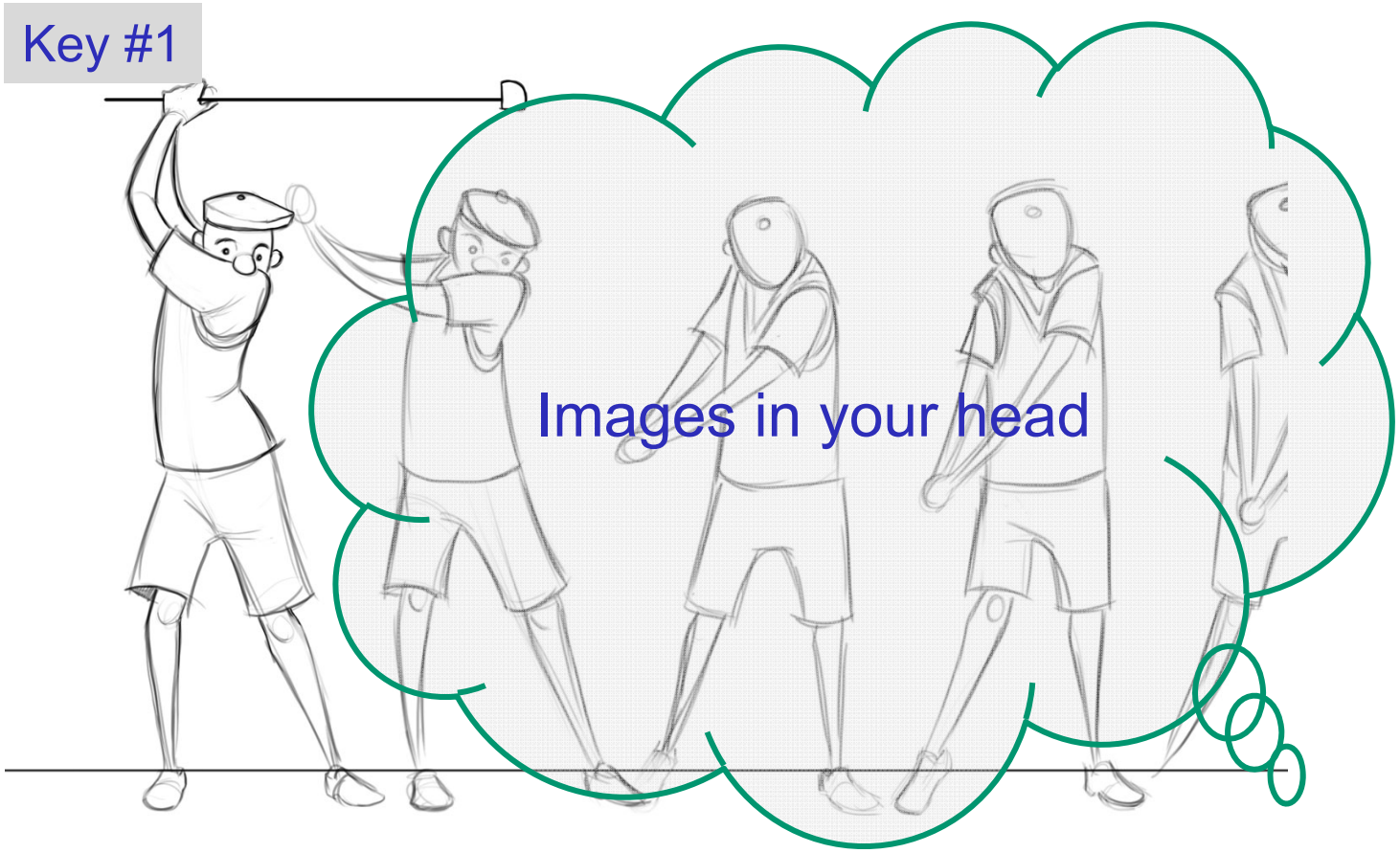
Falling Time

Animation
Physics

Straight-Ahead Action

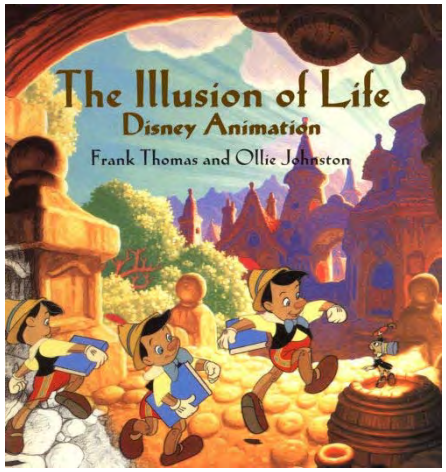
In Straight-Ahead Action, you establish the first key pose and have an idea of what you want for the rest of the poses.



Straight-Ahead Action

In Straight-Ahead Action you continue by drawing the second key pose, then the third key, and so forth.

Principles of Animation



Straight Ahead Action is another one of the Principles of Animation.

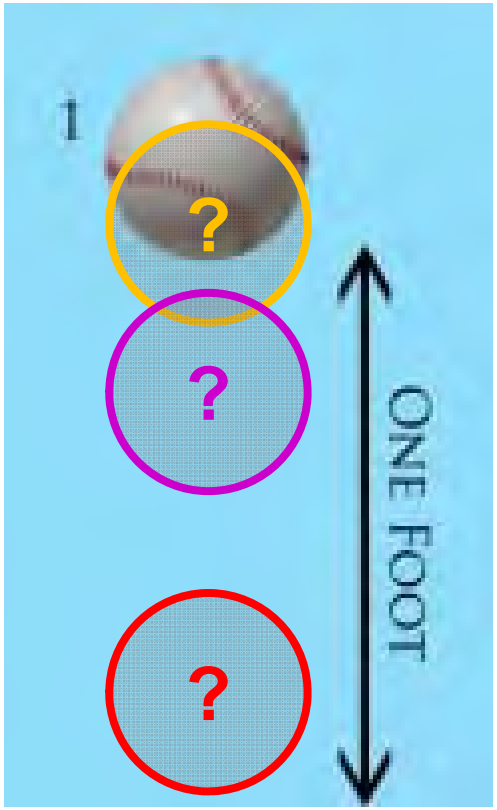
