-type action of arms countering the movement of the legs that you see in adults. The walk has a lot of bounce in it, perhaps most noticeable when children begin to run. Because the legs do not cushion the contact of the foot with the ground in the same way as adults do, there is a jolting of the head as a result.

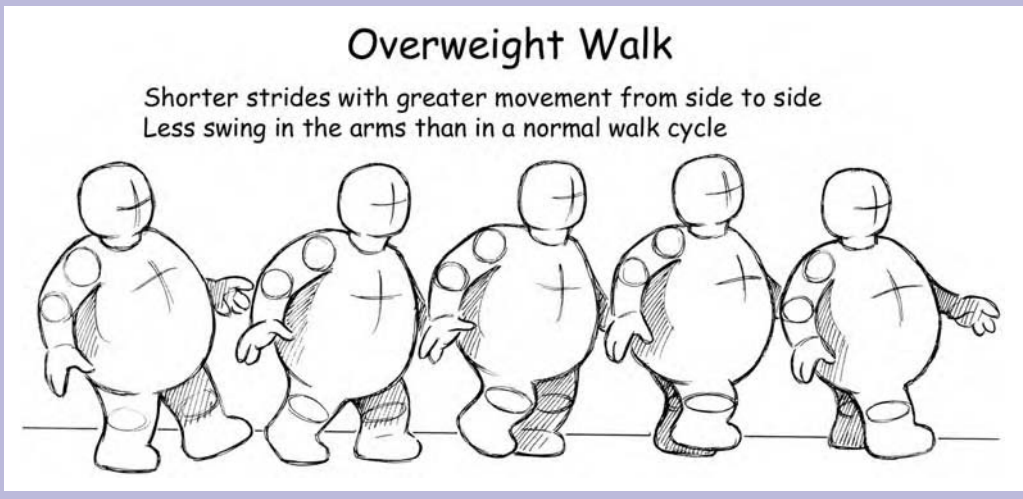


Figure 2.14 You may notice in such a walk that the body is thrown back slightly, creating a centre of balance that is further back than is evident in a less heavy person. This is done in order to counterbalance the extra weight. You may also see this in heavily pregnant women; the additional weight at the front of the body results in the figure leaning back and curving the spine, which sometimes results in back strain. This may be accompanied by an increased sideways motion, swaying from side to side slightly to shift the weight more centrally over the supporting leg during the passing position.

