

TEZUKA SCHOOL of ANIMATION

Vol. I Learning the Basics

by Tezuka Productions



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Preface

Until now, numerous animation technique manuals have been published, written by assorted veterans of the animation world. Each one has been valuable in its own right, but they were all somewhat advanced, geared towards the intermediate animator or above. Up till now, there hasn't been an easy-to-understand, visual-based book that focuses on the needs of the true beginner, novice, or amateur.

This book, first and foremost, carefully explains the introductory aspects and principles of how objects move. You will learn step by step how to create smooth and dynamic animation, as well as the techniques to make an image "flow."

Nowadays, the animation world has seen remarkable technological advances, from the introduction of CG (computer graphics) to advancements in calculated timing and photographic technique. The basics, however, remain the same. Hand drawn frames, whether on cel or computer, are the foundation of all animation

Overall, the contents of this book only skim the surface of the animation world, but it should suffice as an easy-to-understand basic text, particularly for beginners.

In the animation world, even though you may start with one path, there are many other things to learn besides what's included in this book. But in the meantime, let's start learning the fundamentals of how to make pictures move, so you can breathe life into your own characters.



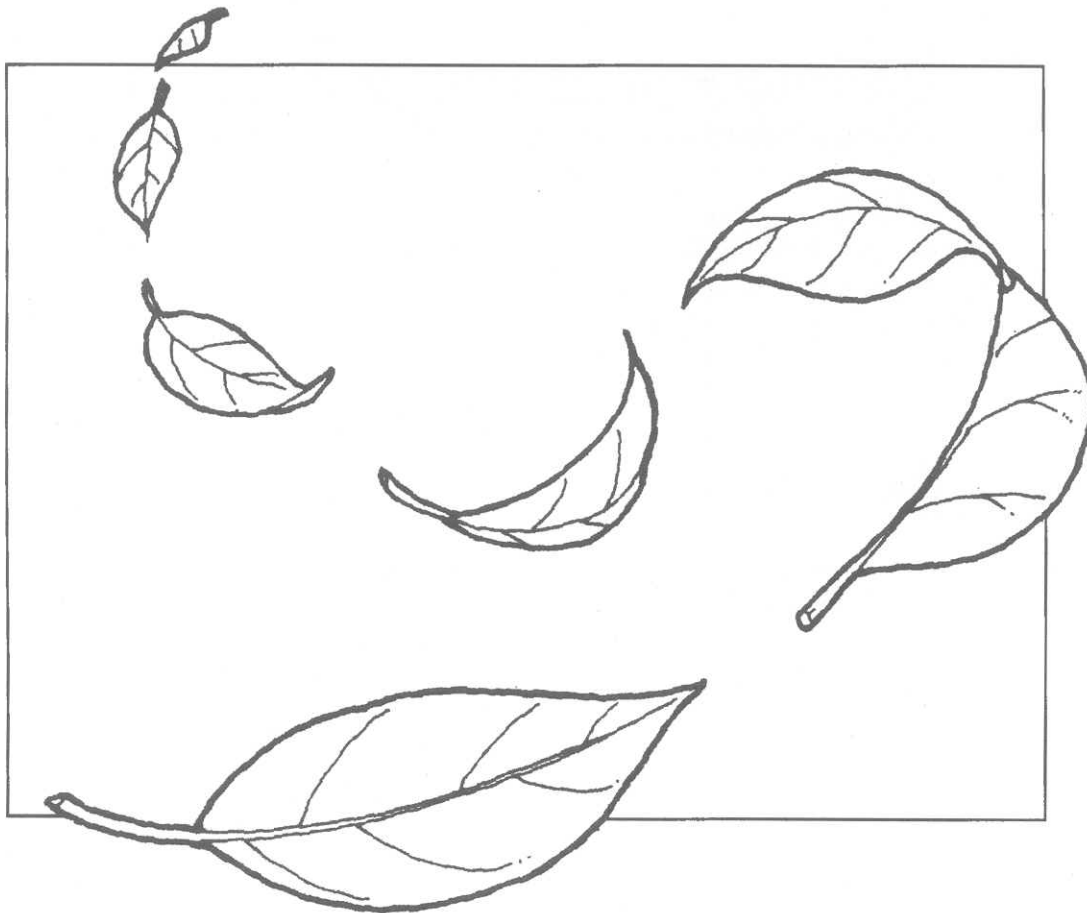
Tezuka Productions, Animation Department
<http://www.tezuka.co.jp/>

Chapter 1

The Basic Knowledge of Animation

Before you start to draw anime, there are few important points that you need to know first:

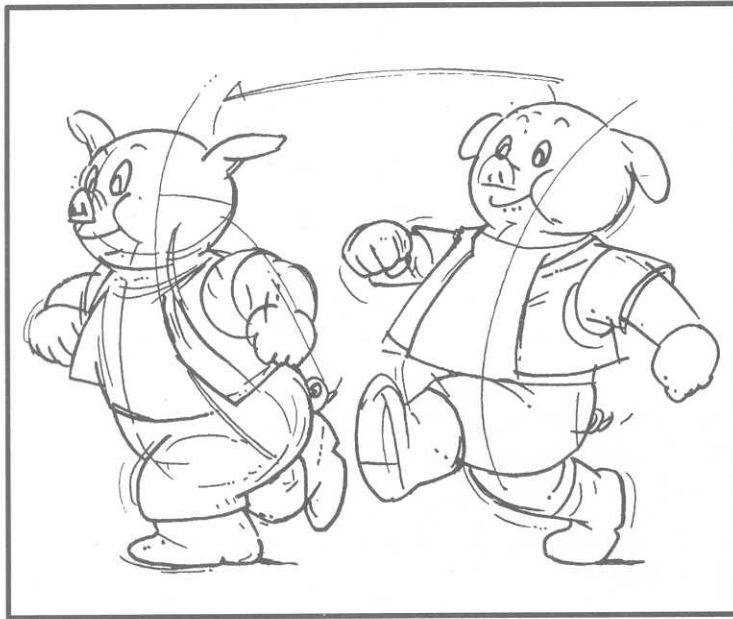
How to Create Animated Drawings
How to Draw Breakdowns and Breakdown lines
The Elements of Movement
Fundamentals of Movement



How to Create Animated Drawings

The creation of animated drawings is at present divided into two stages, as shown below.

Figure 1 (Example of key drawings)

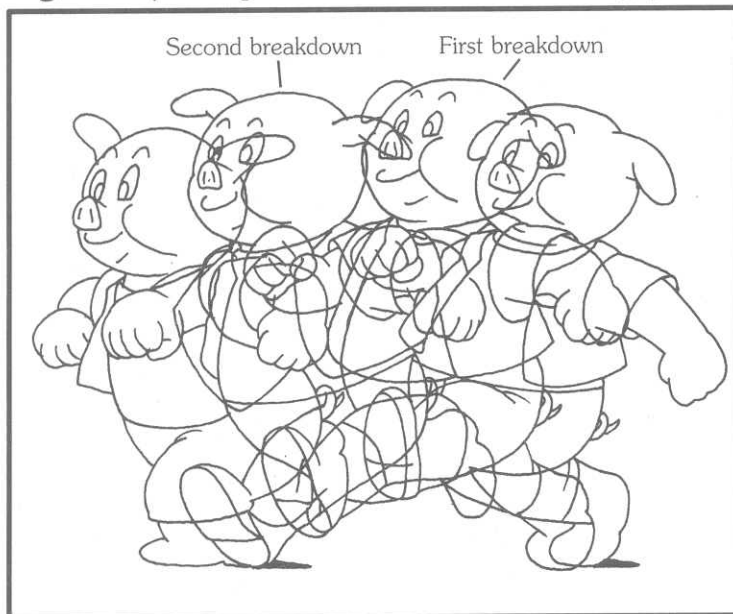


(1) Draw the key drawings

First off, draw only the poses that form the main points along the line of action. Also, pay attention to the timing of the movement.



