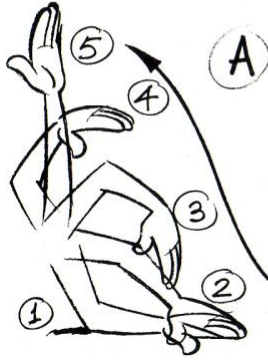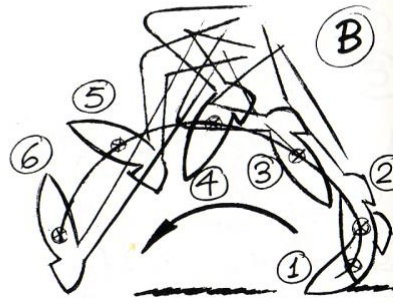# Flexibility

A Raising an arm, showing effect of flexible joints.

B In a walk the flexible ankle joint results in the foot trailing downwards as the ankle goes up on drawings 2 and 3, and trailing upwards as the ankle goes down on drawings 5 and 6.

It is a lot harder to animate living characters vs. something as simple as a bouncing ball. In this chapter, we are going to discuss more about how to get good movement when animating characters. It is a real challenge for animators and especially beginners to understand how to make their characters move around naturally and have believable movement. Most of their work tends to look stiff and flat.

Have you ever watched some bad TV animation and thought...that is very stiff. Or that doesn't look right somehow. Well, here we will discuss some basic devices that will help loosen up your animation and give it vitality and flexibility.

#1 - Breakdowns.

How you choose to in-between or breakdown your main poses makes all the difference. When you have two extremes poses and you have to decide how to move from one into the other, don't just in-between it exactly. If you do, it will look flat and unreal. A well-placed in-between, or better said "breakdown" will loosen up your movement every time.

Let me explain further… There is a difference between an in-between and a breakdown. An exact in-between is placed exactly in between the two extremes and is simply a filler. However, **a breakdown drawing is necessary in defining the movement** thus, becoming a pose itself. That's how you know it's a breakdown drawing instead of an in-between.

Let me demonstrate with these illustrations…In the diagram below from Richard Williams book. If you have a person in a sitting position in the first extreme pose and then your last extreme is the standing up pose, you have to ask yourself what is the best way for me to animate between these poses? How do I get from one pose to the next. Some poor animators will sort of in-between their extremes. Well, that will make for a very flat, unnatural and weightless movement. So before standing up there must be a

weight shift and a leaning forward (even a rock back before that), and then the character may stand up naturally.

GETTING UP FROM A CHAIR, WE GO **BACK** BEFORE WE GO FORWARD and DOWN BEFORE WE GO UP.

ANTICIPATES BACK
TO GO FORWARD

GOES FORWARD
and DOWN TO GO

UP
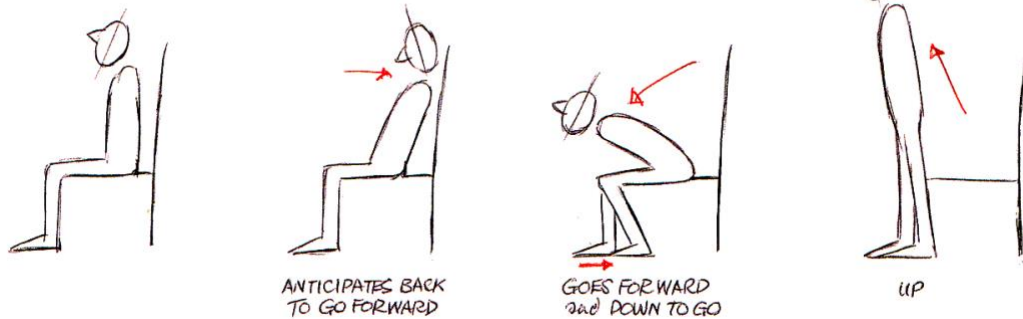
I like to call it the **triangle principle**. And it's simply that if you are going from pose A to pose B, first go to F or P or K or any where before going directly to B. Otherwise, the movement will be flat and unnatural like a robot. This also helps us create arcs in our movement. Of course, there are exceptions but this is the rule, but learn the rule first.
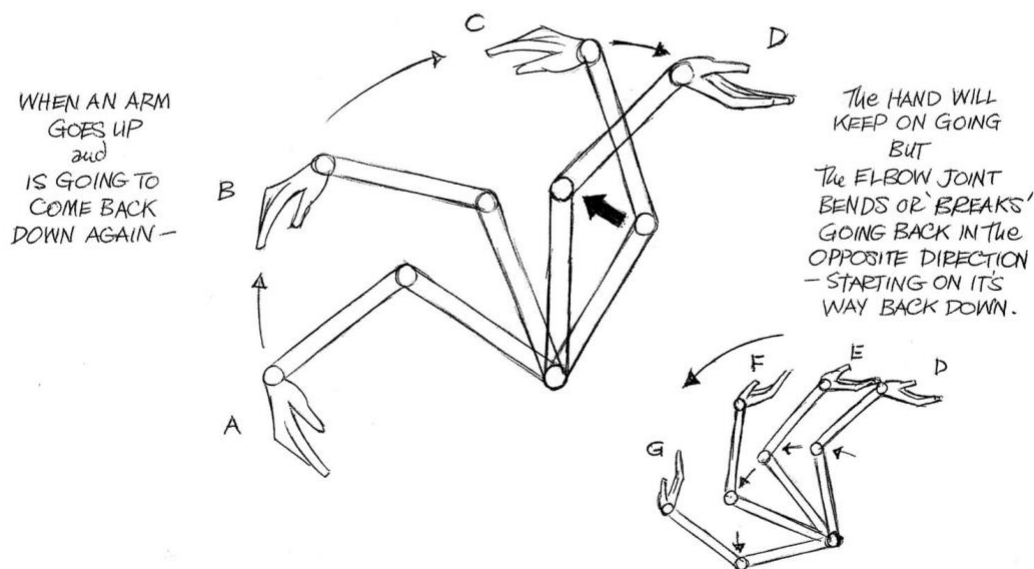
#2 - Successive breaking of joints to give flexibility.
The following are excerpts from a very good book by Richard Williams called the animators toolkit. It explains very well how to get more flexibility by applying successive breaking of joints.
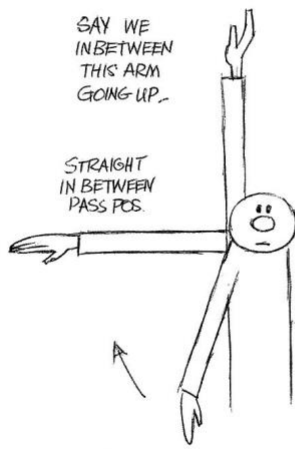
successive breaking of joints
for flexibility