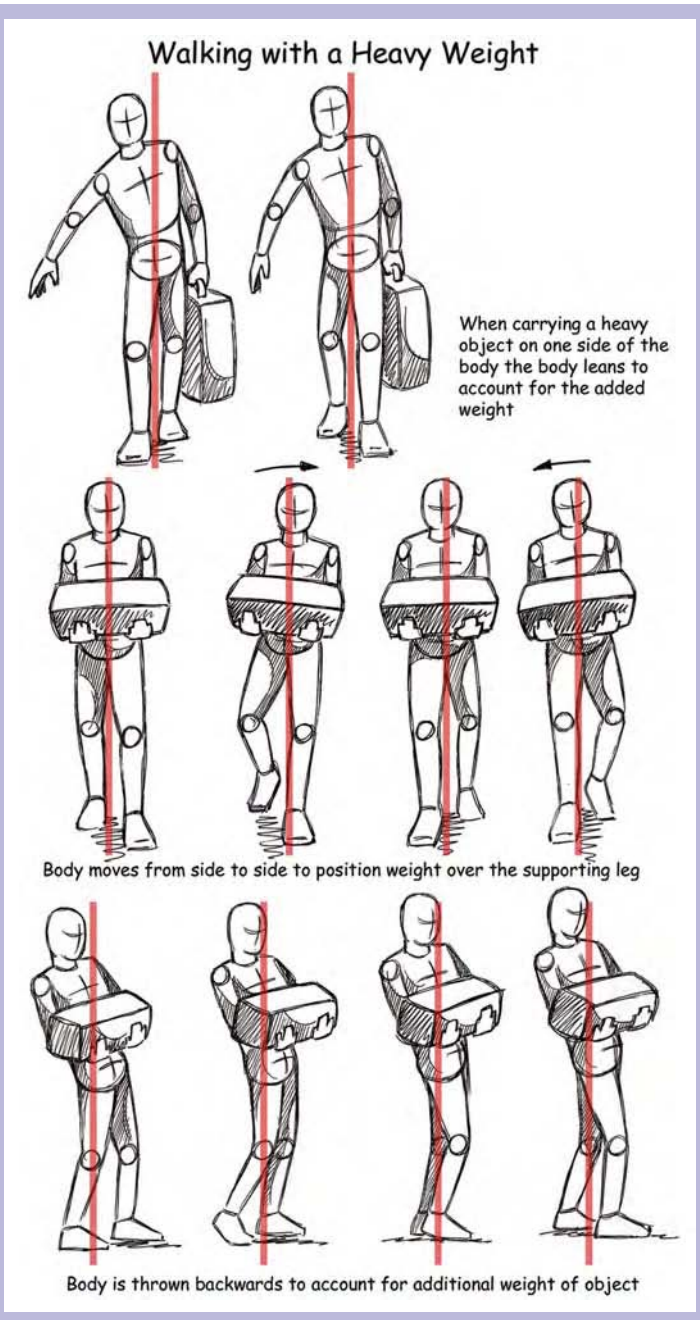


Figure 2.15 This is a very similar walk to an overweight walk. There may be adjustments in posture to accommodate additional weight, with an increase in sideways movement to counter the additional weight during the passing position. The body is thrown backwards. You may notice that there is less bounce in such a walk and if the weight is extremely heavy you may see a kind of shuffle as a consequence.

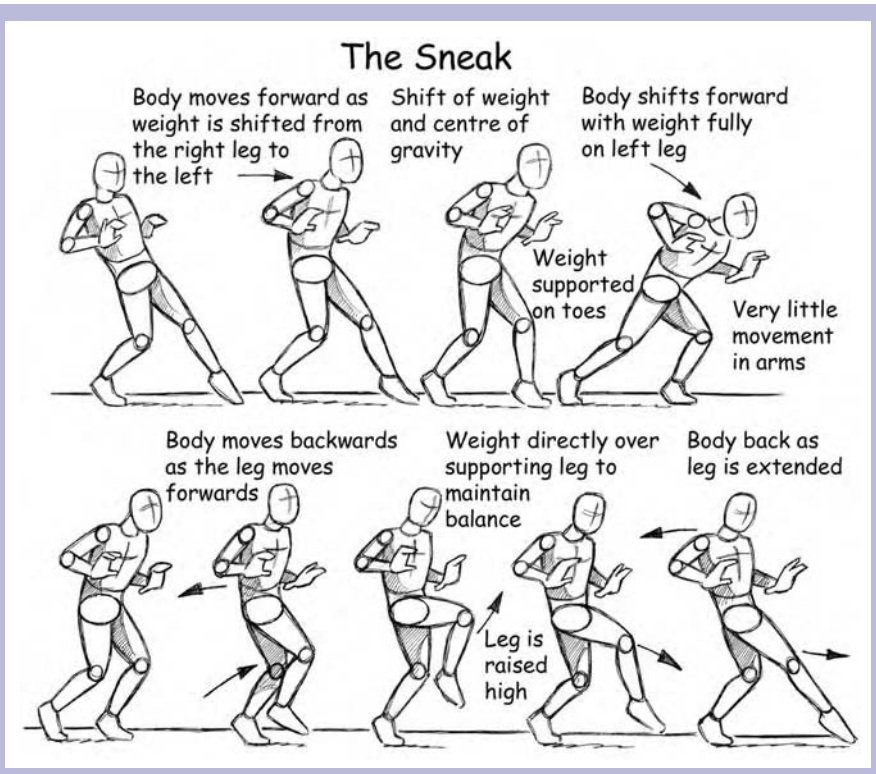


Figure 2.16 An exaggerated sneak (usually reserved for more cartoon-like animation) will result in the body being thrown forwards and backwards, shifting the weight first over the trailing leg and then over the leading leg. This comes from the combination of the wide length of the stride and the slowness of the movement. In order to remain balanced throughout such a movement, the body weight must be constantly shifted over the supporting leg.