Figure 2 (Example of breakdown drawings)



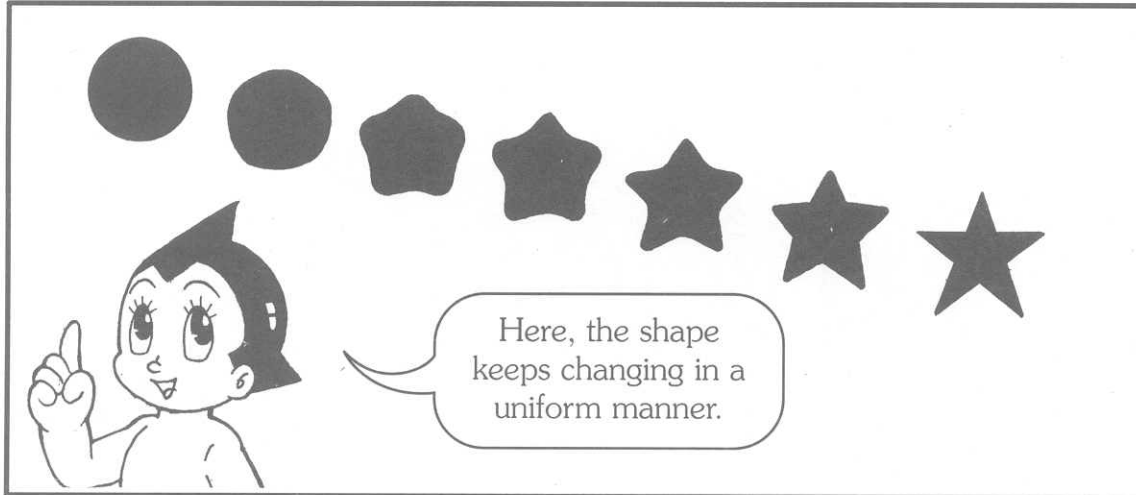
(2) Fill in the breakdown drawings

Put the finishing touches on the movement by drawing poses that fit in between the key drawings. Movement should look as natural as possible. You can think of breakdown drawings in terms of two stages: First breakdown and second breakdown.

How to Draw Breakdowns

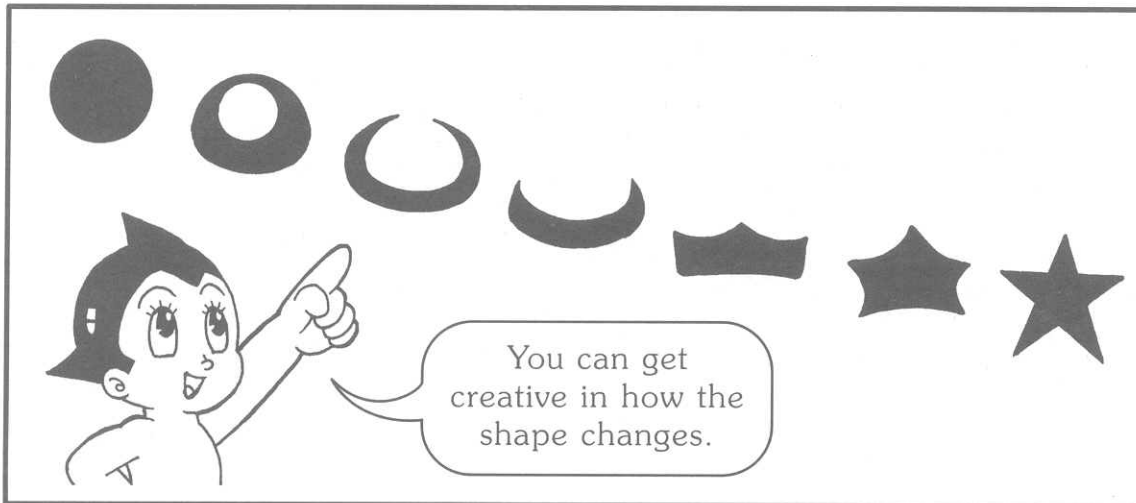
Breakdown drawings are also referred to as “in-betweens.” There are two ways of looking at in-betweens, as shown below.

Figure 3 (Mechanical in-betweens)



Breakdown drawings of a changing shape fill the space between key poses precisely and mechanically.

Figure 4 (Creative in-betweens)

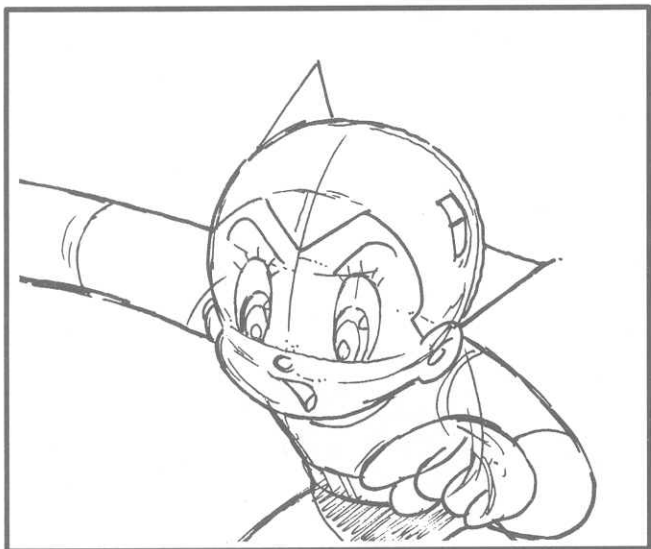


You can make creative in-between drawings that bear in mind the shape, material, and nature of the moving object. Generally, this kind of creative inbetween work is preferred in animation.

How to Draw Breakdown Lines

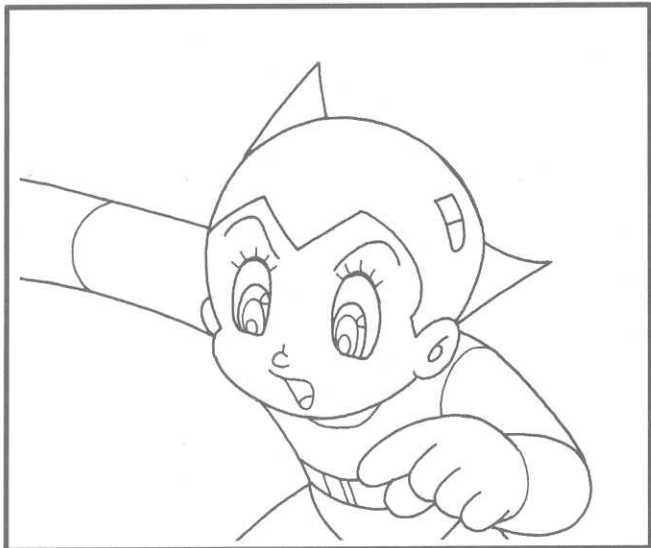
A special technique is necessary to draw the lines of breakdowns. Usually, when making a breakdown drawing, you can start by making a clean copy of the key drawing. Since the key drawing is in rough form, complete the breakdown drawing by tidying up the picture into separate, clean lines, creating a finished product.

Figure 5 Key drawing (rough sketch)



Choose the appropriate lines and make a clean copy.

Figure 6 Breakdown drawing
(A clean copy of the key drawing in Figure 5.)



To do this, you've got to really understand the intention of the key drawing, in addition to having good enough technique so you don't lose the flavor of the key drawing.

What you need in your technique is the ability to show the feel and shape of the object, clearly and accurately.



Also, you need to know which lines to use and which not to use. This is a very important point in making breakdown drawings, so it's important that you really master this skill.

- Thick lines---Used for outlining and for emphasis.
- Medium lines---Used for areas adjoining the outline.
- Fine lines---Used for eyelashes, rims of the eyes, wrinkles in clothing, etc.

Distinguish when to use these three types of lines depending on your purpose.

Figure 7 (Example of not distinguishing between different types of lines)



Figure 8 (Example of distinguishing between different types of lines)



Also, be sure to make a distinction between the way a line stops (and starts).

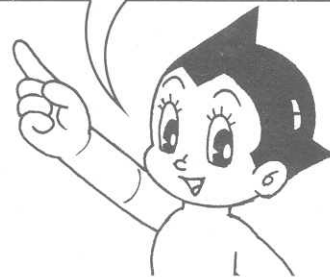


A gradual stop.

