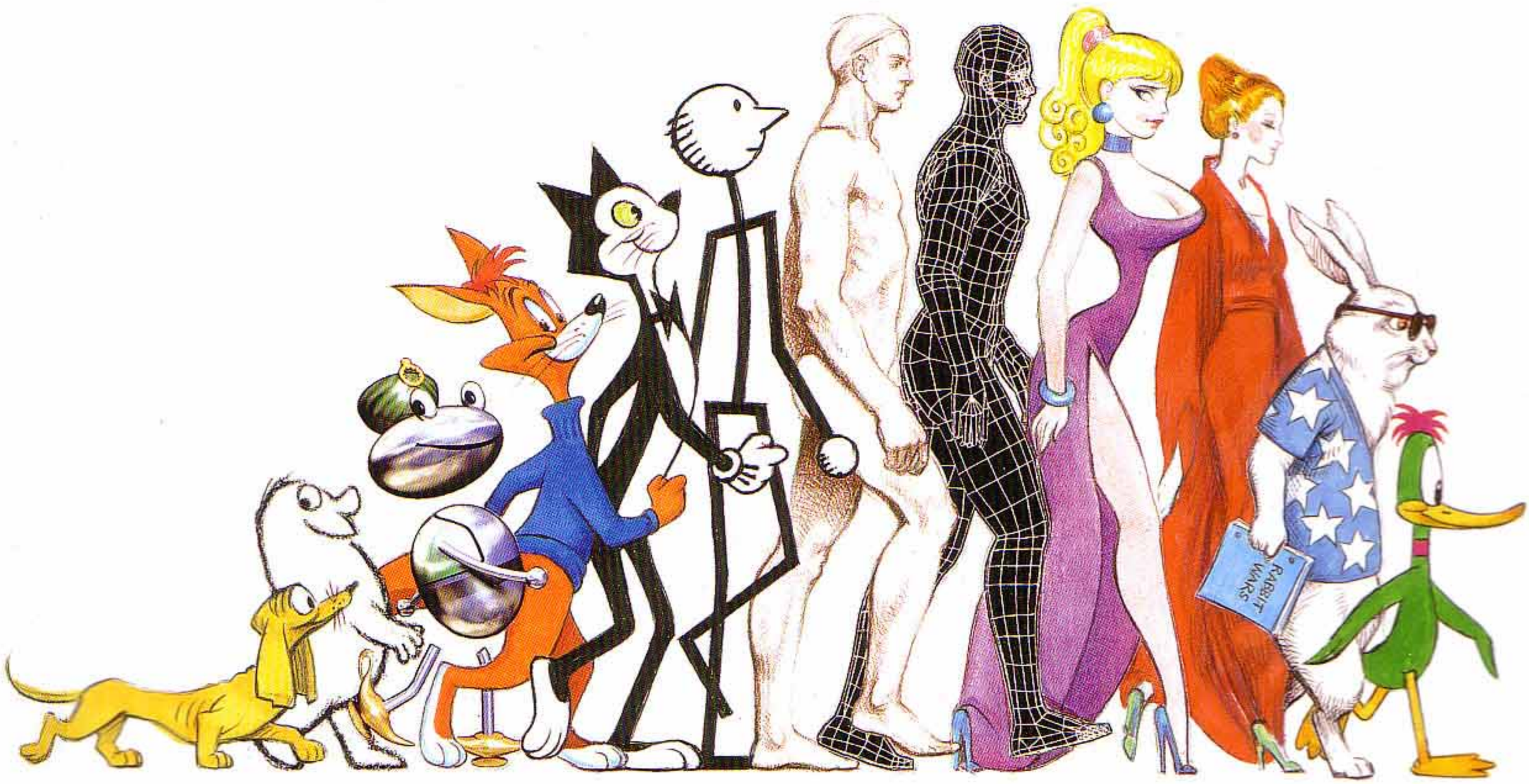
RICHARD WILLIAMS

DIRECTOR OF ANIMATION 'WHO FRAMED ROGER RABBIT'



THE ANIMATOR'S SURVIVAL KIT™

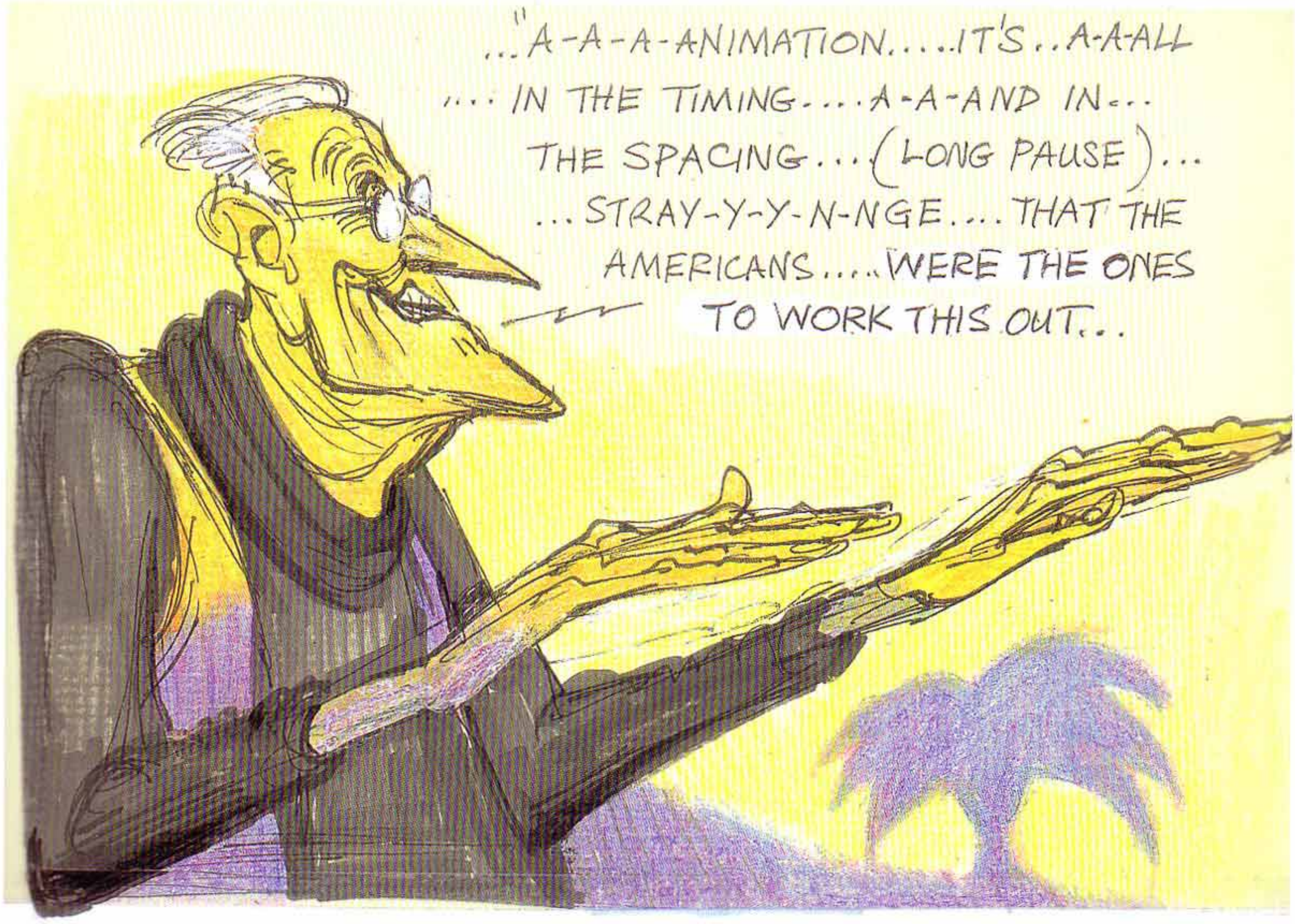
A MANUAL OF METHODS, PRINCIPLES AND FORMULAS

FOR CLASSICAL, COMPUTER, GAMES, STOP MOTION AND INTERNET ANIMATORS

IT'S ALL IN THE TIMING AND THE SPACING

I met Grim Natwick (born Myron Nordveig) in a Hollywood basement when he was in his eighties. Grim was the oldest of the great animators, being already in his forties when he animated eighty-three scenes of Snow White in Disney's *Snow White and the Seven Dwarfs*. Previously, he'd designed Betty Boop for Max Fleischer, for which he received nothing and was furious about it 'til the day he died, aged 100.