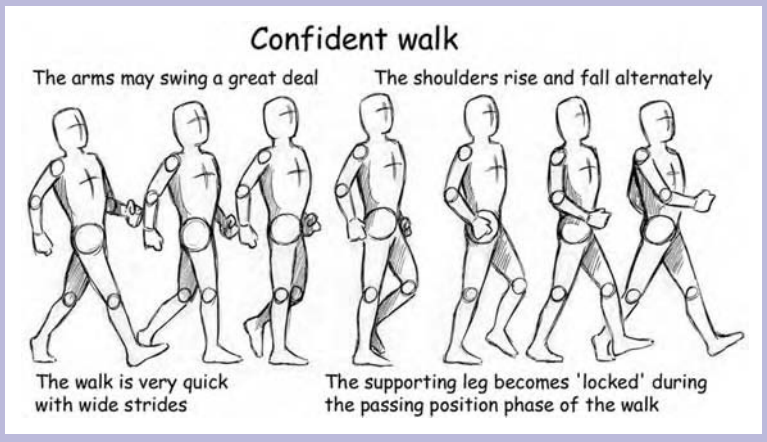


Figure 2.17 In a fast confident walk the body may be thrown forward slightly, the stride will widen and there may well be a greater swinging action on the arms. In this example the stance is very upright, though this is not necessary to achieve a confident look.

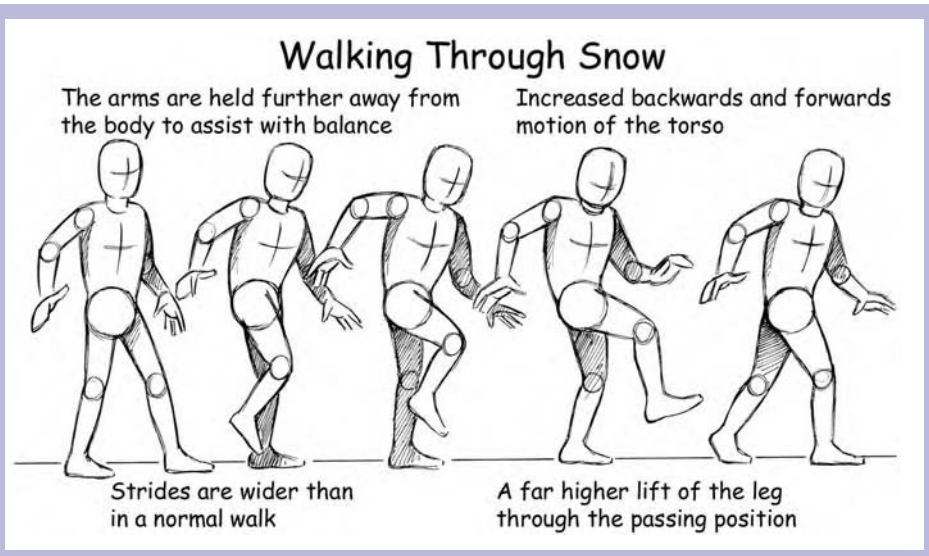


Figure 2.18 There are similar aspects of the sneak in this particular walk, with the body being shifted back and forth to remain balanced. Notice how the legs lift much higher off the floor as the foot is lifted out of the snow, moved forward and placed in the snow at a place further forward. It's easier and more efficient to move the foot up and down out of deep snow rather than trying to push the foot through the snow and encountering resistance. You may notice a similar kind of walk when people begin to walk from the beach into the sea; at first, the shallowness of the water does not affect their walk, though as they get in deeper they will begin to lift their legs higher. Once they are in the water so deeply that this is no longer effective, they revert to a more normal walk, though leaning forward slightly as the water takes their weight.

Animate the character moving in profile either from left to right or right to left. Don't concern yourself with the difficulties of perspective animation at this stage.

1. Make your first key drawing of the first stride position.
2. Make a similar drawing with the opposite arms and legs thrown forward.
3. Using the two stride keys, make the passing position drawing.
4. Make a similar drawing of the passing position with the opposite arms and legs thrown forward, just as you did with the stride.
5. Decide upon the animation timing and draw this on your key drawings, remembering to clearly indicate the slow ins and slow outs.
6. Make the inbetweens using the same process as described in the previous chapter.
7. Remember that the animation should work as a cycle.
8. Shoot your animation.