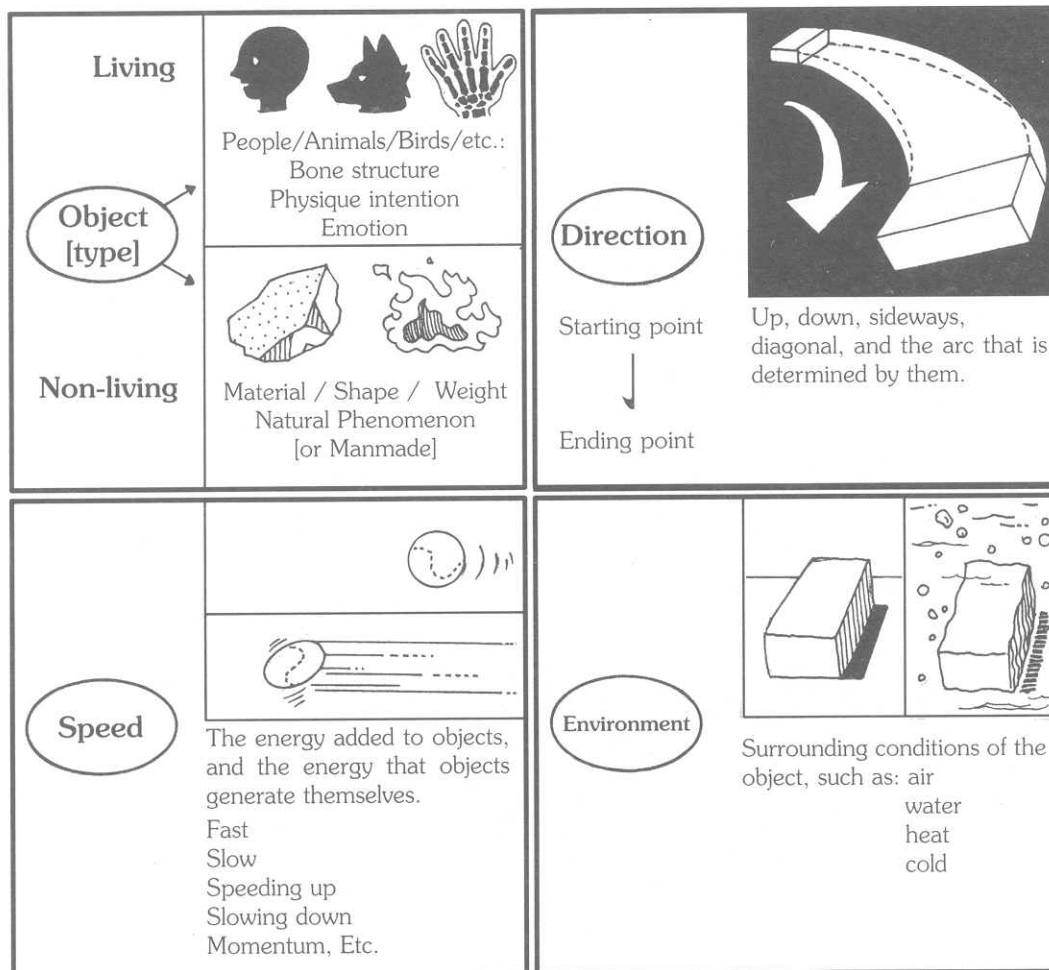
A sudden stop.

Obviously, it's no good if the lines are messy, broken, sticking out, or visibly intersecting.

You see, if you don't make a distinction between line types, a facial expression can look stiff and have an inorganic feel to it. But I'm sure you can see how dynamic it looks when you make a distinction between lines.



For Animation Movement You've Got to Consider:



The elements of movement can be divided into the four general categories above.

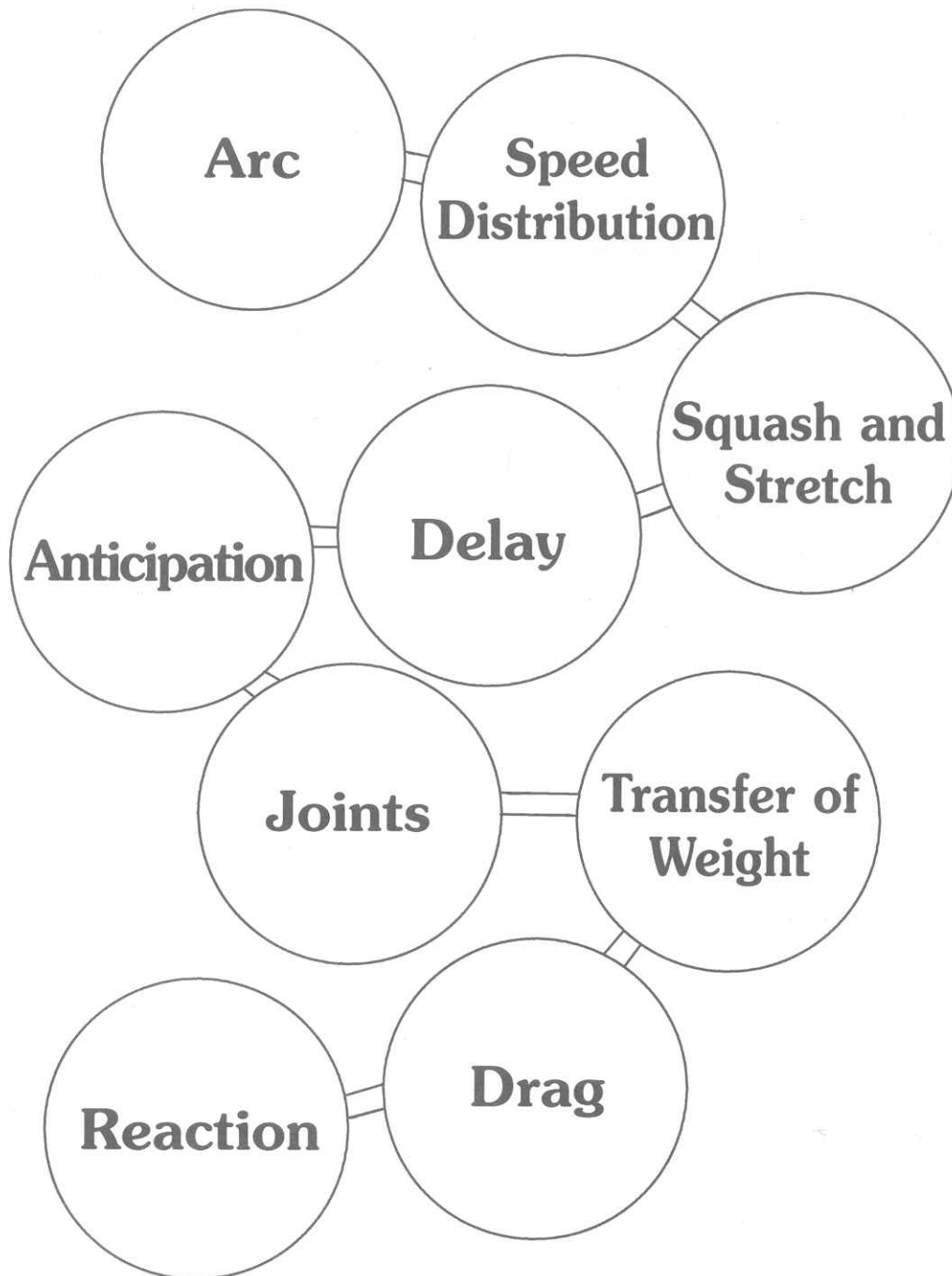
Movement is affected by these combined elements. An animator, always seeking to create better animation, should never fail to consider these factors.

Now, beginning with the next page, let's move on to specifics and learn about the "Fundamentals of Movement."



Fundamentals of Movement

Before actually learning about movement, let's take a look at the following.



Fundamentals of Movement

- Arc -

When objects move, the path that they follow is called an “arc.”

- An arc should be depicted so that it conforms to a constant principle of uniformity.
- An arc without uniformity results in a jerky, awkward motion, lacking in continuity.

Figure 9 Pendulum swing: bad example that ignores an arc

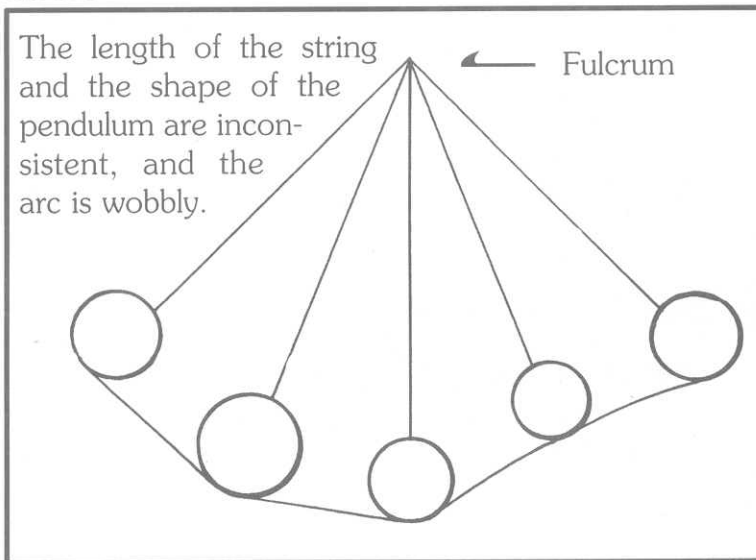
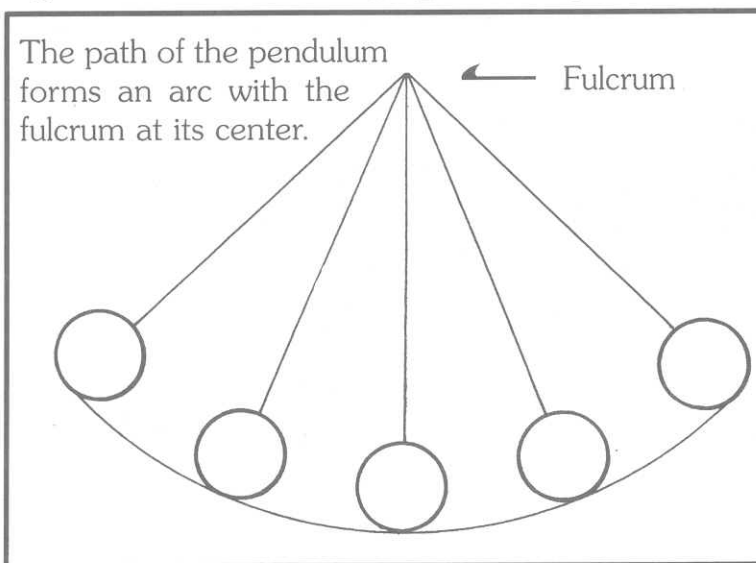


Figure 10 Pendulum swing: good example



An animator must grasp the principle of uniformity for moving objects.