If we look at a human skeleton, you will notice that we are made up of hard rigid
bones that are connected by joints which can bend or break if you will. It's amazing to
watch how we can get so much flexibility through just breaking these joints in succession.
Thus the term, successive breaking of joints for flexibility.

Put simply, it's this...

WHEN AN ARM
GOES UP
and
IS GOING TO
COME BACK
DOWN AGAIN—

The HAND WILL
KEEP ON GOING
BUT
The ELBOW JOINT
BENDS OR 'BREAKS'
GOING BACK IN The
OPPOSITE DIRECTION
— STARTING ON ITS
WAY BACK DOWN.
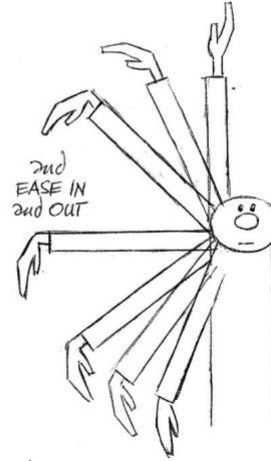
Here is a simple example -

SAY WE IN BETWEEN THIS ARM GOING UP -

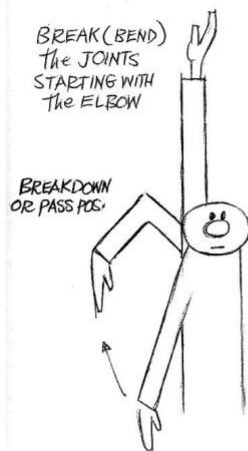STRAIGHT IN BETWEEN PASS POS.

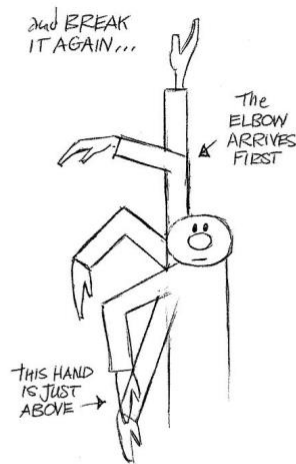IT'S GOING TO BE STIFF AS A BOARD.

MIGHT HELP IT BY DRAGGING the HAND -

2nd EASE IN 2nd OUT

IT'S STILL AWFULLY RIGID.
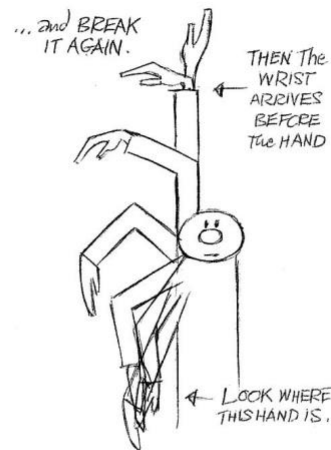
BREAK (BEND) the JOINTS STARTING WITH the ELBOW

BREAKDOWN OR PASS POS.

2nd BREAK IT AGAIN...

The ELBOW ARRIVES FIRST
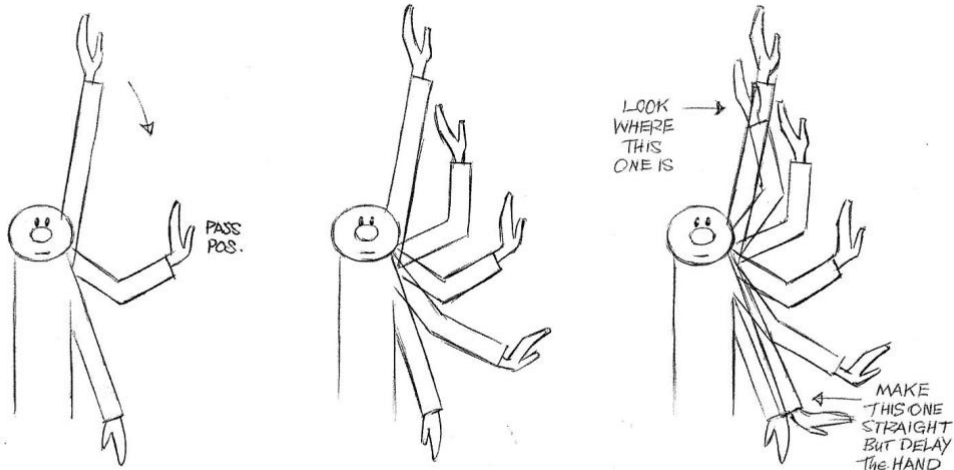
THIS HAND IS JUST ABOVE →