While this will give you the basis for the walk, it really does only cover the bare bones. Once you have mastered the basic principles you could attempt to create a more individualistic walk cycle through a series of animation exercises based on the examples here.

The number of different types of walk is almost endless and we have only just touched upon the topic; however, the basic principles remain the same. In order to get exactly the kind of walk you want you must try to imitate it, and through doing it yourself gain more understanding of the exact nature of the animation. If we choose to, we can observe such actions every time we go outdoors and as animators that is exactly what we should be doing. Using texts such as these, completing exercises and constant practice will help you to develop skills, but learning through observation will give you a much deeper understanding of the dynamics of the human figure.

Runs

You will notice that many of the basic principles covered in a walk cycle also apply to the run. We can break down the action into a few simple positions to create the cycle, just as we did with the walk.

The variations on the run, as with the walk, are almost infinite and the examples illustrated here are very limited. With only a couple of exceptions we have covered the animation of a single adult character in a fairly realistic manner. Once you start dealing with figures of different ages and sizes and within different environments and under different conditions or cartoon animation, the options are limitless.

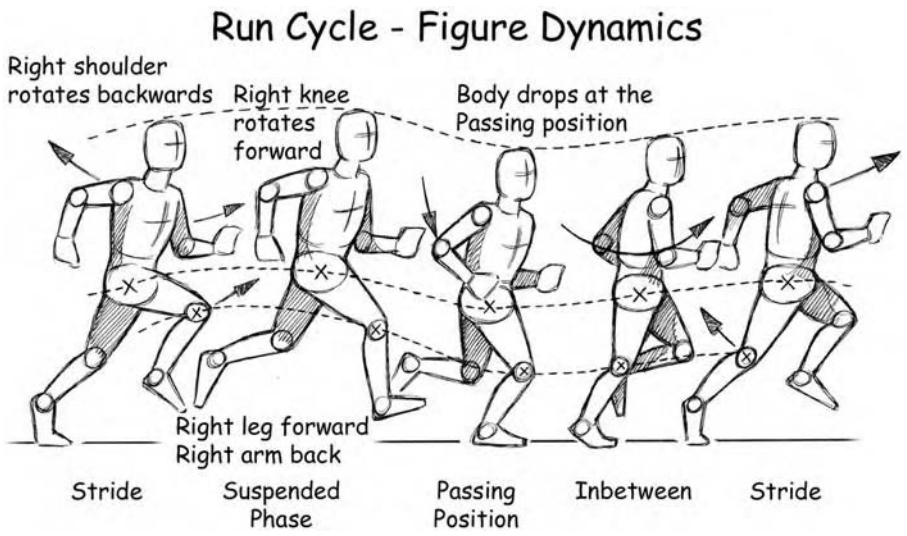


Figure 2.19 Just as in the walk cycle, the run can be said to be a condition of controlled unbalance. The one major difference between the run and the walk is the period within the run that the figure actually leaves the ground. This occurs slightly after what we termed as the stride within the walk. For an instance there is a period where neither of the feet support the figure; in effect it leaps through the air in a series of bounds. In the run cycle this is known as the suspended phase.