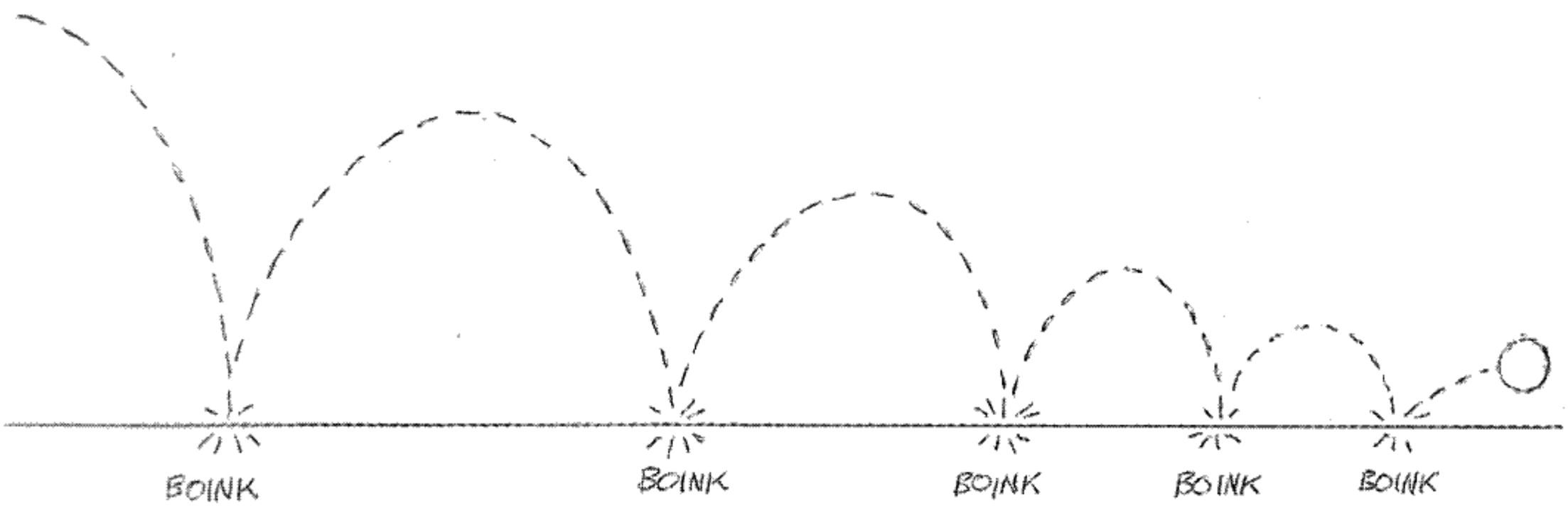
I'll never forget the image of this big Norwegian American sitting in the golden twilight, extending his long arms and spatula hands saying . . .



The bouncing ball says it all.

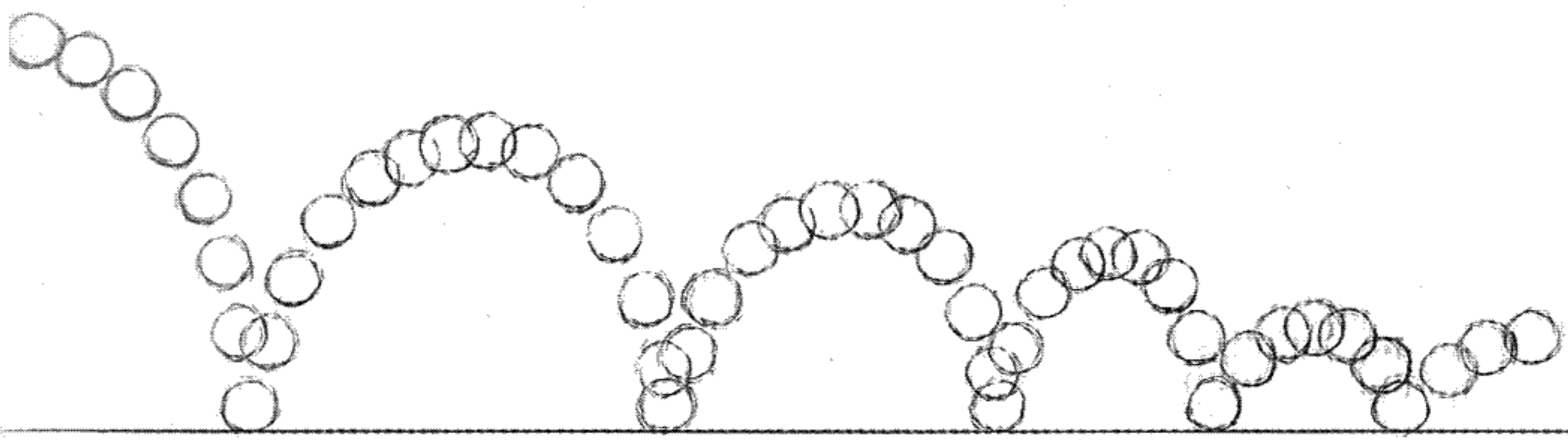
The old bouncing-ball example is often used because it shows so many different aspects of animation.

A ball bounces along,



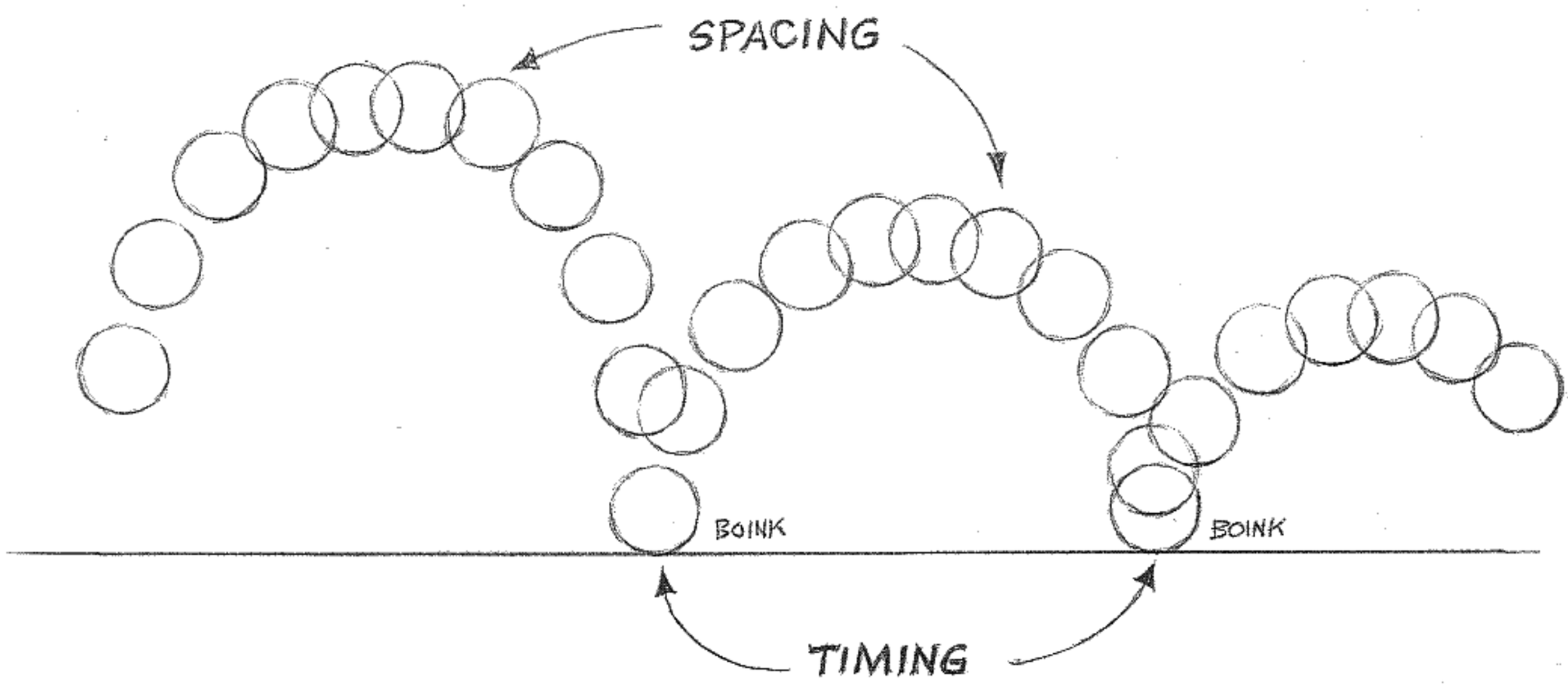
and where it hits – the 'boinks' – that's the *timing*. The impacts – where the ball is hitting the ground – that's the *timing* of the action, the rhythm of where things happen, where the 'accents' or 'beats' or 'hits' happen.