You've got to place moving objects along the proper arc.

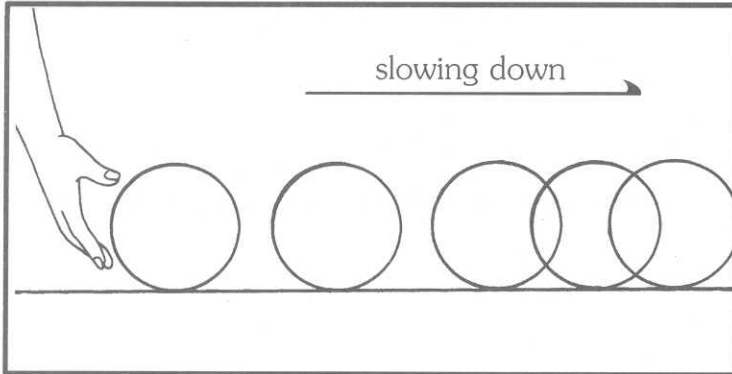
You won't be able to make a proper arc if the size or shape of moving objects is irregular.

Fundamentals of Movement

- Speed Distribution -

When objects move, they don't always necessarily stay at a fixed speed.

Figure 11 Rolling a ball by hand.



It is necessary to adjust acceleration and deceleration according to the circumstance.

Speed adjustments should not be made arbitrarily, but should be based on sound physical principles.

Figure 12 Start of car motion —→ stop

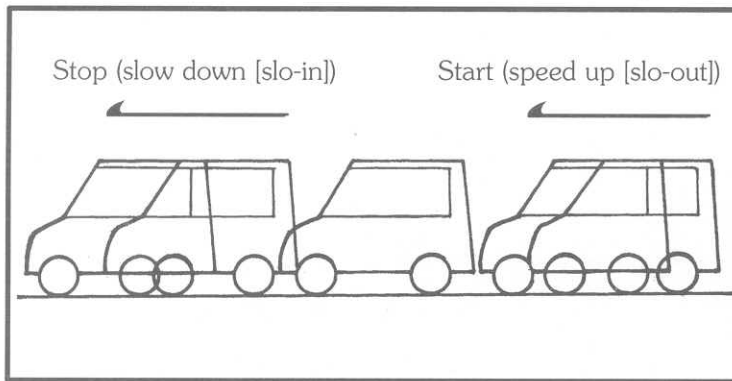
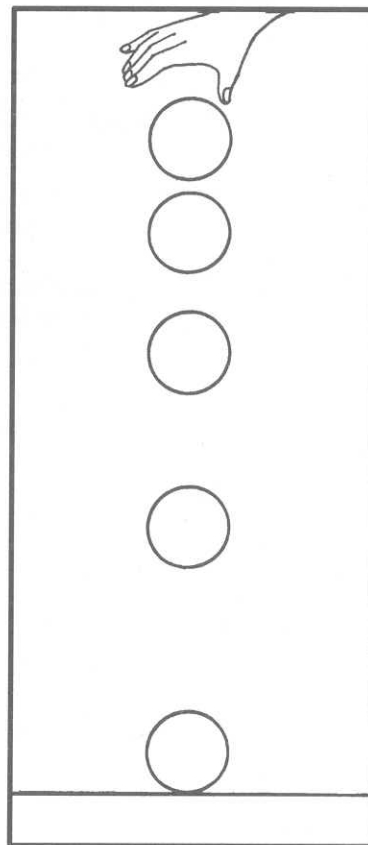


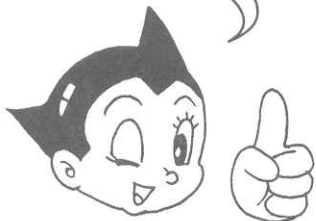
Figure 13 Falling ball



The distance that an object moves is proportionate to the time squared.

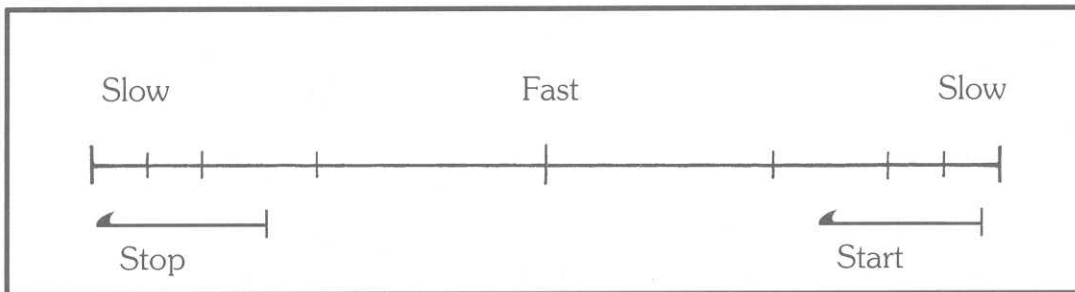
In the example of a falling ball, the ball is affected by gravity and picks up speed.

A rolling ball, however, slows down due to friction from the ground and will eventually stop, as in Figure 11.



- Therefore, when you animate, make sure to adhere to the principle that when objects move, their speed is not constant.
- In Figure 12, the car starts to move slowly, and is fastest at the midpoint, with the movement slowing down again at the end.
- This is particularly the case when a moving object has its own driving force such as a car. That's because the Law of Inertia is at work.

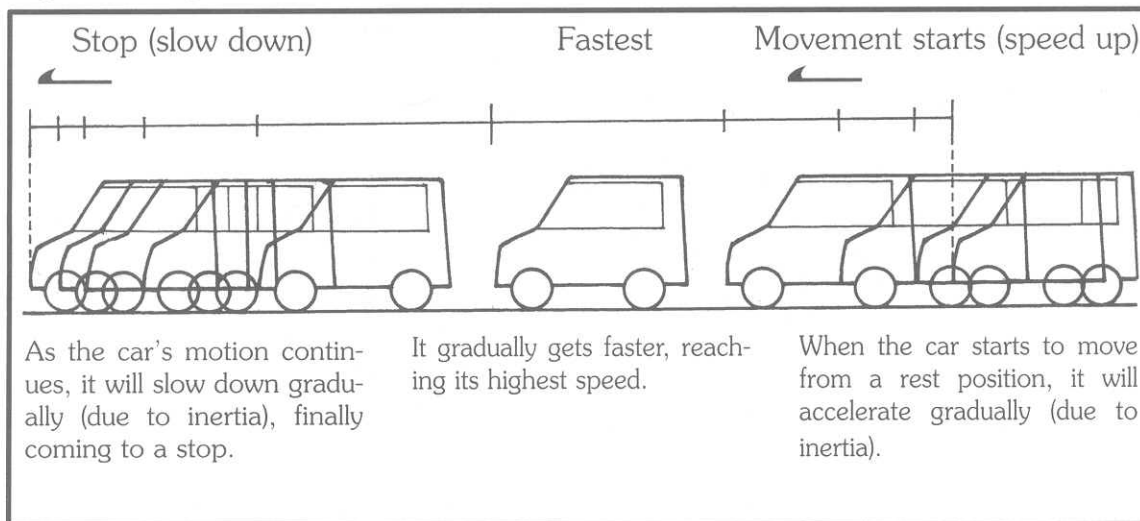
Figure 14 "Cushioning" chart from end to end



The best example of this type of speed distribution is called "cushioning." Right now, my hand is "cushioning" too.



Figure 15 Speed distribution of a car.

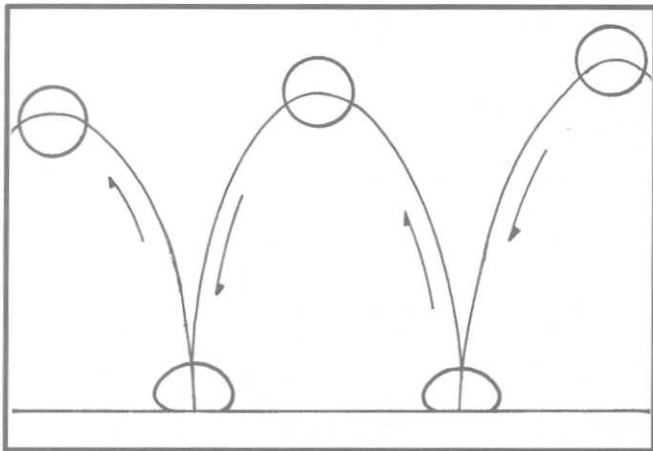


Fundamentals of Movement

- Squash and Stretch -

During movement, the energy affecting an object can often cause it to change its appearance. The change in appearance can be classified into two categories: squash and stretch. These are phenomena that actually occur in nature, but in animation, you can increase their effectiveness by distorting the shape even more exaggeratedly.