... 2nd BREAK IT AGAIN.
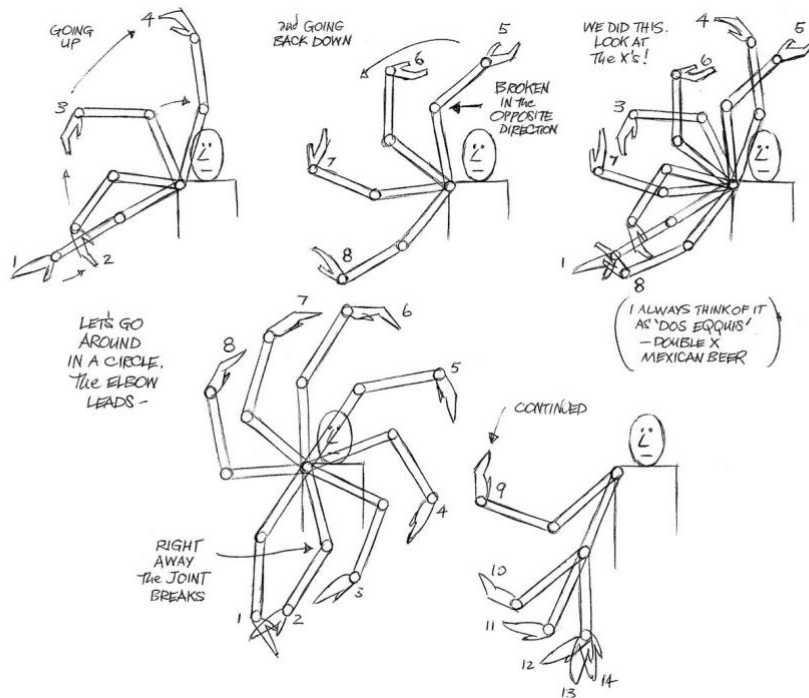
THEN The WRIST ARRIVES BEFORE The HAND

← LOOK WHERE THIS HAND IS.

NOW WE GO DOWN THE OTHER SIDE - SUCCESSIVELY BREAKING THE JOINTS:

PASS POS.

LOOK WHERE THIS ONE IS

MAKE THIS ONE STRAIGHT BUT DELAY THE HAND

IN THIS EXAMPLE ALL THE BENDS OR 'BREAKS' ARE PHYSICALLY POSSIBLE.
WE HAVEN'T HAD TO ACTUALLY BEND OR BREAK ANYTHING THE WRONG WAY YET.
(BUT WE CAN)

LET'S DO IT AGAIN: THE ELBOW LEADS AND THE JOINTS BREAK IN SUCCESSION -

GOING UP

2nd GOING BACK DOWN

BROKEN IN THE OPPOSITE DIRECTION

WE DID THIS. LOOK AT THE X's!

LET'S GO AROUND IN A CIRCLE. THE ELBOW LEADS -

I ALWAYS THINK OF IT AS 'DOS EQQUIS' - DOUBLE X MEXICAN BEER

RIGHT AWAY THE JOINT BREAKS

CONTINUED

5

IT'S WHAT A BASEBALL PITCHER DOES -

(and THIS IS A
GENTLE THROW)

JOINTS BREAK
IN OPPOSITE DIRECTION

X'S AGAIN!

(OF COURSE HIS
BODY WILL MAKE
HUGE MOVES)
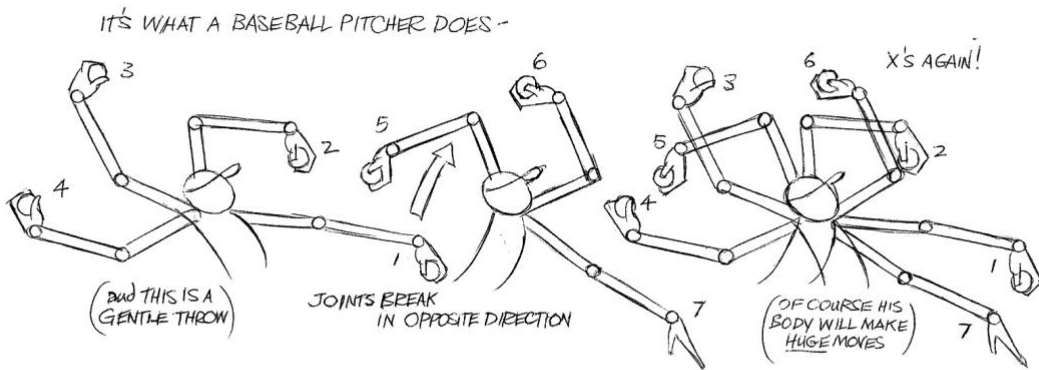
When we break the joints in succession, we can
get a very naturalistic and fluid motion.

LEANS FORWARD
ANTICIPATING
HIS MOVE
BACKWARDS and UP -

HIPS START MOVING
HIM OVER and UP.
THEN the
ELBOW LEADS

ELBOW BREAKS DOWN
AS HAND CONTINUES UP.
the BODY IS
STARTING DOWN NOW.

BAM!