And here's the *spacing*.



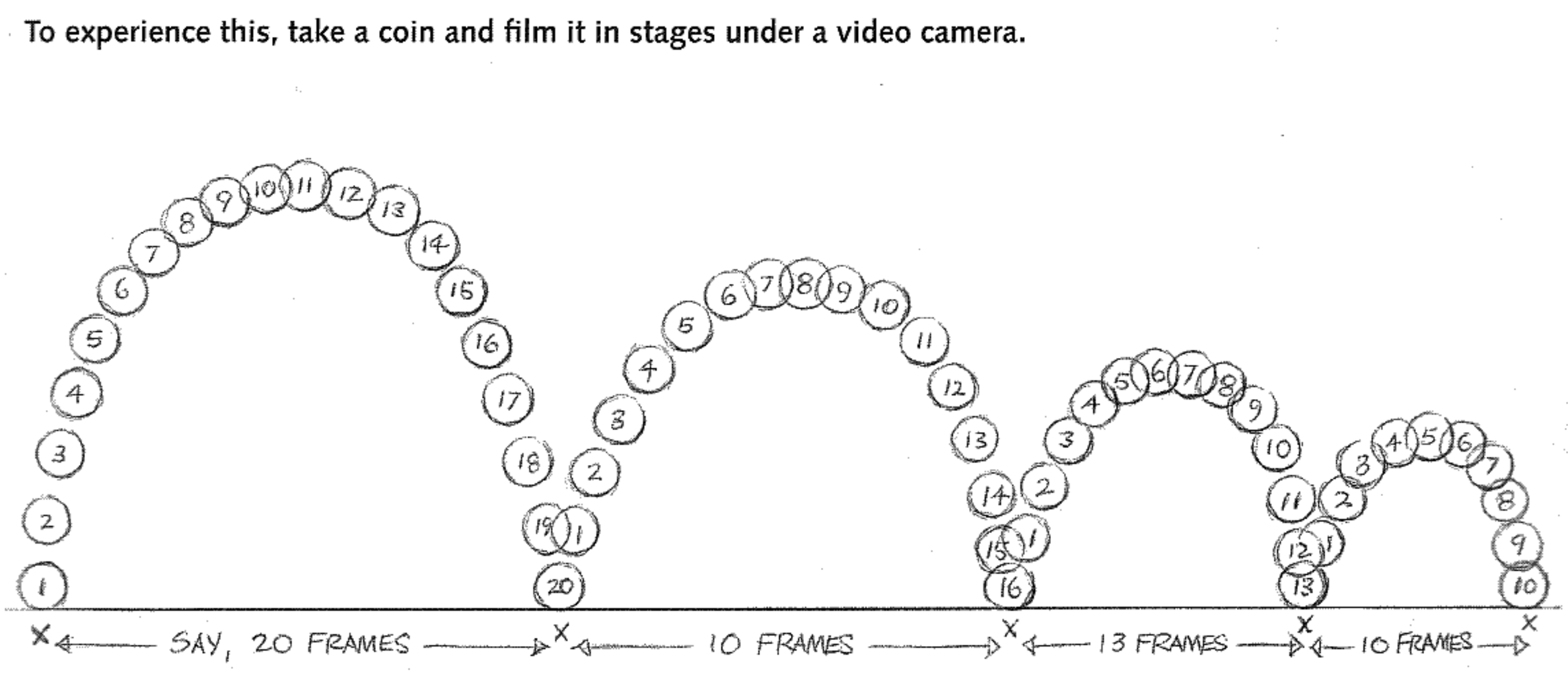
The ball overlaps itself when it's at the slow part of its arc, but when it drops fast, it's spaced further apart. That's the *spacing*. The spacing is how close or far apart those clusters are. That's it. It's simple, but it's important. The spacing is the tricky part. Good animation spacing is a rare commodity.

So we have:



The two basic elements of animation.

To experience this, take a coin and film it in stages under a video camera.



First plot out the *timing* – where you want the ball to hit the ground. Then push the coin around – taking a picture at each frame – and see what looks right or wrong. Try it with different timings and spacing. You're already animating. You're already dealing with the important fundamentals and you haven't even made a single drawing. You're doing pure animation without any drawings.

Hidden in this simple test is the weight of the ball – how it feels, light or heavy; what it's made of. Is it large or small, moving fast or slow? This will all emerge if you do several tests – which only take a few minutes to do. The importance of the timing and the spacing will become obvious.

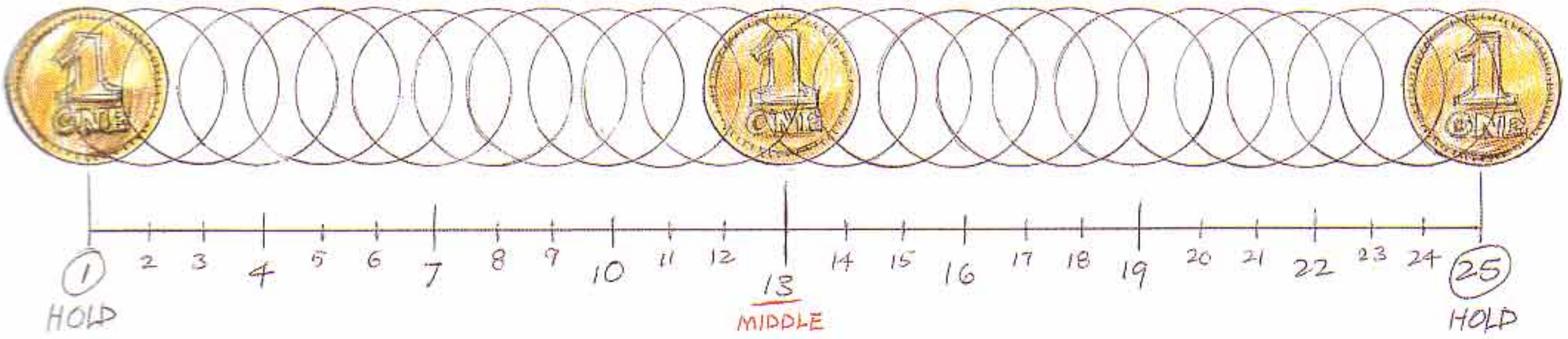
Because *you* did it, a certain amount of personality will creep into the action – whether the ball is deliberate, slow, jaunty, erratic, cautious, even optimistic or pessimistic.