1. Squash & Stretch
2. Timing
3. Anticipation
4. Staging
5. Follow Through & Overlapping Action
6. Straight Ahead & Pose-to-Pose Action
7. Slow In and Slow Out
8. Arcs
9. Exaggeration
10. Secondary Action
11. Appeal
12. Solid Drawing

Pose-to-Pose Action is discussed later.

Straight-Ahead for Ball Drop

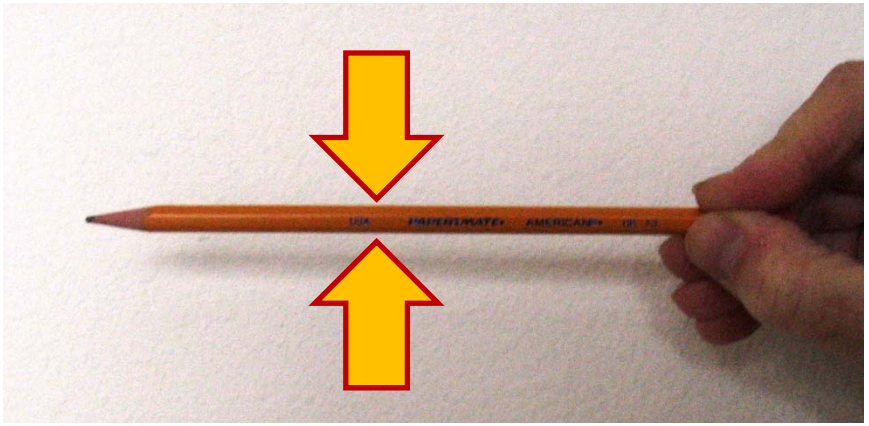
The falling ball slows out from the apex (key #1).

To use Straight-Ahead Action we need to find the position of the ball for key #2, which is the first drawing after the apex.