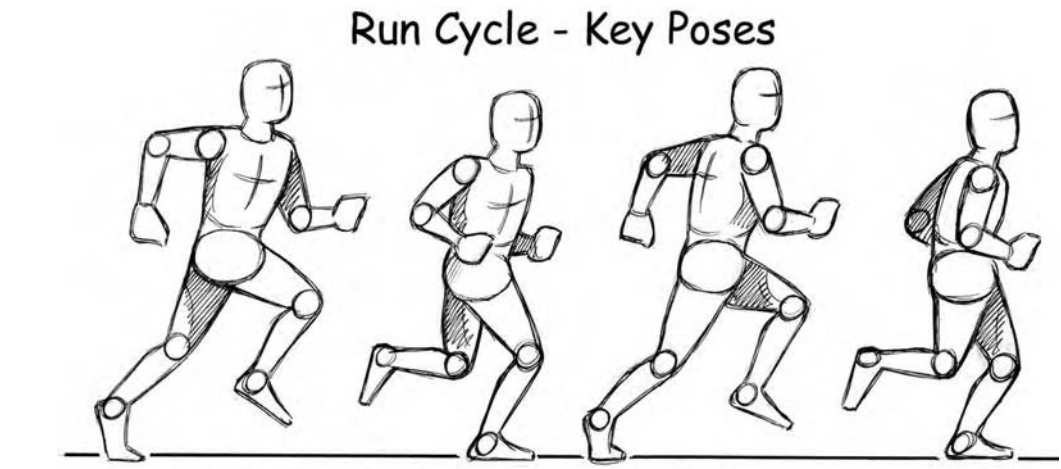


Figure 2.20 The stride in this case is the period whereby the figure is about to become unsupported and enters the suspended phase. The passing position remains fundamentally the same as in the walk. The passing position is the frame whereby the leg moving forward in the cycle passes the leg that supports the body. As in the walk cycle, it's these two positions that form the basis of the cycle. Notice once again that as the left leg moves forwards the left arm moves backwards. Also notice how a running figure in the passing position, unlike the walk cycle, lowers slightly (squashes) as the supporting leg acts as a shock absorber. The figure then moves toward the fully upright position.

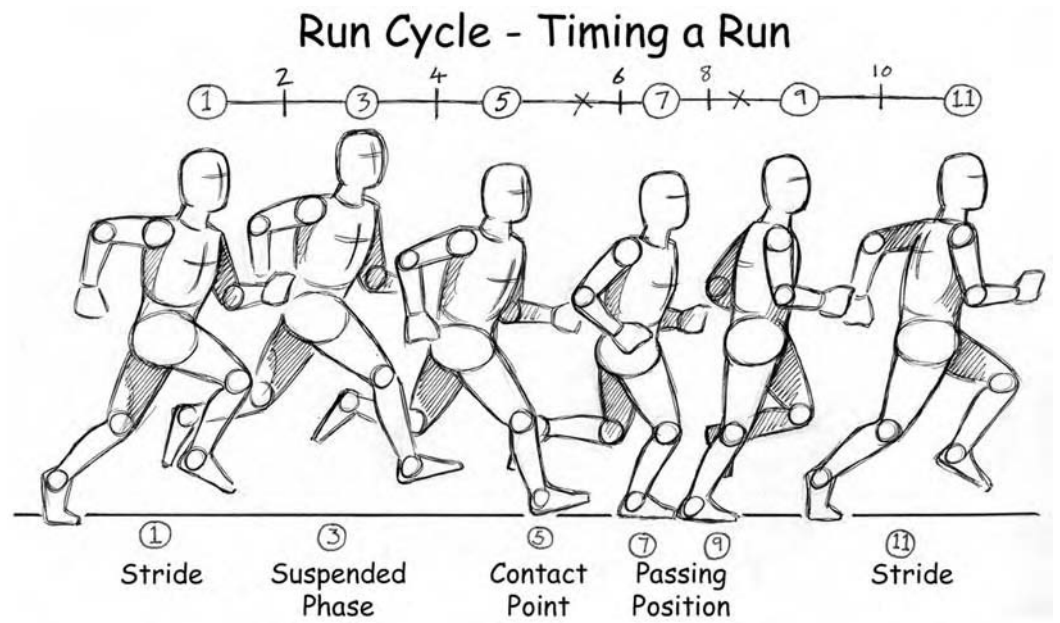


Figure 2.21 The timing of a run, rather like that of a walk, will be determined by the effect you are trying to achieve. The same general approach to animation timing is taken, with slow ins and outs appearing in the same place. While this may be varied to create other results, it is a good starting position to get a general understanding of the process.