And all this, before you've made a single drawing. This reveals how important and dominant the timing and the spacing is. Even if the ball positions were drawn in detail by Michelangelo or Leonardo da Vinci, the timing and the spacing of the drawings will still dominate.

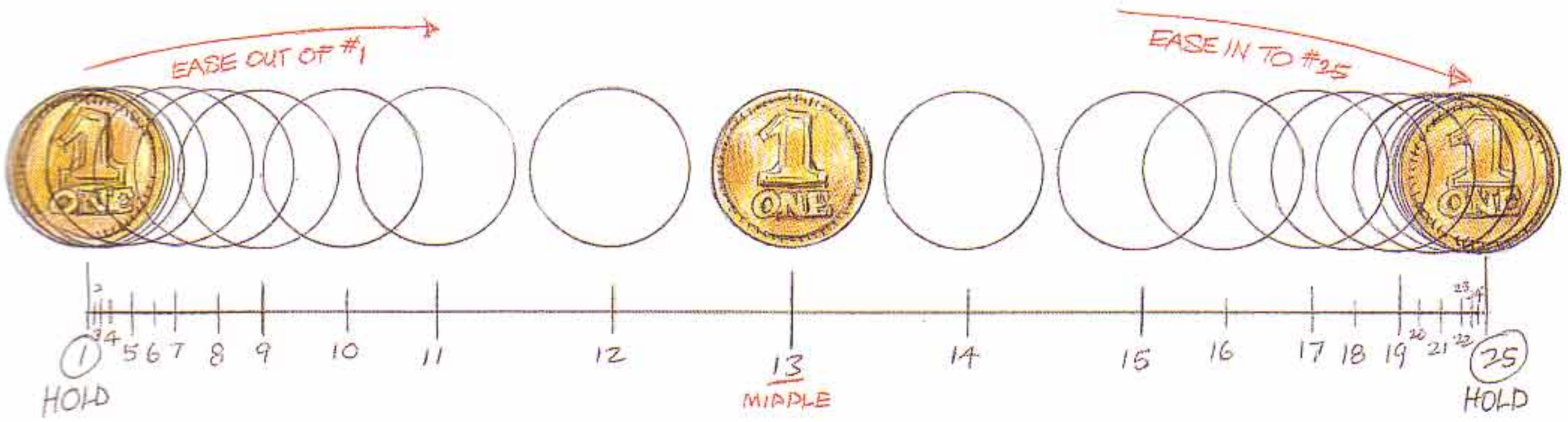
Another interesting way to experience the difference between timing and spacing right away is this:

Let's put a coin under the video camera and move it across the page (or screen) in one second – 24 frames of screen time. That's our *timing*.

We'll space it out evenly – and that's our *spacing*.



Now we'll keep the same *timing* – again taking one second for the coin to move across the page. But we'll change the *spacing* by slowly easing out of position number 1 and easing gradually into position number 25.



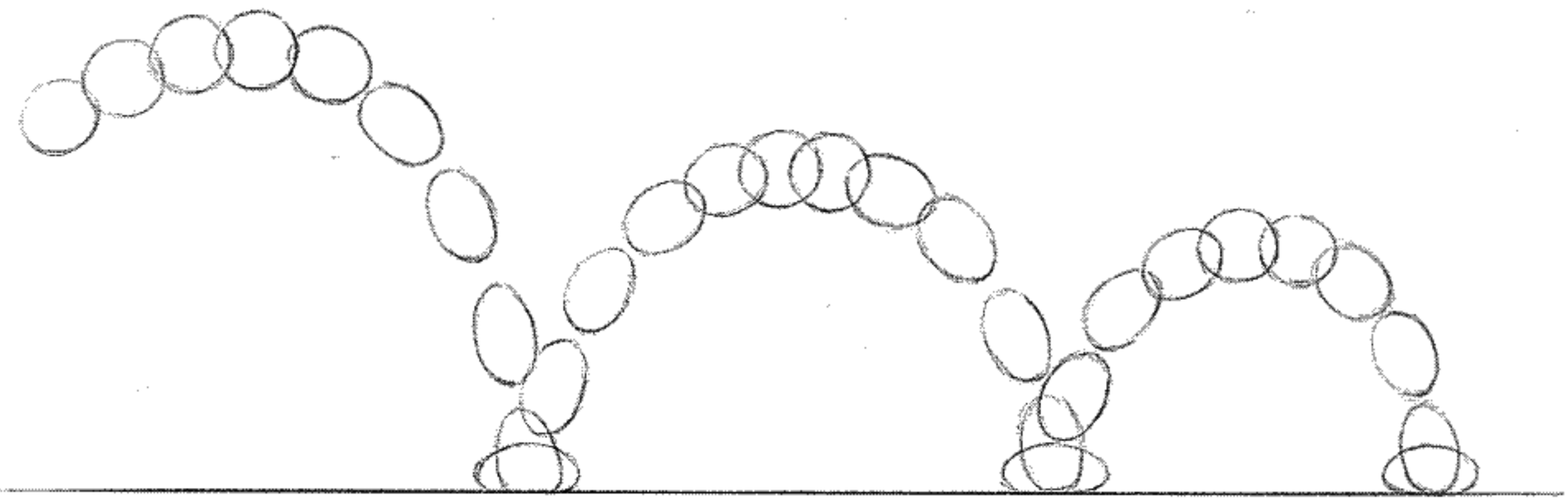
It still takes one second for the coin to get over there. It has the same timing – but there is very different movement because of the different spacing. Both start together – and both hit the middle together – but the spacing is quite different. And so the action is very different.

You could say that animation is the art of timing. But you could say that about all motion pictures.