ELBOW
LEADS

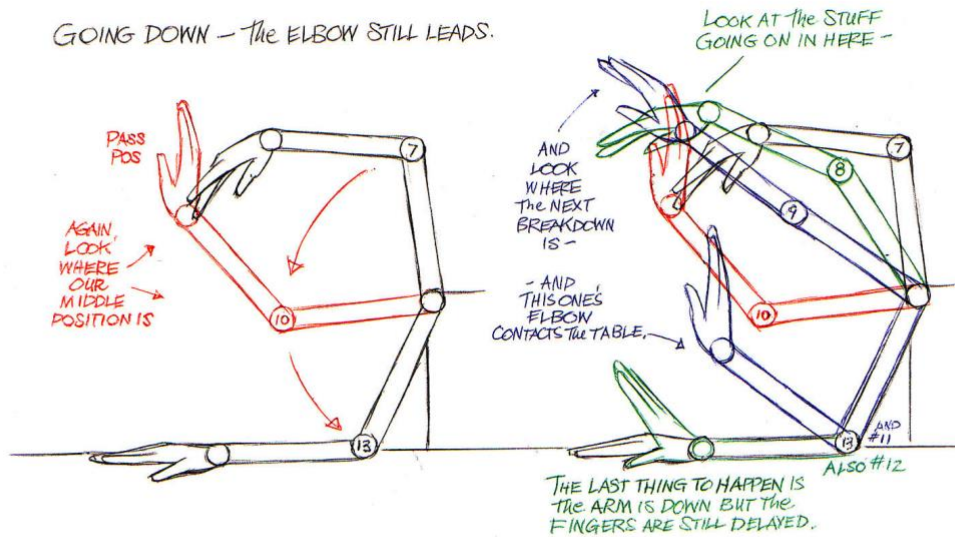HAND
DRAGS

HANDS
REVERSE
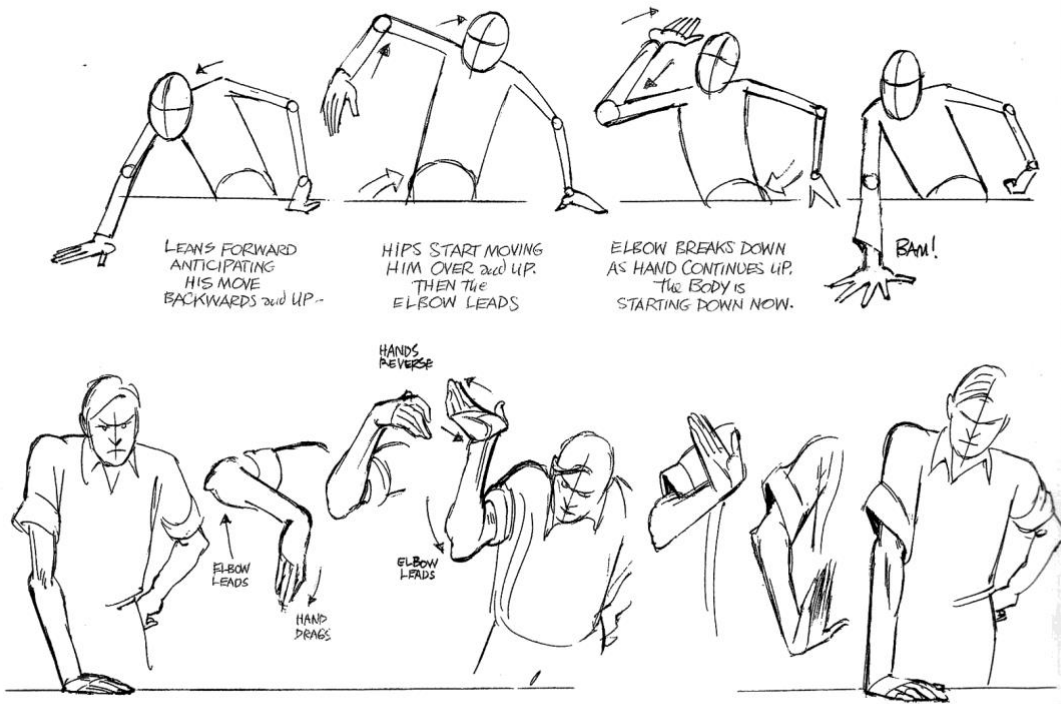
ELBOW
LEADS

LET'S KEEP ON HITTING THE TABLE -
IT'S AN AWFULLY GOOD EXAMPLE OF HOW WE CAN ACHIEVE THE SAME FLEXIBILITY
AS 'RUBBER HOSE' ANIMATION BY BREAKING THE JOINTS WHEREVER WE CAN —
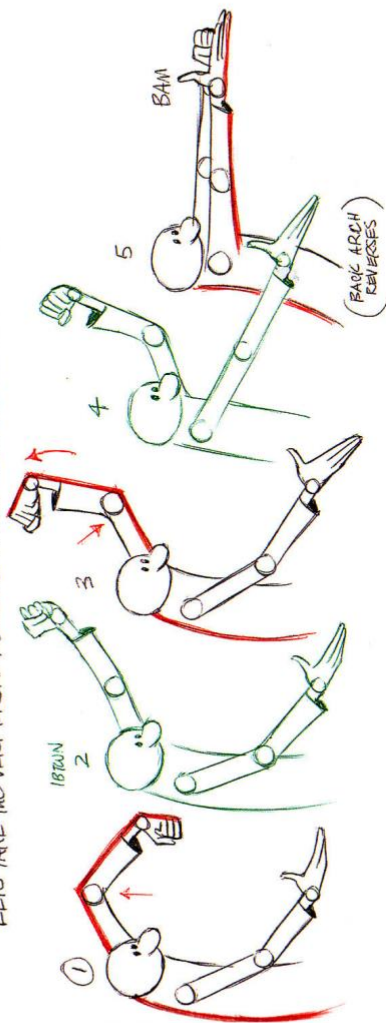
GOING UP — THE ELBOW LEADS and THE HAND DRAGS.