Figure 16 A bouncing ball



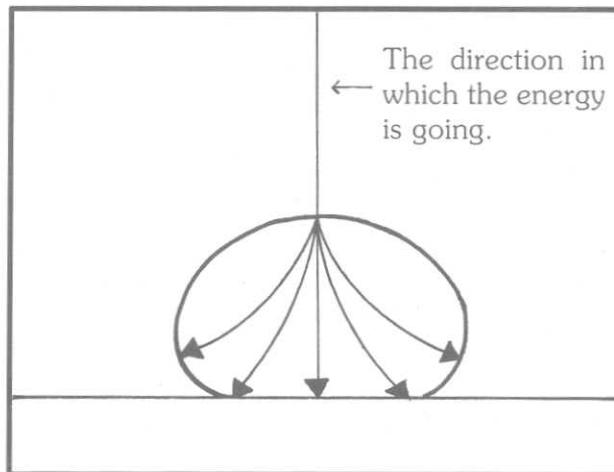
- Bounce can be thought of as divided into three stages: falling
contact
rising
- The arc of the bouncing ball depicts a “parabola.”

- When bouncing, the ball speeds up when it falls and slows down when it rises.

- Because the speeding ball hits the ground forcefully, its shape changes, becoming squashed. This phenomenon is known as “squash.”

- Squash and stretch are used to depict objects that have elasticity.

Figure 17 The moment “squash” occurs.



You can also use squash for comedic takes like this.

Figure 18 The moment when "stretch" occurs.

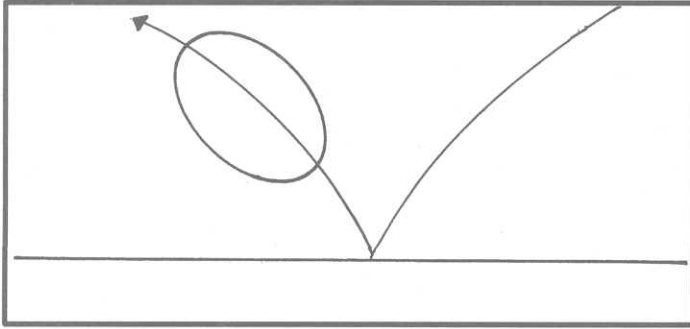


Figure 19 During stretch, make sure the volume of the ball is constant and the ball's orientation remains consistent.

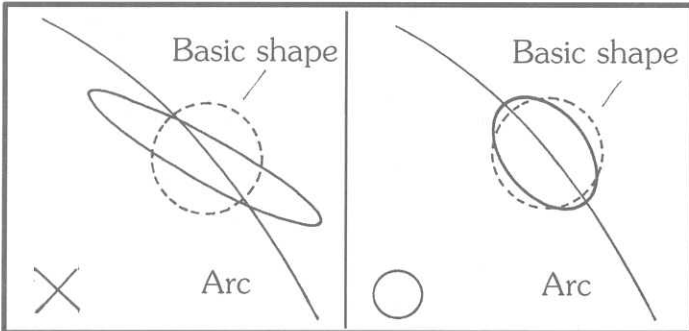
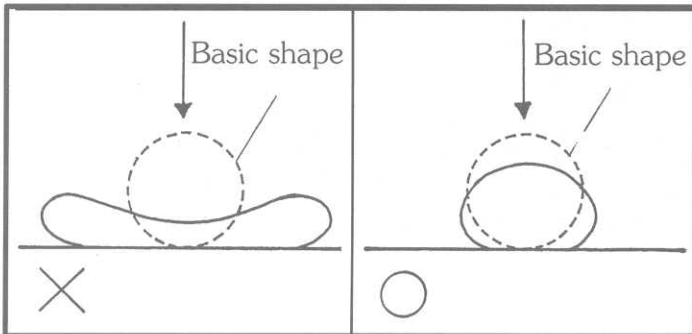


Figure 20 Similarly, during squash, the volume of the ball should not change.



- After impact, the ball bounces up, and in that instant it changes shape, extending out vertically. This is called "stretch."

- It is more effective to use squash and stretch momentarily during movement.

- If you use them more than necessary, objects will appear to have an overly sticky or fluid consistency.

- You can get interesting results when applying squash and stretch to human or other movement.

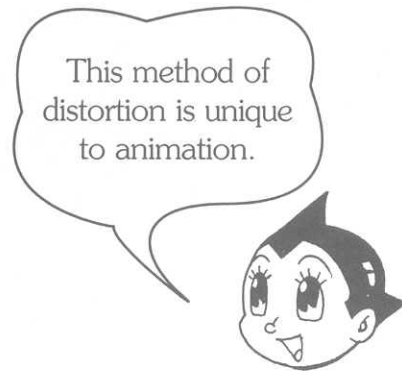
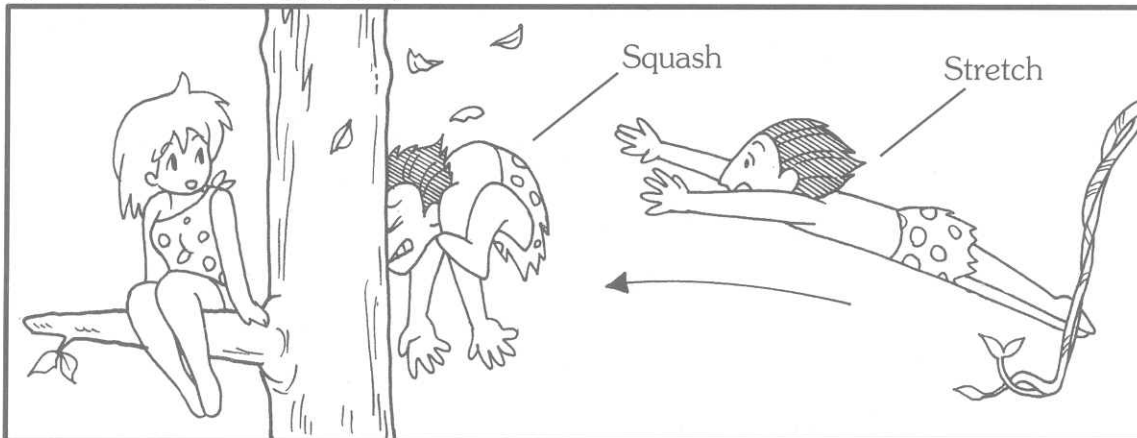


Figure 21 Example of applying squash and stretch to humans



Fundamentals of Movement

- Delay -



Depending on the material of a moving object, all parts will not necessarily move at the same time. This is referred to as “delay.”

Figure 22 Bad example of an elephant's trunk where the entire trunk moves simultaneously.

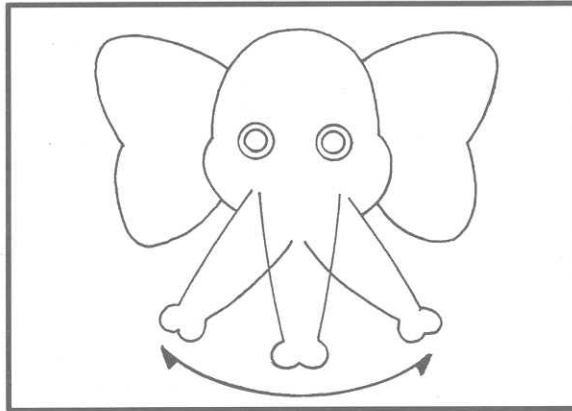
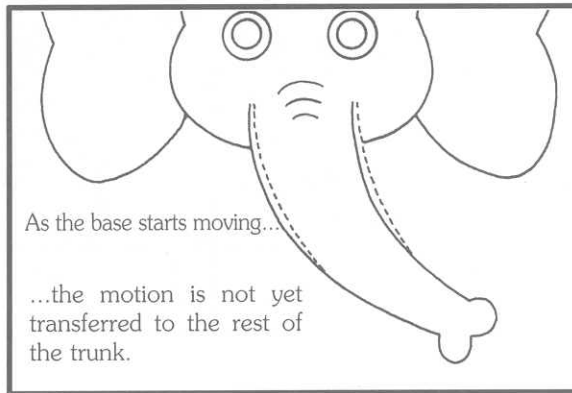
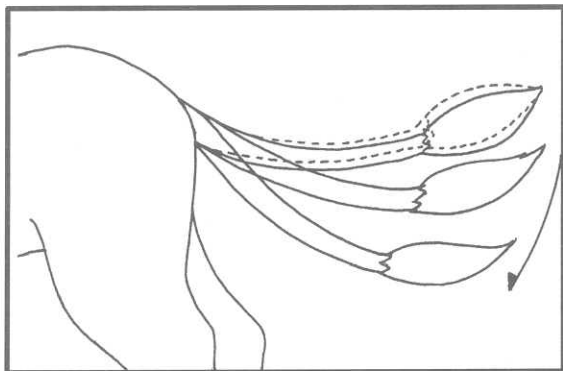


Figure 23 Good example.