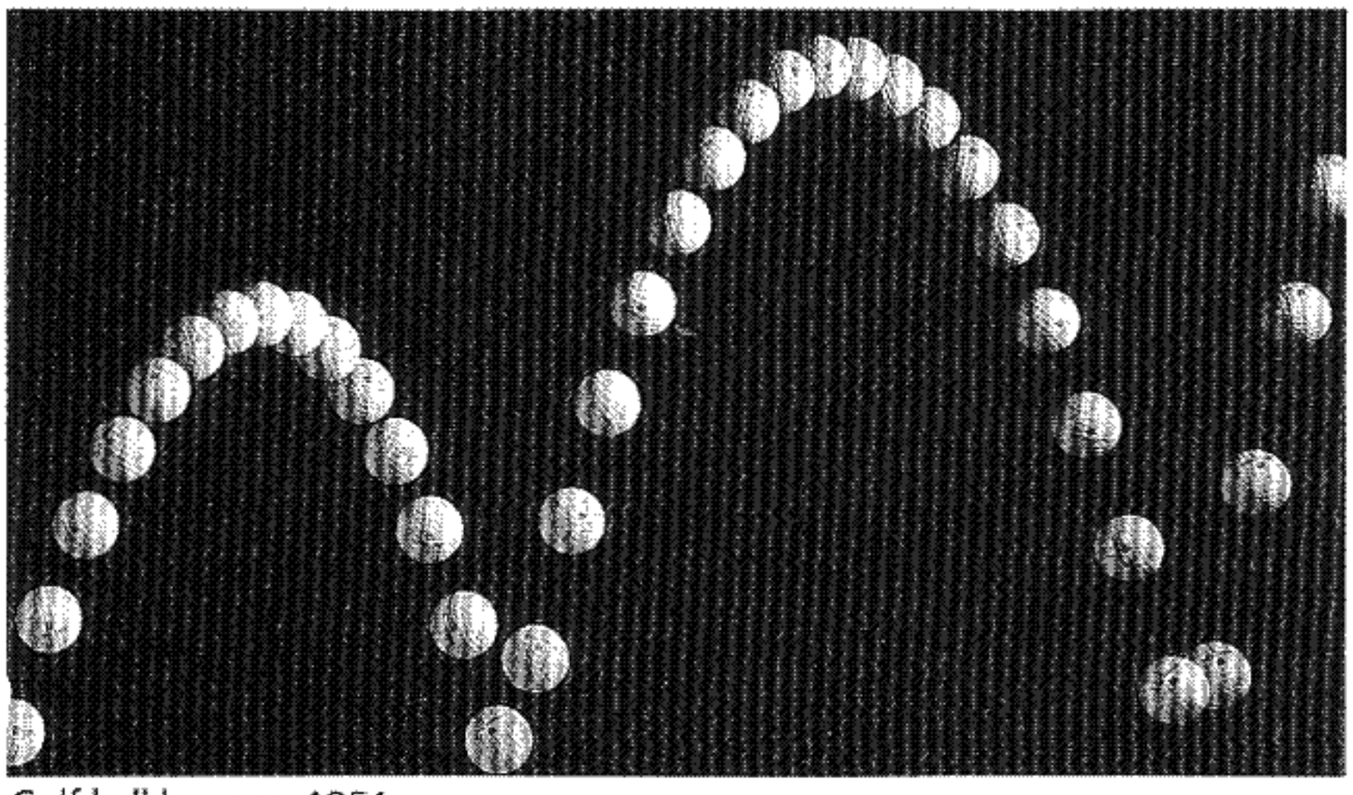
The most brilliant masters of timing were the silent comedians: Charlie Chaplin, Buster Keaton, Laurel and Hardy.

Certainly for a film director, timing is the most important thing. For an animator, it's only half the battle. We need the spacing as well. We can have a natural feel for timing, but we have to learn the spacing of things.

One other thing: The bouncing ball example is often used to show animation 'squash and stretch' – that is, the ball elongates as it falls, flattens on impact with the ground and then returns to its normal shape in the slower part of its arc.
It *might* squash and stretch this way if it was a very soft ball with not much air in it, but what



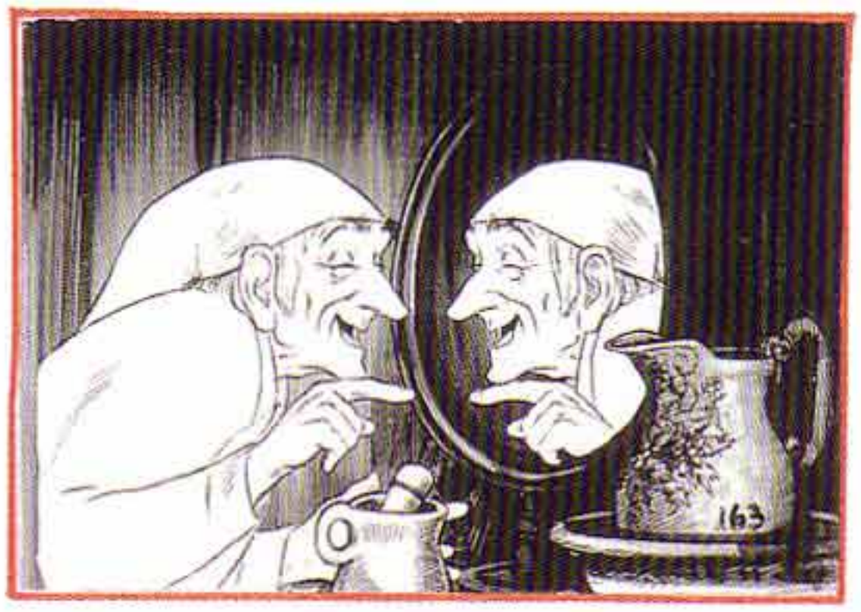
I've found is that you can get a good enough effect with a rigid coin – *provided* the spacing of it was right – so this added technique is not always necessary. Certainly a hard golf ball isn't going to bend all over the place. In other words, if you do this squishy squashy thing too much, everything comes out a bit 'sploopy', like it's made of rubber. Life ain't like that. At least most of it ain't. More about this later.



© Harold Edgerton

Golf ball bounce, 1951

Having established all this, let's go to lesson one:



Stills from Charles Dickens' *A Christmas Carol*, 1972. We're starting to get better. I got my first Oscar for this half-hour film made originally for TV. You wouldn't think a lot of this was drawn by Bugs Bunny animators! It couldn't have been done without Ken Harris who carried the load on Scrooge. Towards the end, Chuck Jones (the Executive Producer) lent us Abe Levitow, a great unsung animator with majestic qualities. We also had help from Disney alumni George Nicholas and Hal Ambro. My own stalwarts were Richard Purdum, Sergio Simonetti and Roy Naisbitt.

LESSON ONE

UNPLUG!

Unplug! Take off your head phones! Turn off the radio! Switch off the CD! Turn off the tape! Close the door.

Like many artists, I had the habit of listening to classical music or jazz while working. On one of my first visits to Milt Kahl I innocently asked:


OF ALL the S-S-S-
QUESTIONS I-I-STUPID
NEVER HEARD
I-I'VE
SUCH
GOD-GOD-GOD-DAMNED
EVER HEARD! I-I-I-I-I-
A-A-A-F-F-F-F-F-STUPID
QUESTION!

IY-IY-IY-IY-

I'M NOT

SMART

ENOUGH

TO THINK OF MORE THAN ONE THING AT A TIME!

I WONT DO IT ANY MORE...

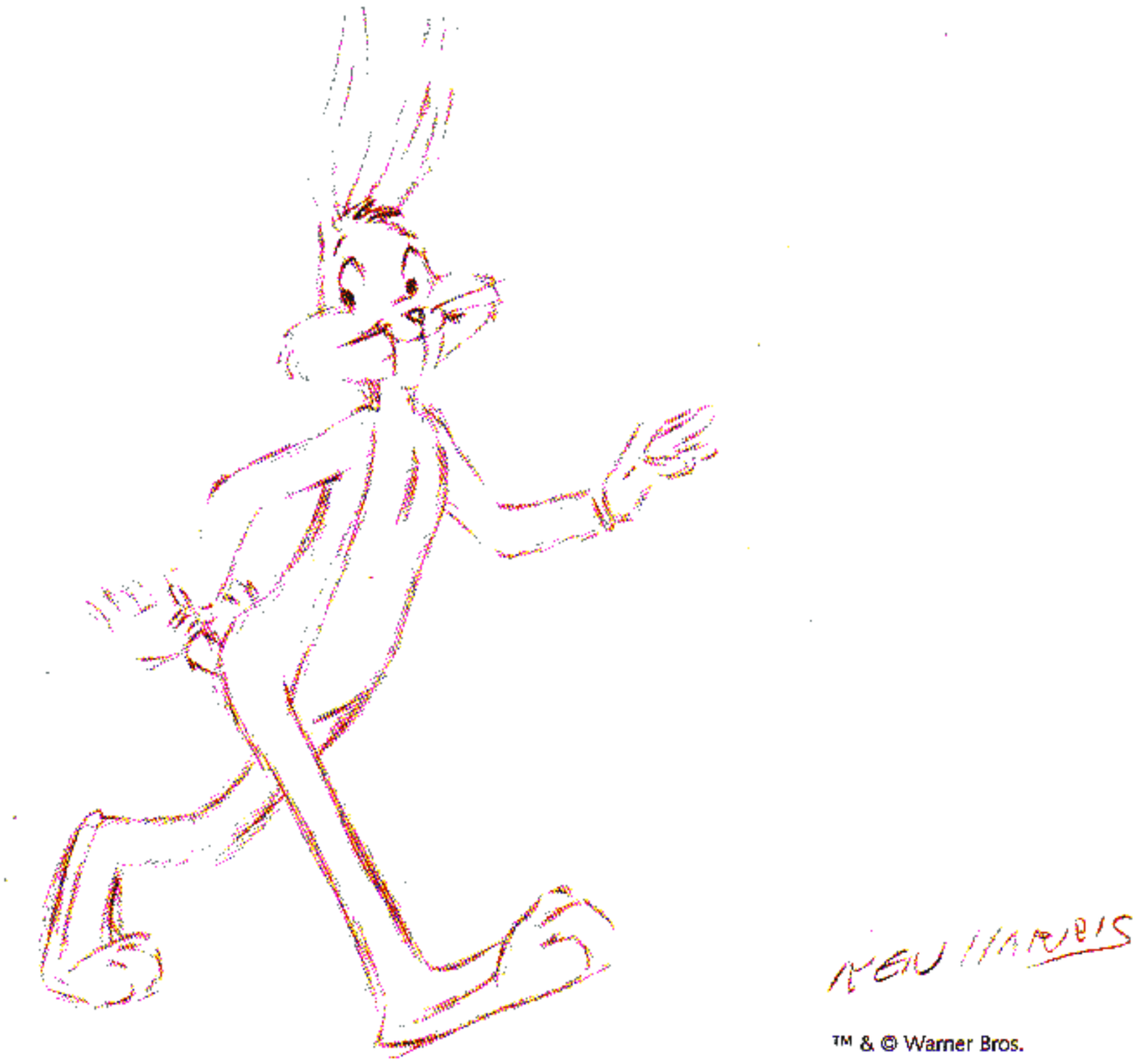
Since it came from a genius, this made quite an impression on me. After this I learnt to face the silence and think before swirling my pencil around. My animation improved right away.