LOOK WHERE OUR MIDDLE POSITION IS

PASS POS

SHOULDER

#6 HAND IS CLOSE TO #7

THE NEXT BREAKDOWN
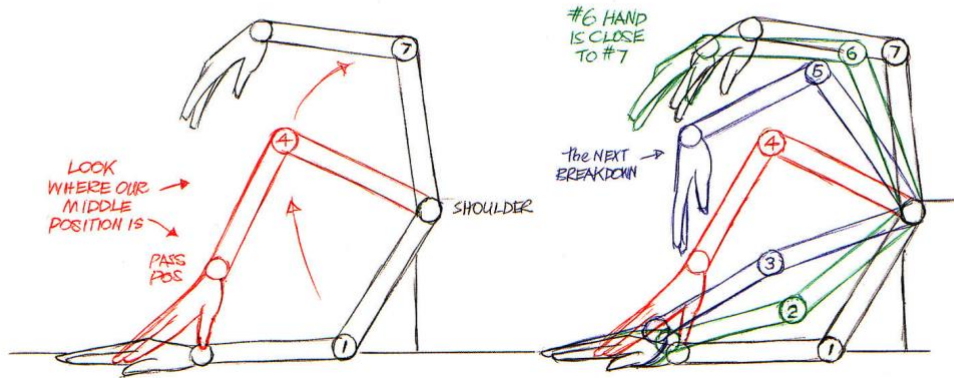
GOING DOWN — THE ELBOW STILL LEADS.

PASS POS

AGAIN, LOOK WHERE OUR MIDDLE POSITION IS

LOOK AT THE STUFF GOING ON IN HERE —

AND LOOK WHERE THE NEXT BREAKDOWN IS —

— AND THIS ONE'S ELBOW CONTACTS THE TABLE.

AND #11

ALSO #12

THE LAST THING TO HAPPEN IS THE ARM IS DOWN BUT THE FINGERS ARE STILL DELAYED.

7

LET'S TAKE THE VERY BROAD ACTION OF A MAN SLAPPING OUT A MUSICAL BEAT -

IT'S BASICALLY THE SAME ACTION AS HITTING THE TABLE OR BEATING THE BASS DRUM -

BAM

(BACK ARCH REVERSES)

1BRUN

(ROUGHLY AS #1)

HITS ON #15 (AS #5)

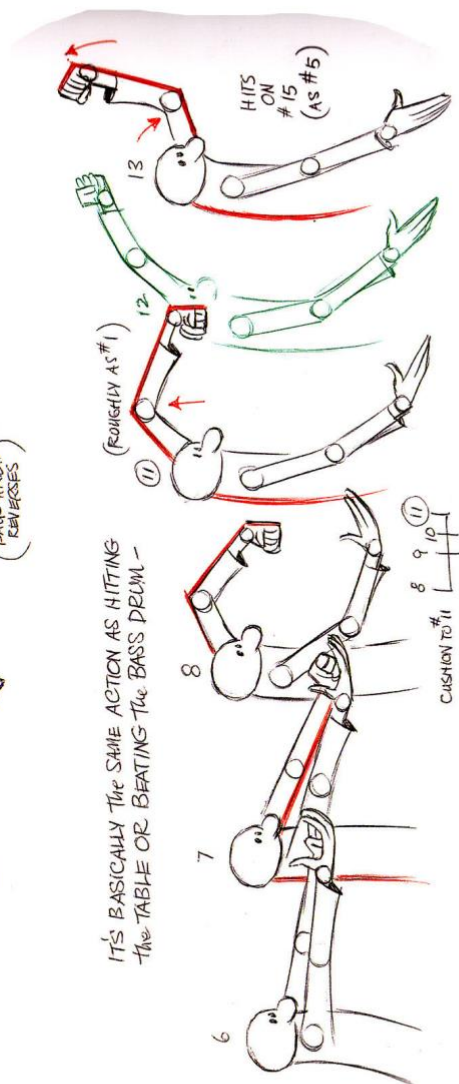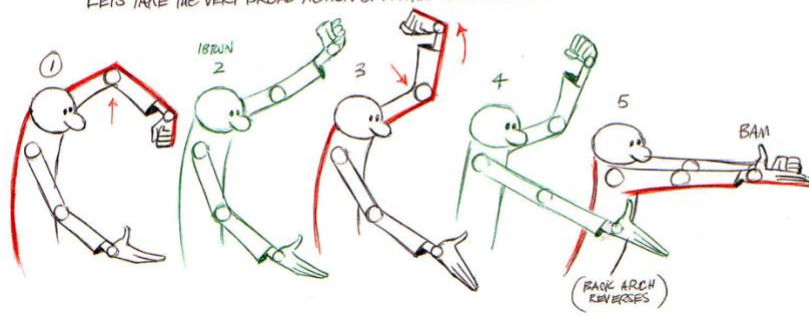CUSHION TO #11