Distance Fallen from Apex

This table lists the distance fallen from the apex after the first few frames.

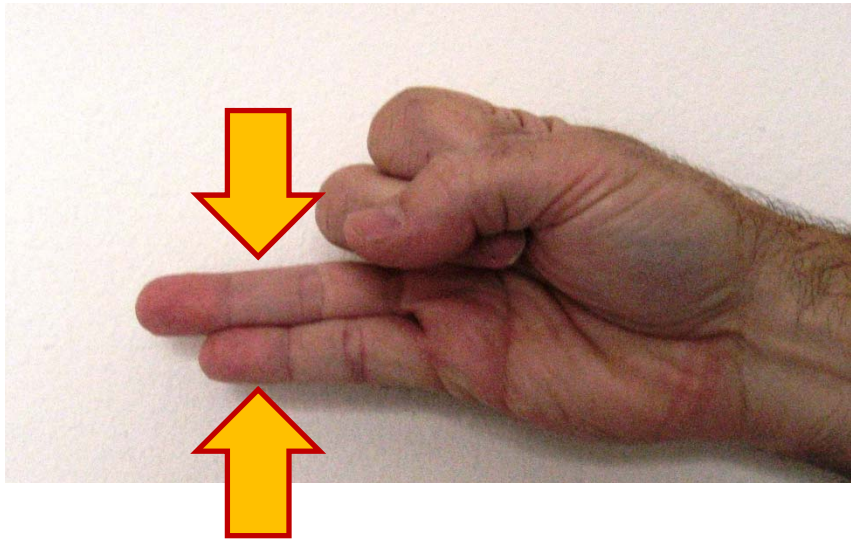


Time (seconds)	Frames	Distance fallen from apex
$^1/_{24}$	**1**	**$^1/_3$ inch**
$^1/_{12}$	2	1 $^1/_3$ inches
$^1/_8$	3	3 inches
$^1/_6$	4	5 $^1/_3$ inches

After one frame the distance fallen is only slightly greater than the width of a pencil.

Distance Fallen from Apex

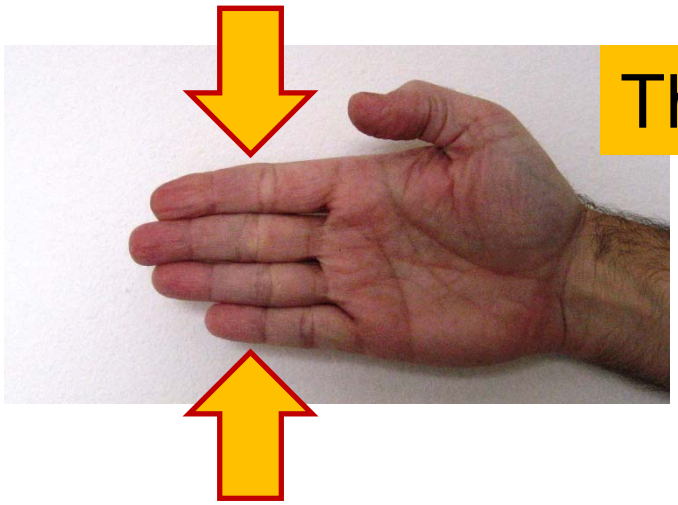
After two frames the distance fallen is about the width of two of my fingers.



Time (seconds)	Frames	Distance fallen from apex
$^1/_{24}$	1	$^1/_3$ inch
$^1/_{12}$	**2**	**1 $^1/_3$ inches**
$^1/_8$	3	3 inches
$^1/_6$	4	5 $^1/_3$ inches

Your hand may be smaller or larger so you may need to use another measure, such as the length of your thumb.