This has been the case with many artists when I've passed this wisdom along. Recently, two previously sound-addicted computer animators were shocked to find that their plugged-in colleagues instantly made them objects of ridicule for not having wires coming out of their ears. They were even more surprised at the startling improvement in their work.

. . . end of lesson one.

Photo Frank Herrmann

Portrait of the artist after receiving lesson 1.



™ & © Warner Bros.

ADVANCING BACKWARDS TO 1940

Let's advance backwards to approach where animators were during the 'Golden Age'. And then go forward from there – so we can do new things.

The thing you are going to build on must be basic.

Everyone wants to decorate their house with interesting pieces before putting in the corner-stones and supports. Everyone wants to jump ahead to the sophisticated bit – glossing over the dull, old support work.

But it's the thorough understanding of the basics that produces real sophistication.

As Art Babbitt said:
'The knowledge that went into making little drawings come to life is in the early Disneys. Nobody taught us how to articulate these fanciful characters. We had to discover the mechanics ourselves and pass them around amongst each other. There are many styles but the mechanics of the old Disney animation remain.'

They had it all worked out by 1940, around the time that *Pinocchio* was released.

It was a wonderful system – precise and *simple*.

First we'll take it bit by bit – and then we'll put it all together.

HISTORY OF The CHART and INBETWEEN

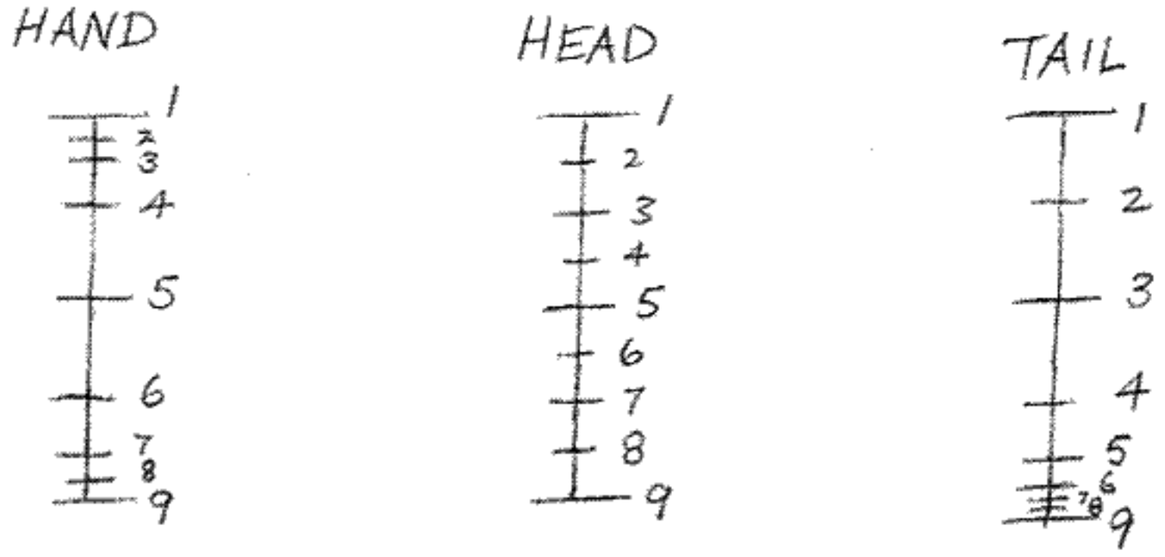
A very interesting thing happened when we worked with Grim Natwick. He was so old that each day he tended to snap back into a different professional period of his life: one day he would come in and do circular 'rubber hose' animation from the 1920s, then the next day he would be in a 1936 '*Snow White*' phase, making tons of smoothly moving drawings, the next day would be sharp, physical actions with plenty of static holds from his 1950 UPA 'Mr Magoo' period, then he'd be doing as few drawings as possible, as if he were animating a 1960s TV ad, and then the next day back into fulsome *Fantasia* mode.

One day I found him drawing in an old style – something like this:

He wasn't just showing the arc of the action – he was indicating all the different spacings on his drawing.

I suddenly realised that this was probably the origin of the charts that animators put on the edge of their drawings

e.g.



I asked, 'Hey, Grim – did these charts just gradually move across the page away from the drawings?

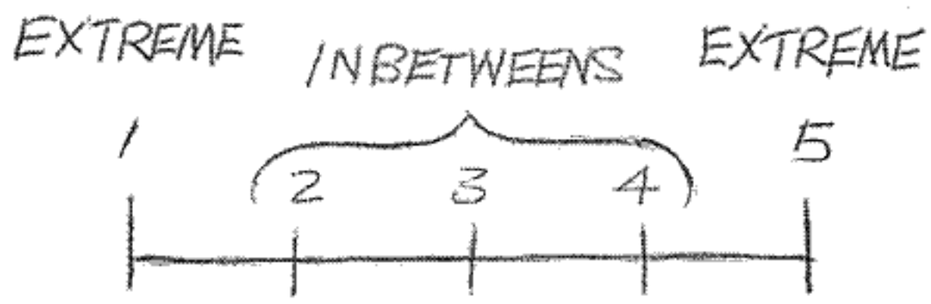
A far-away look came into his eyes – '. . . Yes . . .'

In the 1920s, animators did most of the work themselves. Dick Huemer was the top New York animator and was working for Max and Dave Fleischer on their *Mutt and Jeff* series. Dick told me they said to him, 'Your work is great, Dick, but we can't get enough of it.' So Dick said to them, 'Give me someone to put in the in-between drawings and I'll do two to three times as much work.' And that was the invention of the 'inbetweener'.

Dick later said in an interview that it had been the Fleischers' idea and that he just went along with it. But Dick actually told *me* that he had invented the inbetween and the inbetweener, the helper or assistant.