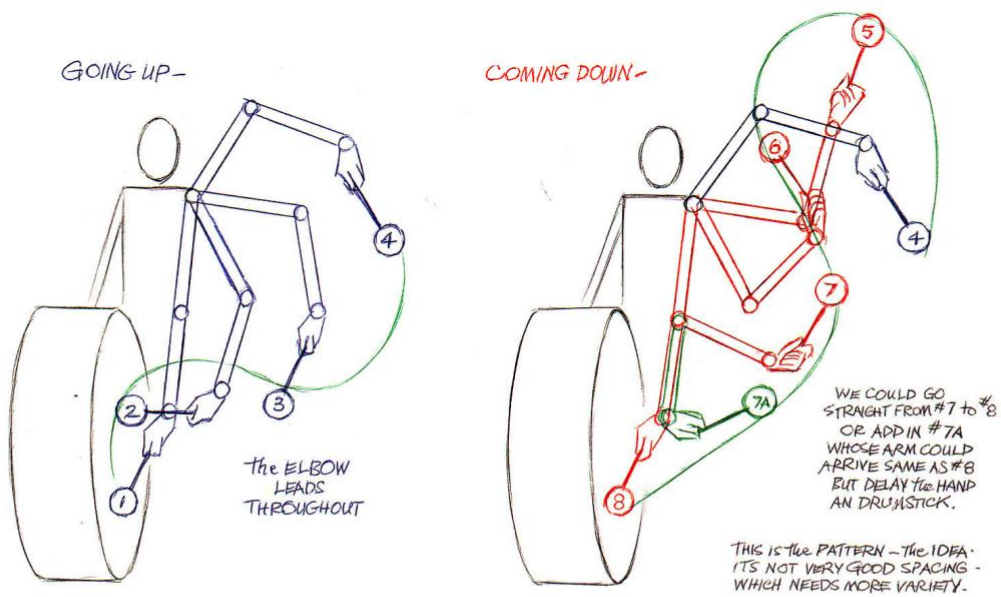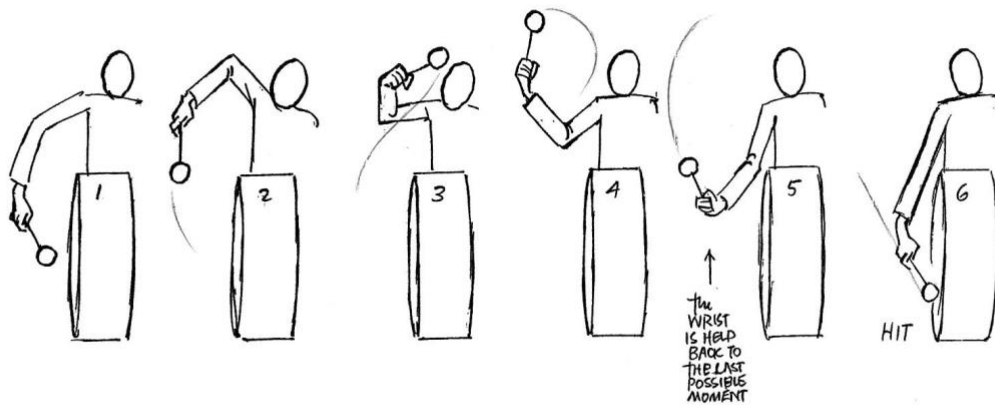LET'S TAKE THE VERY BROAD ACTION OF A MAN SLAPPING OUT A MUSICAL BEAT.-

IT'S BASICALLY THE SAME ACTION AS HITTING THE TABLE OR BEATING THE BASS DRUM -
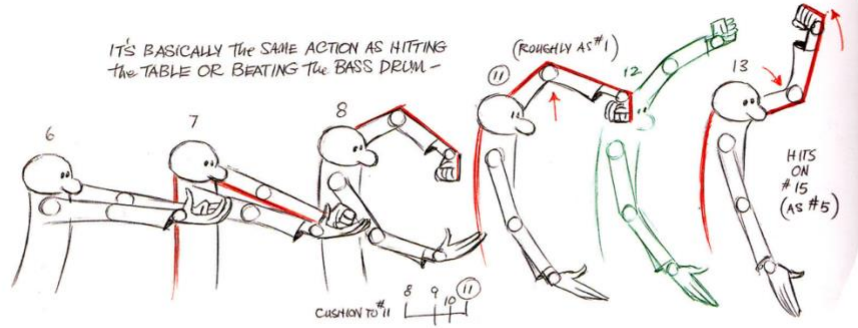
Beating a bass drum has a very similar action to smacking the table

1 2 3 4 5 6

The WRIST IS HELD BACK TO THE LAST POSSIBLE MOMENT

HIT

GOING UP—

1 2 3 4

the ELBOW LEADS THROUGHOUT

COMING DOWN—

5 6 4 7 7A 8

WE COULD GO STRAIGHT FROM #7 to #8 OR ADD IN #7A WHOSE ARM COULD ARRIVE SAME AS #8 BUT DELAY the HAND AN DRUMSTICK.

THIS IS the PATTERN — the IDEA. ITS NOT VERY GOOD SPACING — WHICH NEEDS MORE VARIETY.

More examples - Successive breaking of joints for flexibility.

BREAKDOWN AS PREVIOUS

The WRIST BREAKS AS the FINGERS KEEP RISING

MAYBE HAVE NO IN BETWEEN GOING DOWN

OR COULD HAVE ONE IN BETWEEN GOING DOWN.

OR

WITH ONE IN BETWEEN THE WRIST COULD ARRIVE FIRST

AND THEN DISPLACE the PALM ON THE HIT.

ELBOW LEADS GOING UP

HAND CONTINUES UP AS ELBOW GOES DOWN

THEN The WRIST LEADS DOWN

AND WE DISPLACE The HIT

A VIOLINIST - GOING UP The WRIST LEADS

DRAGGING

COMING DOWN The WRIST STILL LEADS and the HAND DRAGS.

DRAGGING

11

ELBOW
LEADS
GOING
UP

STILL
GOING UP

ARM GOES DOWN
AS HAND CONTINUES UP

HAND IS STILL
GOING UP
AS ELBOW
SPEEDS DOWN

FOREARM
SNAPS DOWN
— PROBABLY
NO
INBETWEENS
TO THE
IMPACT.

HAND
REVERSES

(DOS EQQUIS)

BAM

OR

AS ON THE PRECEEDING PAGE
THE ELBOW HITS THE TABLE
FIRST—
FOLLOWED BY THE FOREARM
AND FIST
= MORE UNFOLDING.