- When a soft object moves, such as the elephant's trunk in figure 22, the object will appear stiff if everything moves at once.
- Let's consider the concept of “energy transmission.”
- The energy that moves the elephant's trunk originates in the muscular power at the base of the trunk and is gradually transmitted to the middle of the trunk and finally reaches the outermost tip.
- Therefore, when the base of the elephant's trunk starts to move, the tip of the trunk should not be moving yet.
- As a result, the elephant's trunk takes on a smooth, wavy appearance.
- This lagging movement of the tip is a concrete example of “delay.”



“Delay” is a phenomenon that can also be seen in the movement of animals' tails, like in the illustration to the left. In contrast to the base of the tail, the tip of the tail moves later. This also occurs for a fish's tail fin and for inanimate, cloth-like objects, such as flags or capes.

Why the Principle of "Delay" Occurs

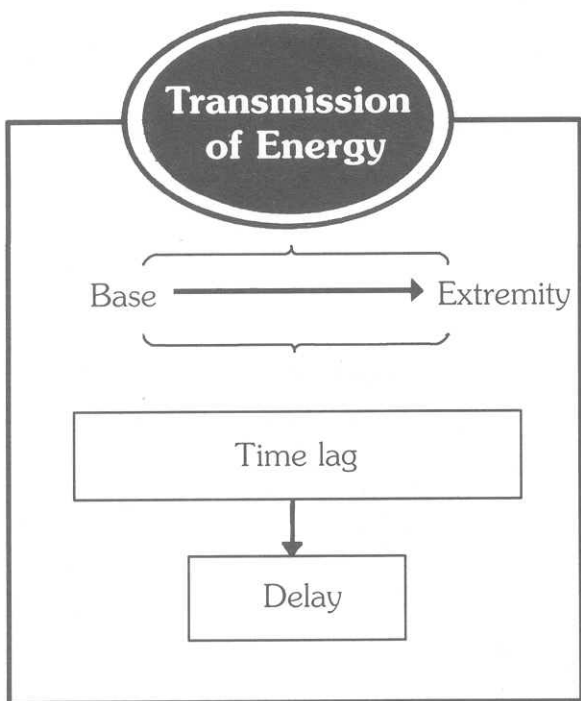


Figure 24 Specific examples of "Delay" (1)

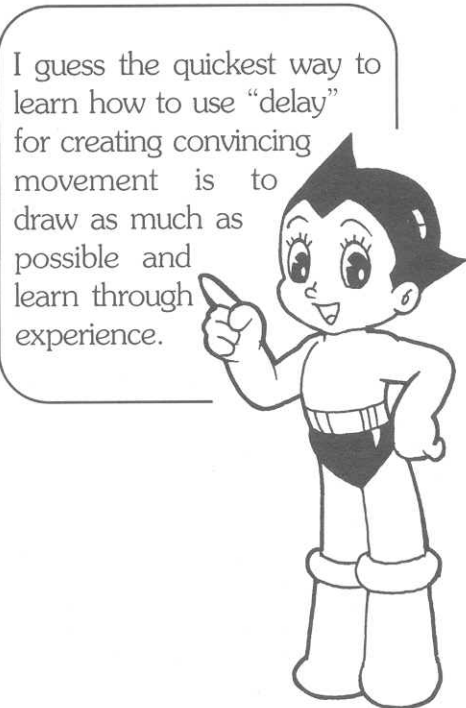
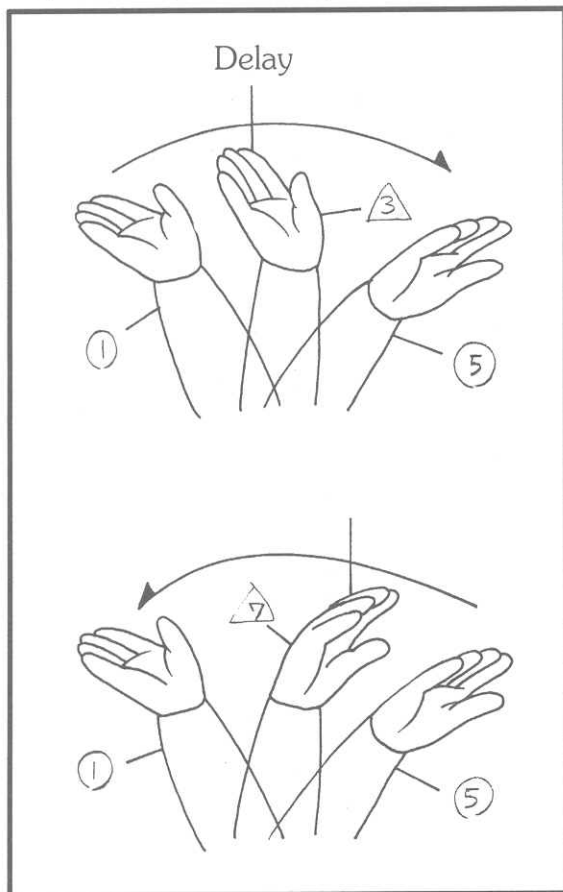
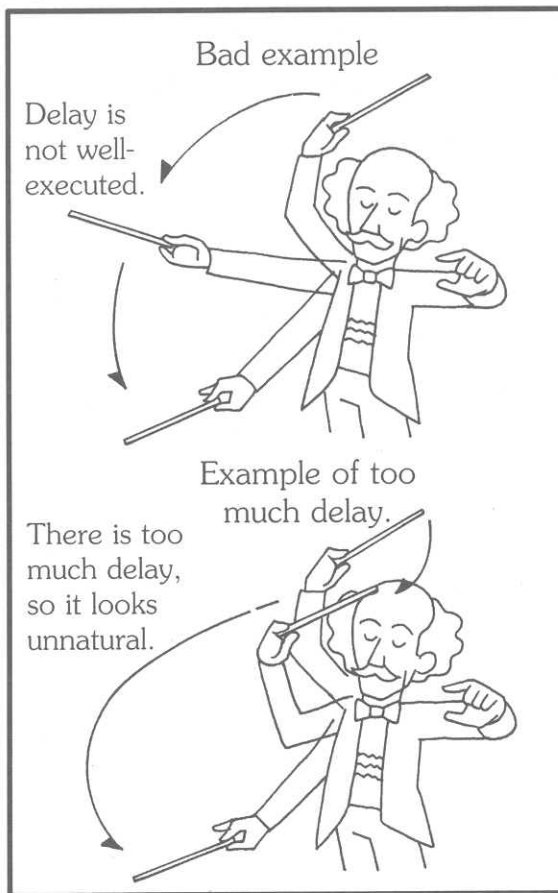


Figure 25 Specific examples of "Delay" (2)

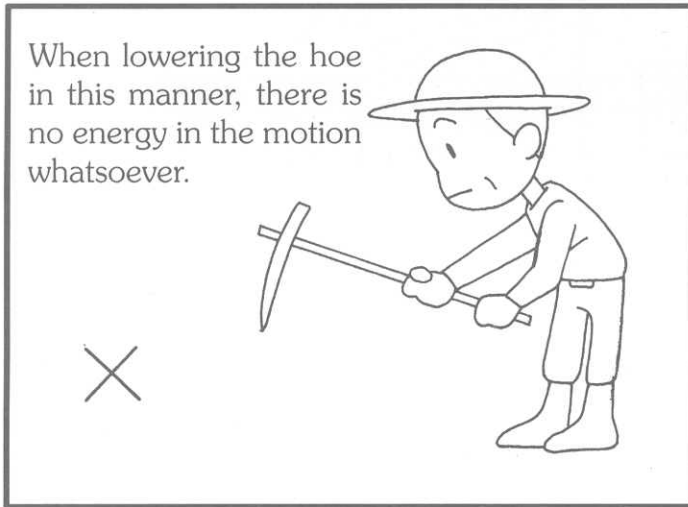


Fundamentals of Movement

- Anticipation -

Human movement, depending on the context, can be divided into a “preparatory action” and a “main action.” The “preparatory action” is also known as “anticipation.”