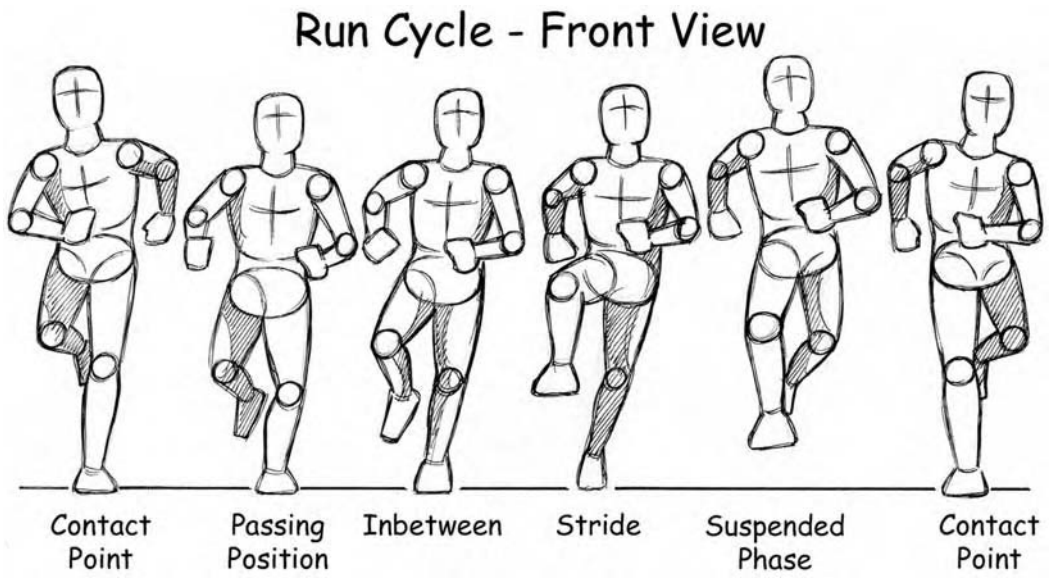


Figure 2.22 In this front view we can see how the figure moves from side to side slightly as it is placed over the thrusting leg of the stride and the leading leg at the contact point.

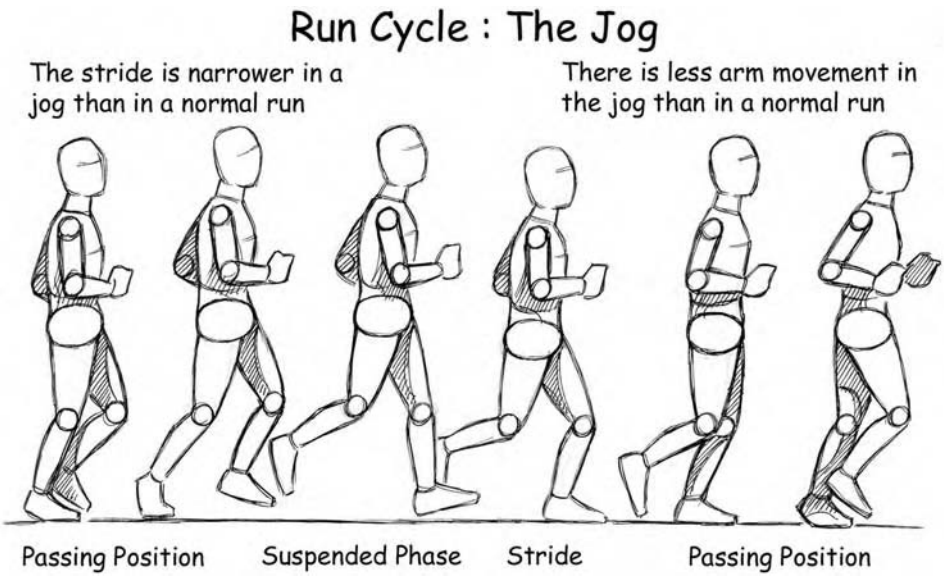


Figure 2.23 Jogging is generally less quick than the run. There is often just as much up and down movement as in a run but the strides are much shorter, though the backwards kick of the foot may be rather high. You will find there is much less rotation of the shoulders and the swinging action within the arms is much reduced and limited to short backwards and forwards action, usually keeping the hands in front of the body.