KER-

THUMP
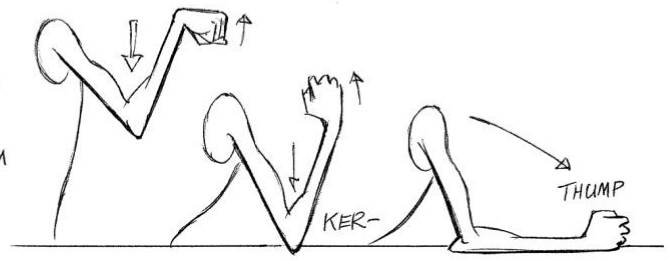
IT'S HAPPENING WITH A DOG'S FOOT—

EVEN IN A LITTLE THING LIKE THIS WE CAN GET FLEXIBILITY—

A   B   C

C

B

A   A

TO OPEN THESE FINGERS A STRAIGHT
INBETWEEN GOING UP WOULD BE OK.

BUT ON THE WAY DOWN
DRAG THE INBETWEEN

IF WE HAD A BETTER
FEELING OF CONTACT
AND PRESSURE TO BEGIN WITH—

= BETTER GOING UP
WHEN THIS PRESSURE
IS RELEASED.

#3 - Overlapping action, follow through and drag.

In dealing with characters and objects that have weight and loose clothing etc., you must understand that within our movements, different parts of the body move at different speeds and overlapping accurse. Things move in parts. Everything does not happen at the same time.

Overlapping means, one part starts first and other parts follow.

ANIMATOR: Bill Tytla—
Snow White.

Loose flesh in fast moves creates a feeling of realism. By itself the drawing is too broad, but in action, it is never seen, only felt.
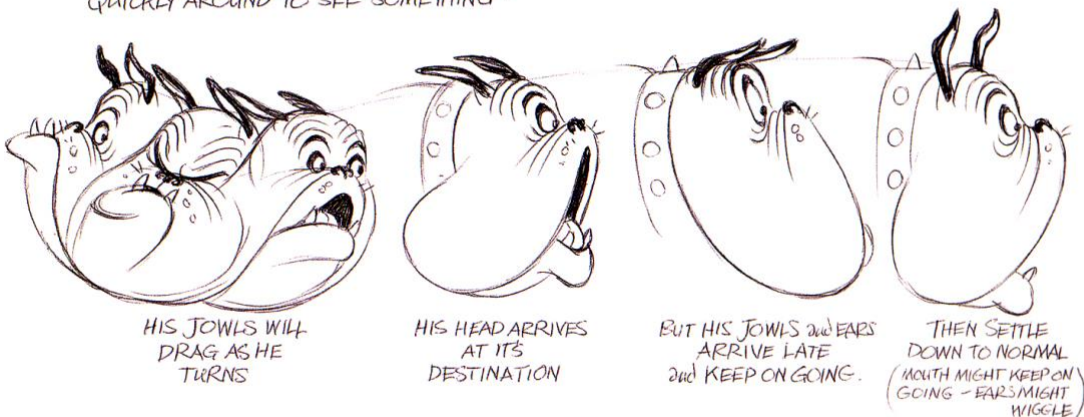
OVERLAPPING ACTION

THIS IS WHERE THINGS MOVE IN PARTS.
- WHERE EVERYTHING DOES NOT HAPPEN AT The SAME TIME.

TAKE A HOLLYWOOD BULLDOG TURNING QUICKLY AROUND TO SEE SOMETHING -

HIS JOWLS WILL DRAG AS HE TURNS

HIS HEAD ARRIVES AT IT'S DESTINATION

BUT HIS JOWLS and EARS ARRIVE LATE and KEEP ON GOING.

THEN SETTLE DOWN TO NORMAL
(MOUTH MIGHT KEEP ON GOING - EARS MIGHT WIGGLE)

THE JARGON IS - "The JOWLS and EARS "DRAG"
and THEN THEY "FOLLOW THROUGH"

THEY'RE The RESULT OF The MAIN ACTION
- GENERATED BY The MAIN ACTION.

'OVERLAPPING ACTION' MEANS ONE PART STARTS FIRST and OTHER PARTS FOLLOW.