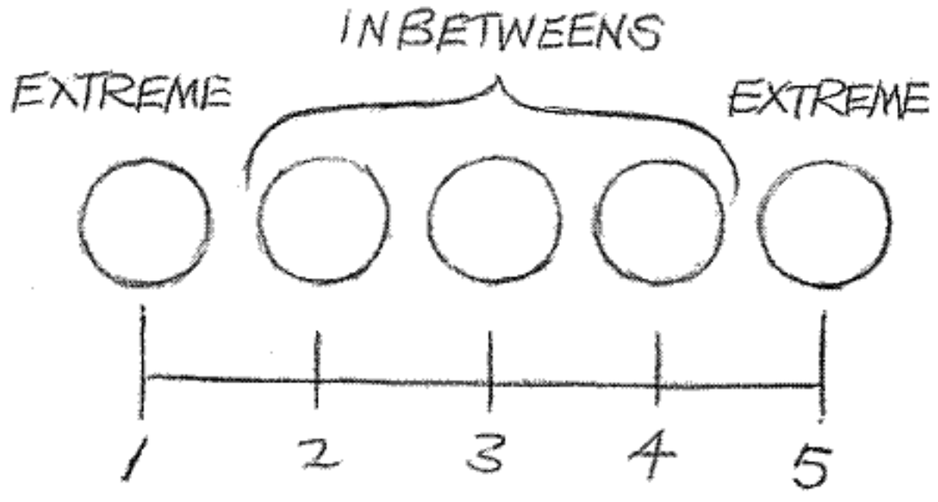
The main drawings or extreme positions came to be called *extremes* and the drawings in between the extremes were called the *inbetweens*.

The chart shows the spacing.



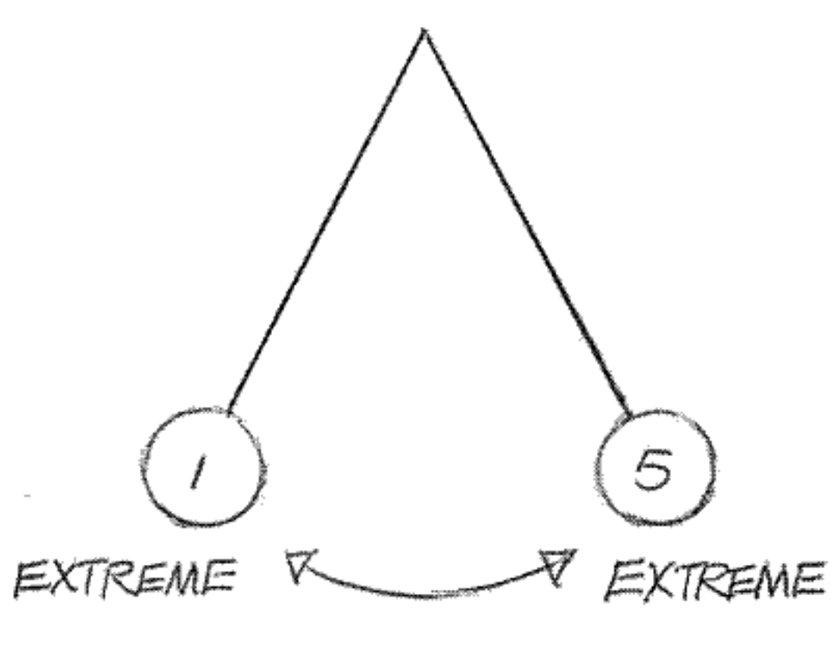
We'll put in three even inbetweens between the two extremes.

Number 3 is smack in the middle between 1 and 5. Then we put number 2 right in the middle between 1 and 3 – and number 4 in the middle between 3 and 5. We've got the inbetweens spaced evenly.

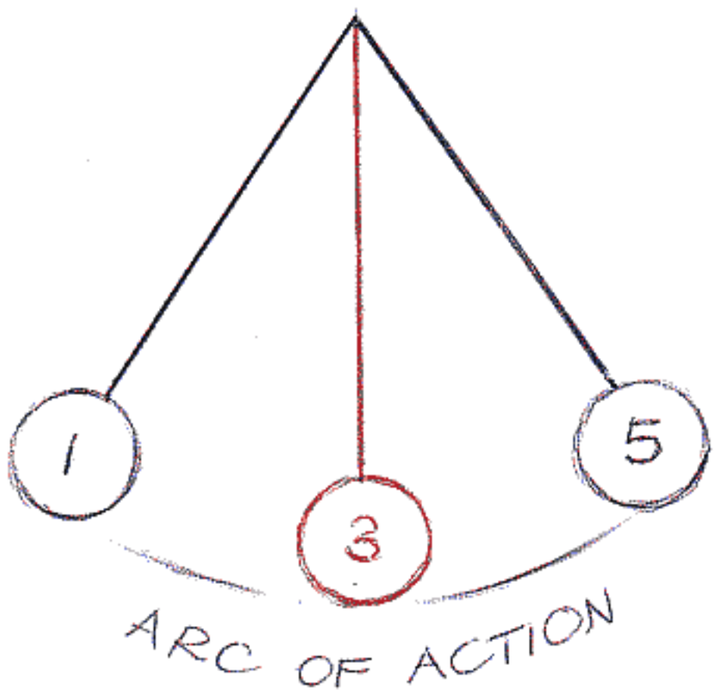


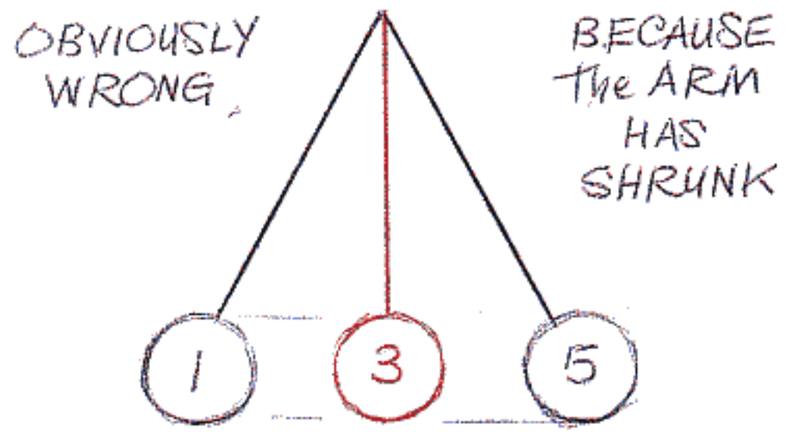
EXTREMES and BREAKDOWNS

Take the example of a swinging pendulum: The extremes are where there is a change in direction – the ends of the action where the direction changes.



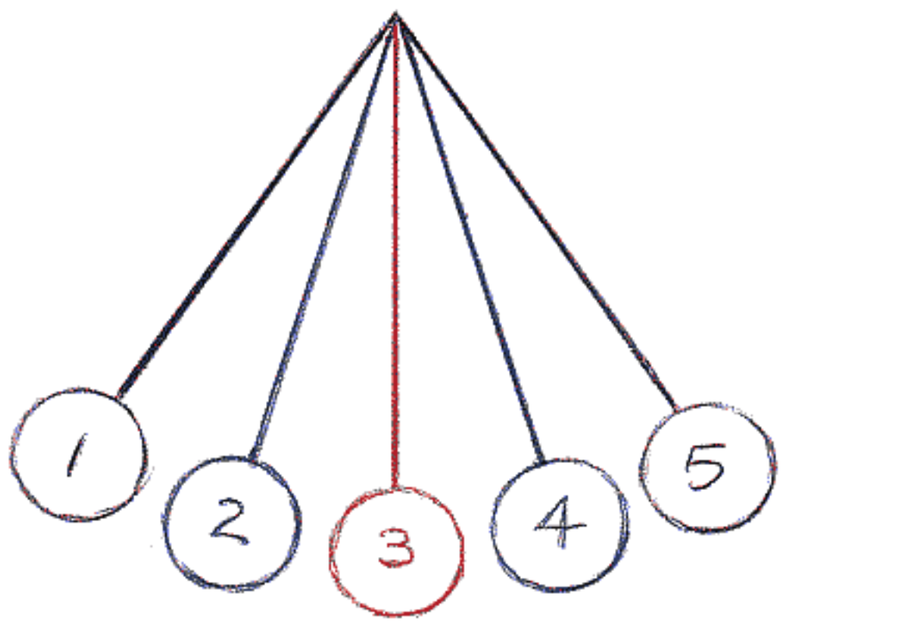
Because the pendulum's arm maintains its length as it swings, the middle position creates an arc in the action. We can see how important that middle position between the two extremes is going to be to us.