Distance Fallen from Apex



Three frames

Four frames

Time (seconds)	Frames	Distance fallen from apex
$^1/_{24}$	1	$^1/_3$ inch
$^1/_{12}$	2	1 $^1/_3$ inches
$^1/_8$	**3**	**3 inches**
$^1/_6$	**4**	**5 $^1/_3$ inches**

Straight-Ahead for Ball Drop

The first key drawing after the apex, shooting on twos, is located at about this position →

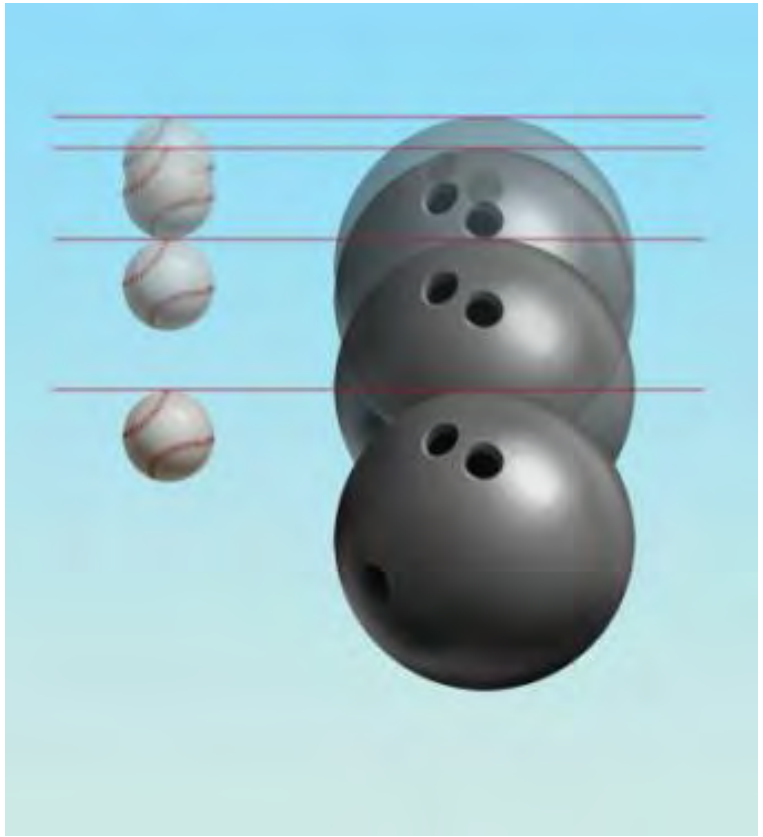
Time (seconds)	Frames	Distance fallen from apex
$^1/_{24}$	1	$^1/_3$ inch
$^1/_{12}$	2	1 $^1/_3$ inches
$^1/_8$	3	3 inches
$^1/_6$	4	5 $^1/_3$ inches

The table tells us that after two frames the ball falls by 1 $^1/_3$ inches, a third of its diameter of 4 inches.

Distance Fallen & Weight

The distance that an object falls does *not* depend on its weight so long as the force of air resistance is minimal.

A baseball and a bowling ball fall together when released from the same apex.



Distance Fallen from an Apex

Distance fallen from the drawing at the highest point (called the apex) is given by this table.

Time (seconds)	Frames	Distance fallen from apex
1/24	1	1/3 inch
1/12	2	1 1/3 inches
1/8	3	3 inches
1/6	4	5 1/3 inches
¼	6	1 foot
1/3	8	1 ¾ feet
½	12	4 feet
2/3	16	7 feet
¾	18	9 feet
1	24	16 feet

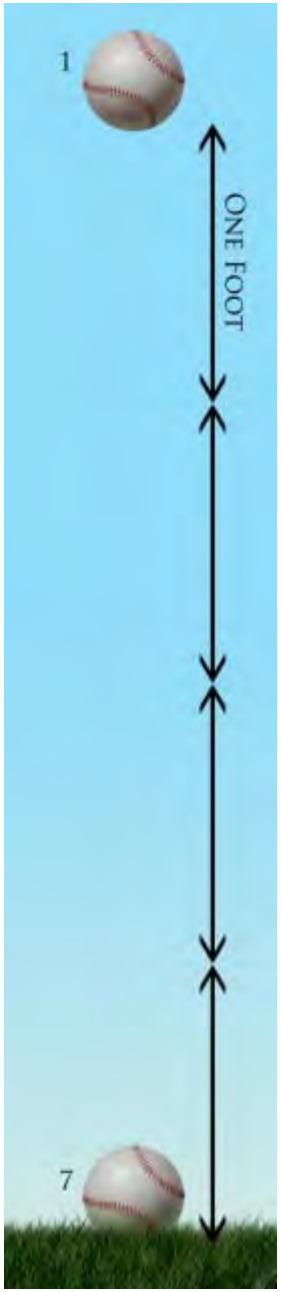
The formula to compute this table is:
(Distance in inches) =
(Number of Frames) x
(Number of Frames) x
(1/3 inch)

Planning a Scene

The table of distance fallen is also useful for planning a scene.