To maintain fluid animation it is essential to treat the weight of a body differently from its accessories or extremities. These are example of drag and followthrough.
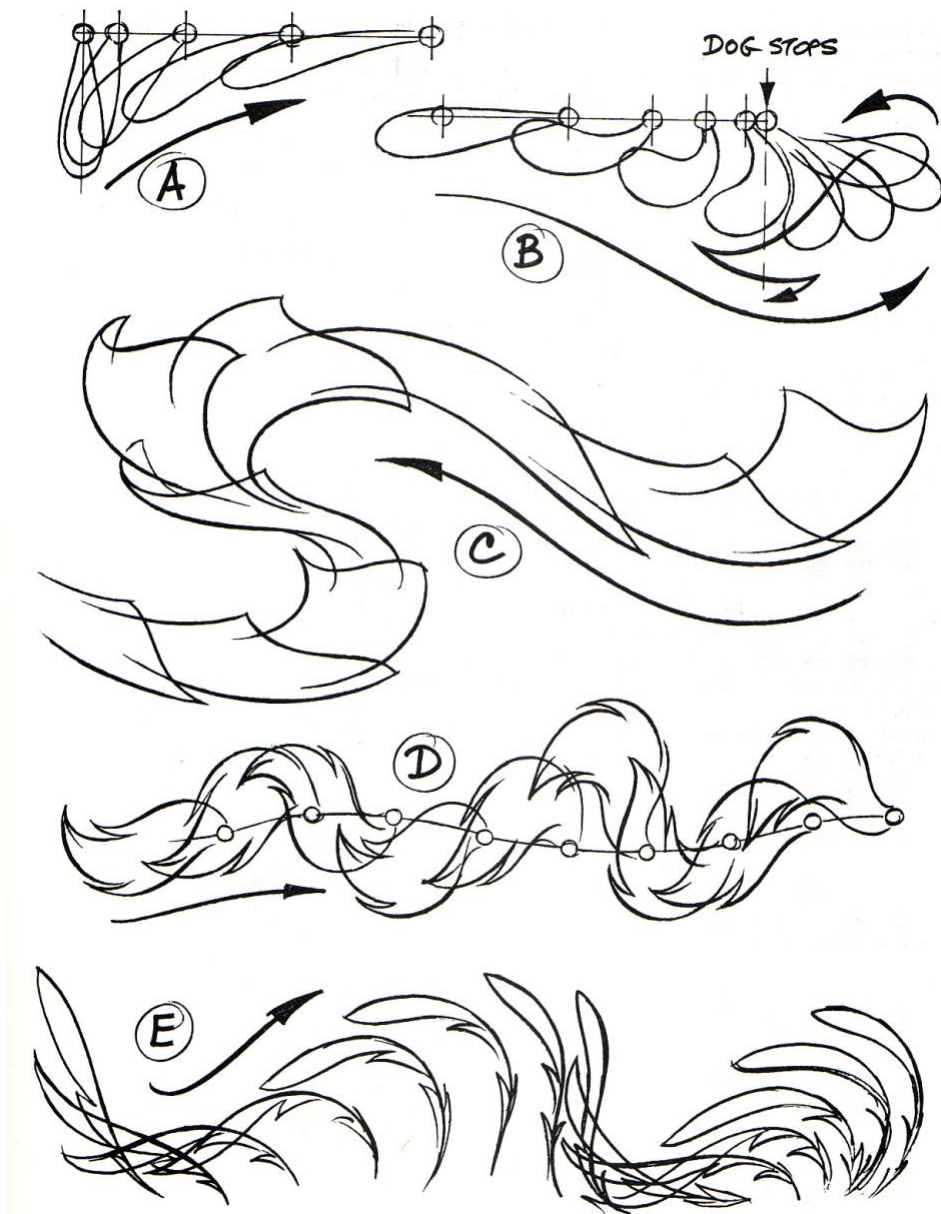

DOG STOPS

A – A simplified dog's ear and it's attachment to the dog. As the dog accelerates away the ear trails behind.

B- When the dog stops, the ear tends to continue forwards at the same speed before swing8ing to rest.

C – Cloth trails in a way which combines the effects of its weight and the air resistance.

D – A Horses tail.

E – A feather, which is more springy than the other examples.
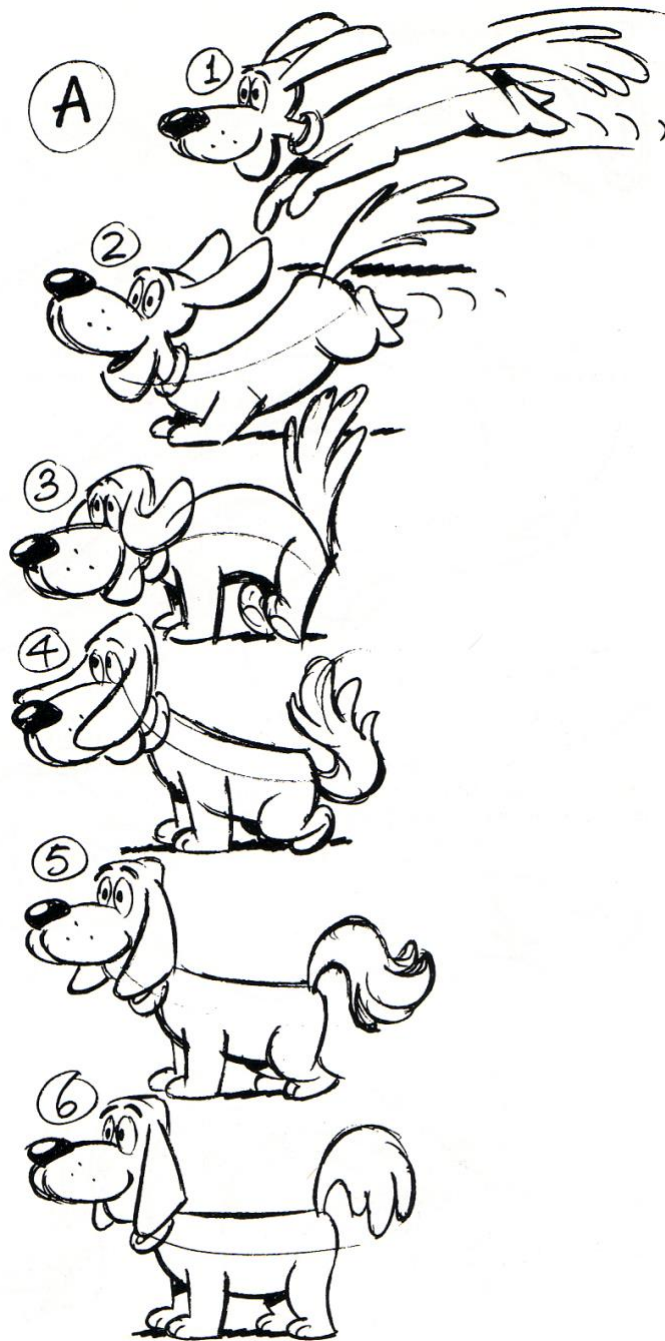
A A dog jumps in and stops. The front legs squash on 2 and the back legs on 4. The head and front legs are static on 5, although the back legs, tail and ears are still moving.

Assignments for this week…

- **Generic walk cycle (in place)**
- **Walk cycle with attitude**