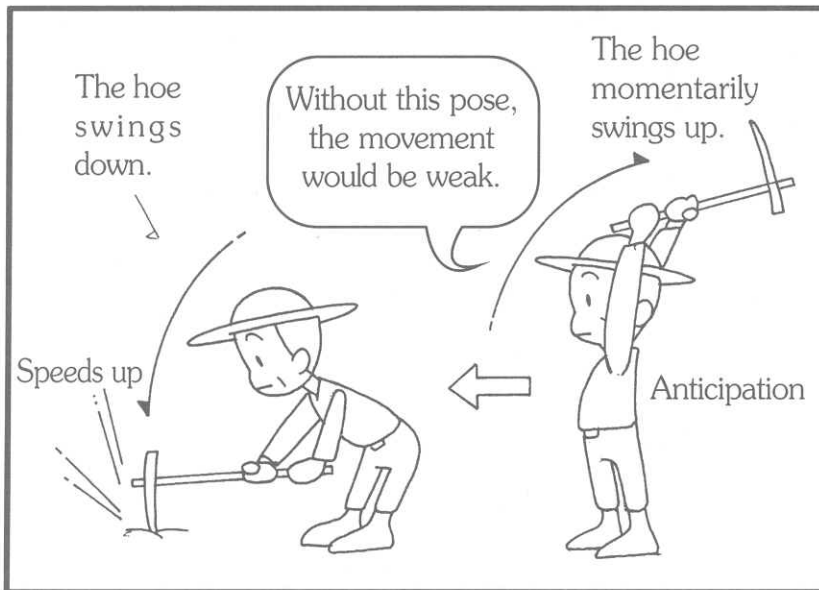
Figure 26 Lowering a hoe
A weak pose with no energy.



- A person tilling a field will not be able to till well if he lowers the hoe in this manner. That's because it is a weak movement lacking energy.

- In the actual movement, there's always an initial motion in which the hoe is momentarily swung upwards. If not, the movement will lack power. That's where the “anticipation” comes in.

Figure 27 The hoe is swung up.
As a result, the motion becomes powerful.



There are lots of ways to apply this, but it can get tricky.



Fundamentals of Movement

- Joints -

Human movement is generated by the interconnected motion of various joints. It's important to gain an understanding of the workings of individual joints first and then apply it effectively to each motion.

Figure 28 Raising the arms



Figure 29 An inbetween that doesn't consider joint movement.

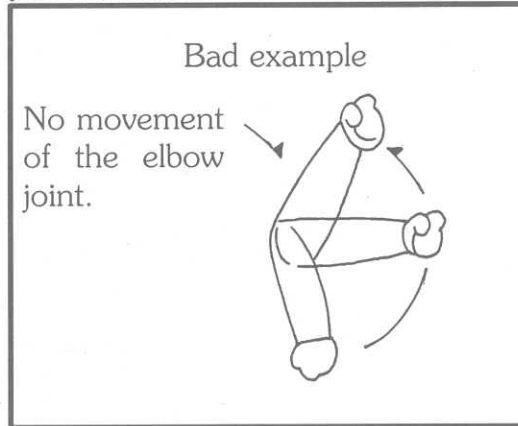


Figure 30 Example of an inside arc

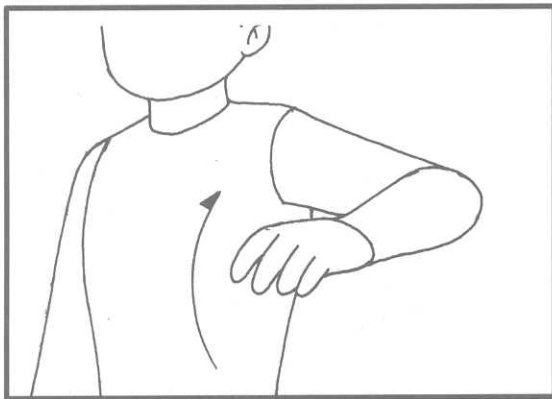


Figure 31 Example of a middle arc

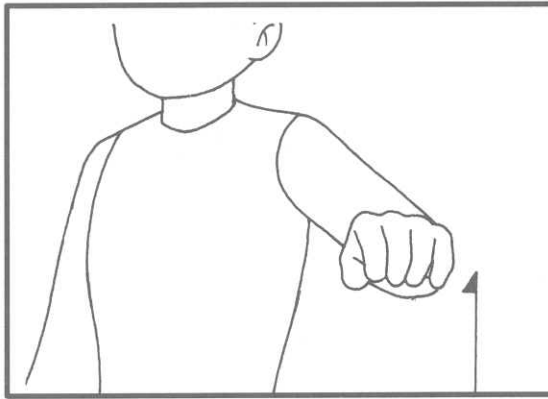
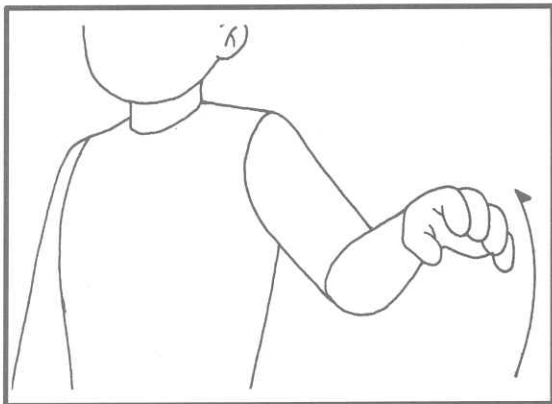


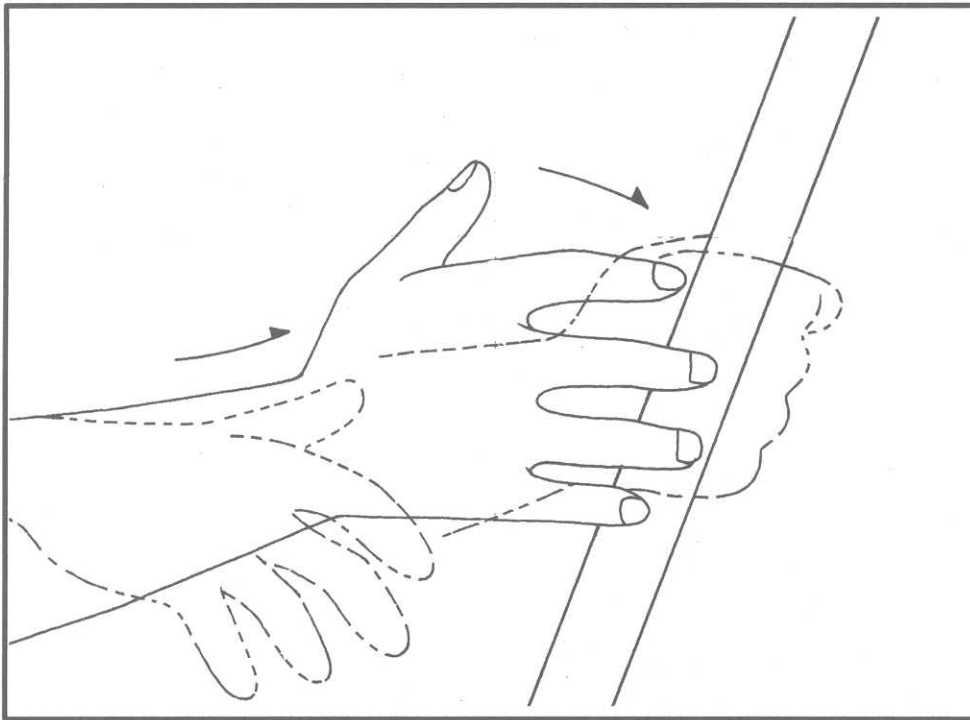
Figure 32 Example of an outside arc



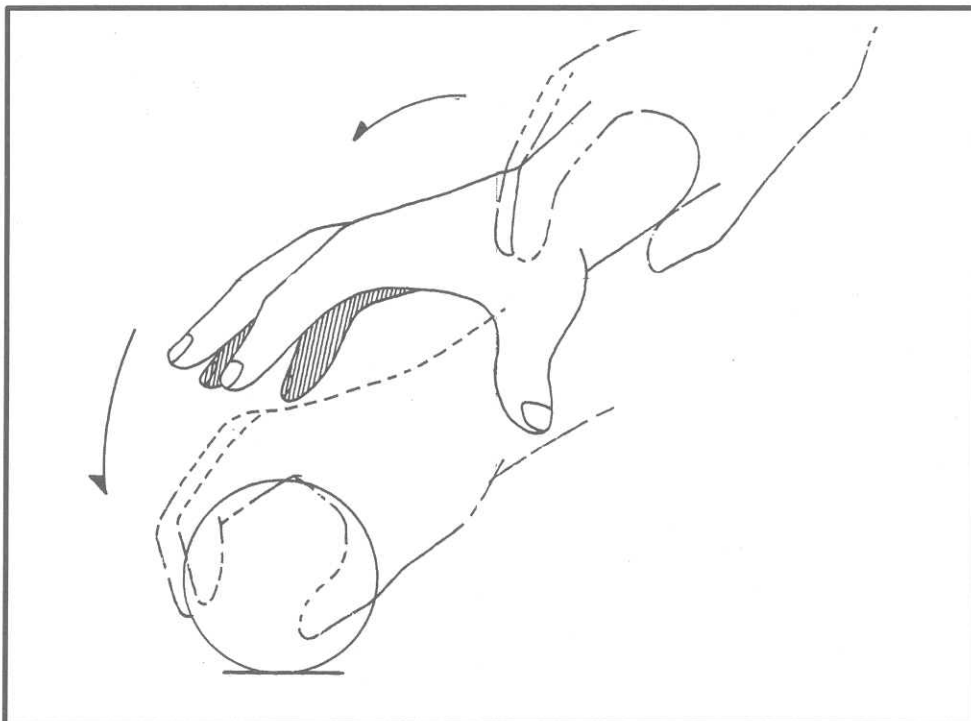
- The movement of joints is not uniform; many variations possible.
- For example, even for a motion like raising the arms in Figure 28, it can vary depending on whether you decide to use an outside, middle, or inside arc for the middle pose.