For example, falling from a height of 4 feet takes 12 frames.

Warning: Falling motion is often animated as being *faster* than reality; use the table only as a guide.



Slugging & Reaction Time

In planning a scene, you might also use a stopwatch to time the live action (this is called "slugging" a scene).

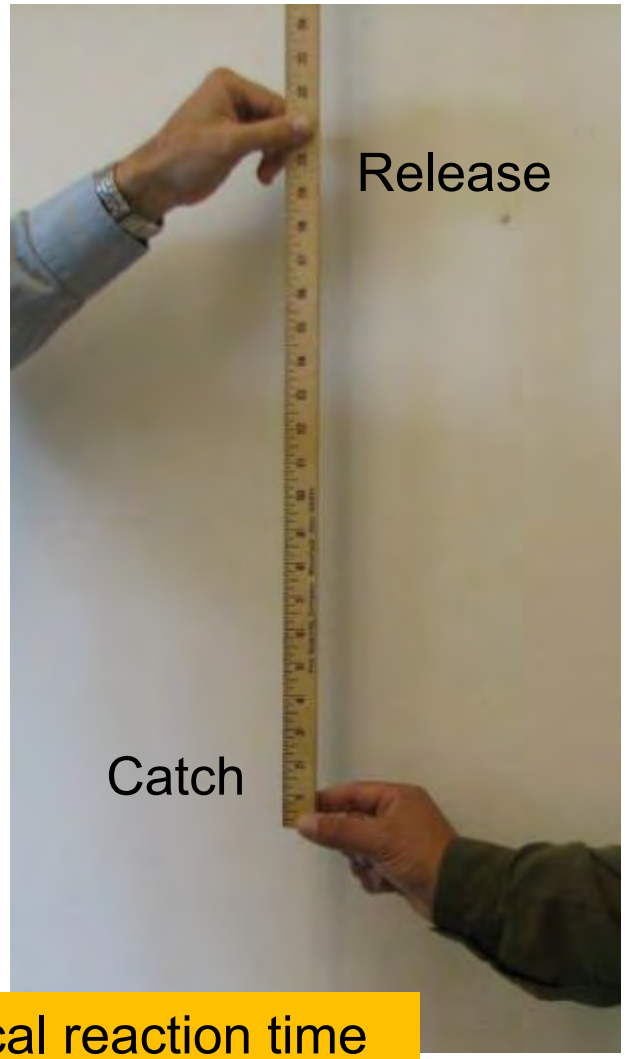
Your reaction time is probably a $^1/_4$ second delay so should you subtract that much from your stopwatch reading?

No, because there's a reaction time delay in hitting START but also in hitting STOP.

Reaction Time

Can measure your reaction time by measuring the distance a ruler falls before you catch it and comparing with the table below.

Distance (inches)	Time (seconds)	Distance (inches)	Time (seconds)
1	0.07	8	0.20
2	0.10	10	0.23
3	0.12	12	0.25
4	0.14	14	0.27
5	0.16	16	0.29
6	0.17	18	0.30
7	0.19	20	0.32



Typical reaction time is 0.2 to 0.25 seconds

Summary

- In Straight-Ahead Action you start from the first key, then create the next key, etc.
- Everything falls with the same timing and spacing (if air resistance is negligible).
- After one frame the distance fallen is about the width of a pencil; after two frames it's about the width of two fingers.
- The distance fallen may be looked up in a table or calculated with a simple formula.
- The fallen distance table may also be used when planning the total length of a scene.