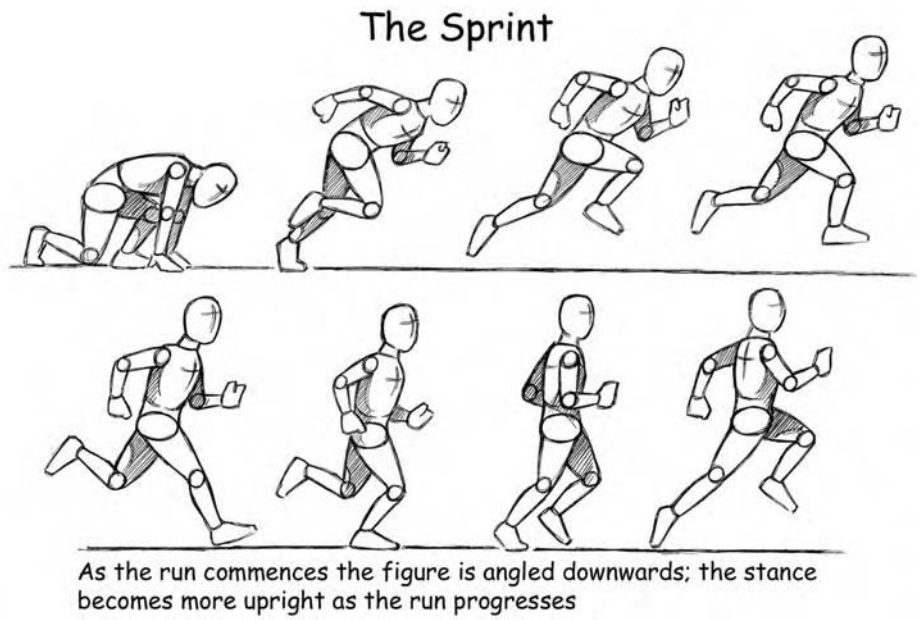


Figure 2.24 It is often the case that a fast run is animated with the figure leaning forward, but you only have to look at video footage of sprinters to notice the upright gait of the athletes. The stride is often very wide on a fast run and the arms may swing in an exaggerated fashion, moving well in front of the body on the forward action and trailing behind the backwards position. A figure may in fact lean forward a great deal when beginning the run, particularly if starting from blocks, and it may well lean heavily into the finishing tape, but for the most part it remains fairly upright.

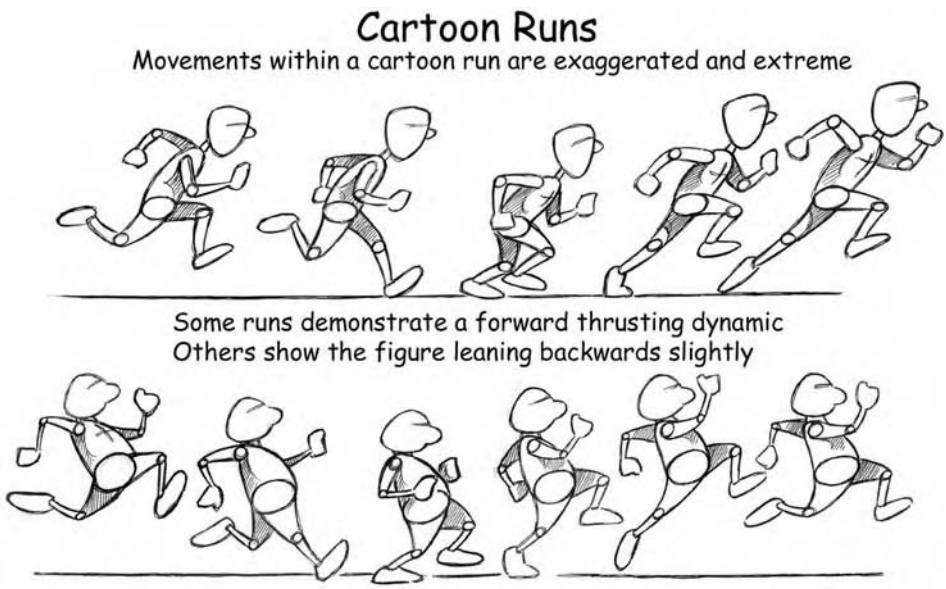


Figure 2.25 A fast run cartoon style may incorporate not only an acutely angled figure, but the arms may also be extended out in front of the character. All manner of variations are possible to create a comic effect.