Figure 33 An example of movement that incorporates accurate joint-use (when grabbing an object).

A. Grabbing a stick



B. Grabbing a ball



Fundamentals of Movement

- Transfer of Weight -

Figure 34 Standing up from a chair

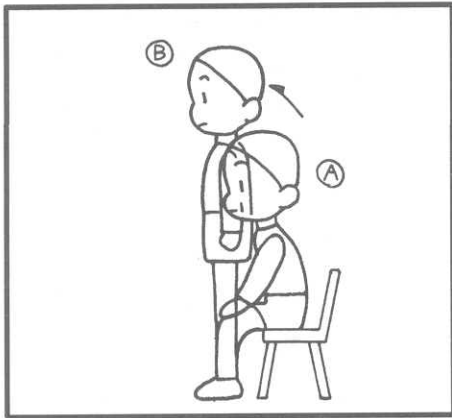


Figure 35 Example of an inbetween that ignores the center of gravity.

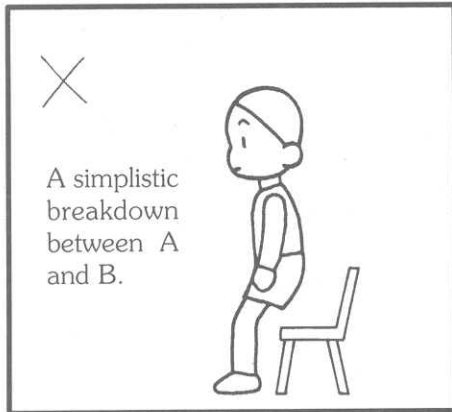
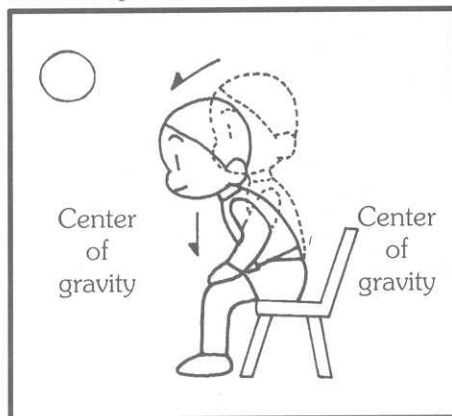


Figure 36 Example of an inbetween that incorporates the center of gravity.



Standing up from a chair can't be done unless the upper half of the body leans forward briefly, like in this picture.

When depicting human movement, you have to figure out where to place the center of gravity. Drawings without a center of gravity appear unnatural and lack vitality. Make sure you draw the body so it won't fall, with the center of gravity always stable.



For example, it looks unnatural if you draw the motion of standing up from a chair with a breakdown pose like the one in Figure 35. You can't possibly stand up from this posture.



Actually, the best pose is the one in Figure 36, where the center of gravity is balanced.

Be aware that the center of gravity is constantly shifting during movement.

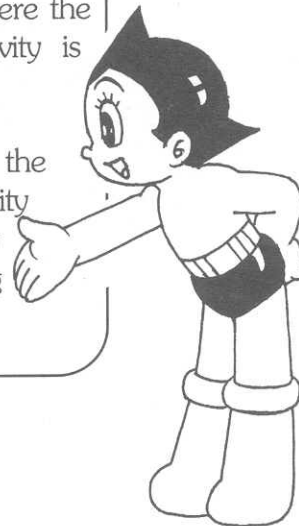
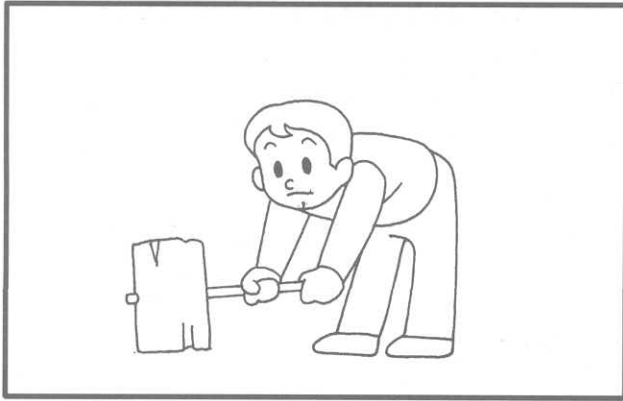


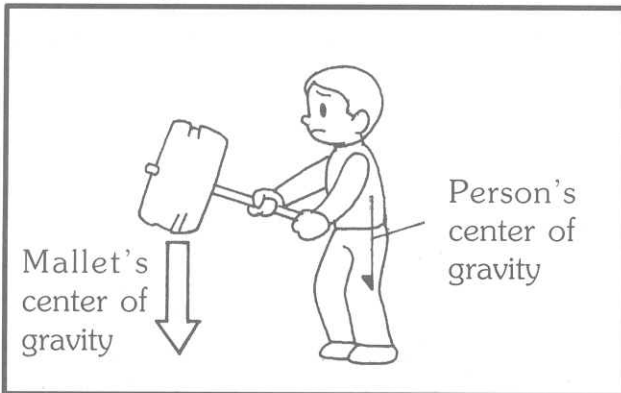
Figure 37 Lifting a mallet



- Getting the center of gravity right means that you are sufficiently conveying the heaviness of an object.

- For example, when the mallet is lifted in Figure 38, the weight of the mallet is not sufficiently conveyed.

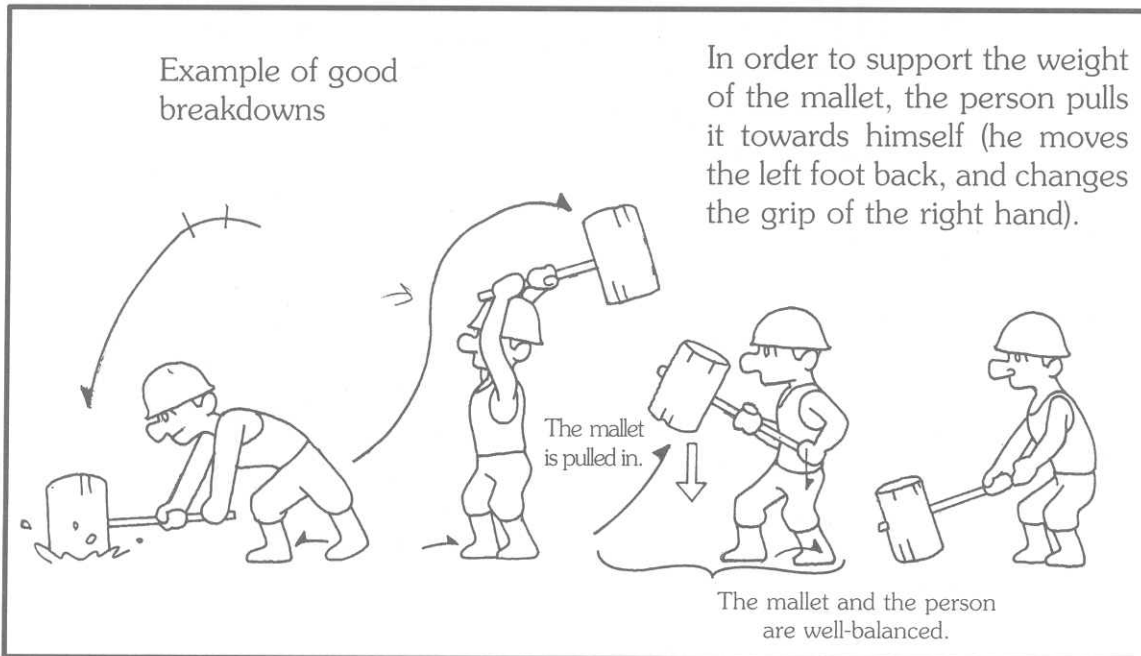
Figure 38 An unnatural pose that doesn't convey weight



If you want to convey the weight of a mallet, look at the movement in Figure 39.



Figure 39 Movement that incorporates the weight of the mallet



Example of good breakdowns

In order to support the weight of the mallet, the person pulls it towards himself (he moves the left foot back, and changes the grip of the right hand).