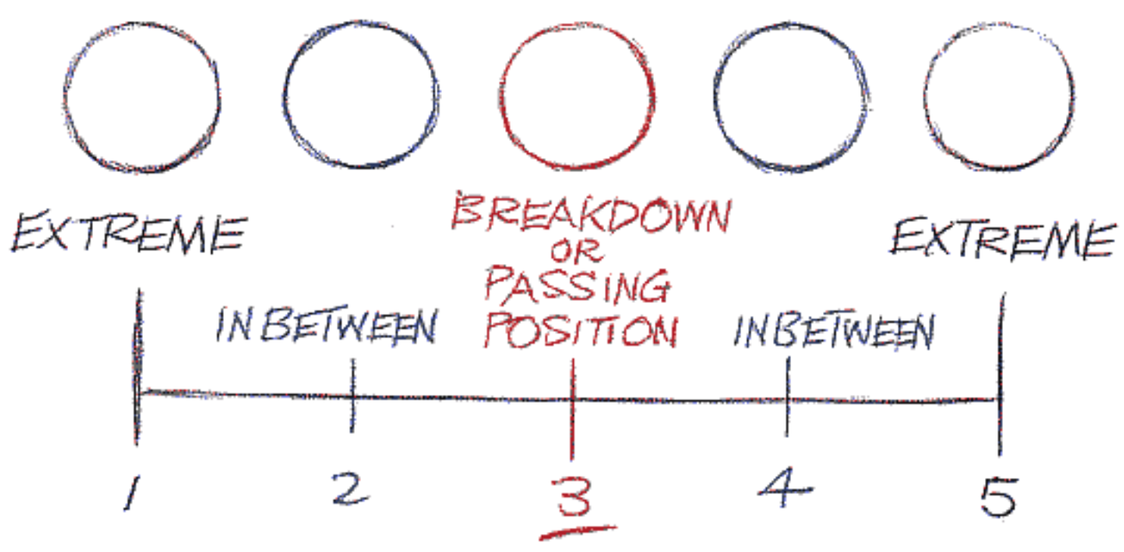




It's obvious how important this middle position is. In the 1930s they called this the 'break-down' drawing or 'passing position' between two extremes.

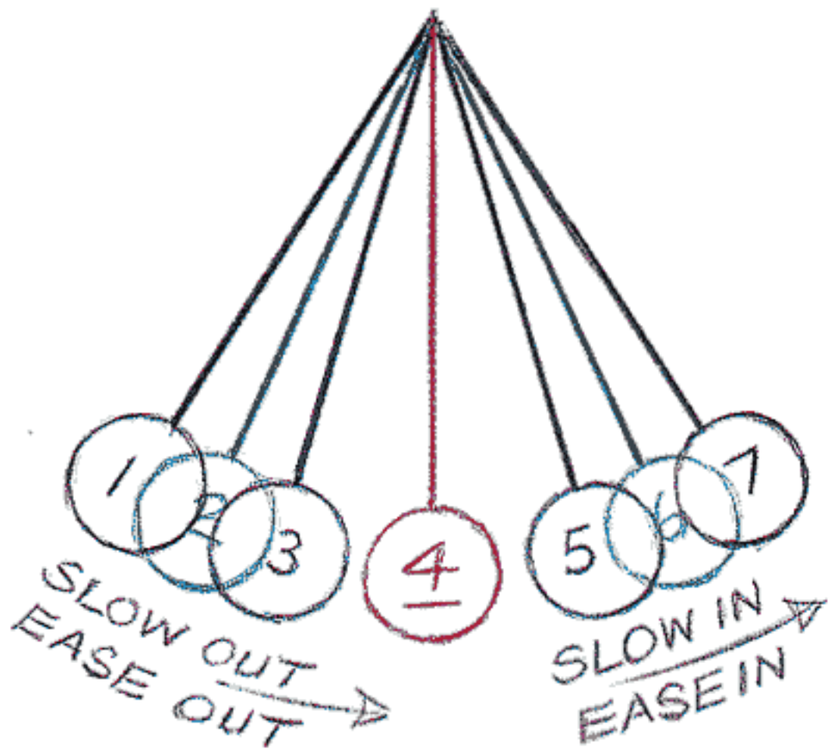
We'll add two inbetweens.



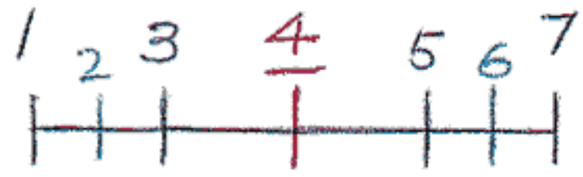


Some animators <u>underline</u> the breakdown or passing position because it's so important to the action. I have the habit of doing this because it's a position which is crucial to helping us invent. We're going to make tremendous use of this middle position later . . .

If we want to make our pendulum ease in and out of the extreme positions, we'll need a couple more inbetweens:

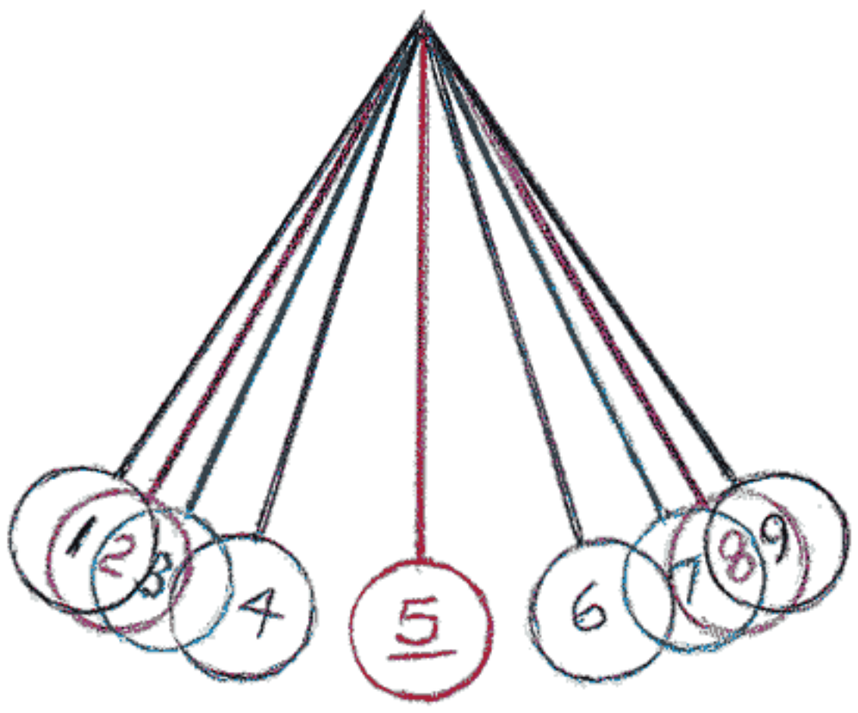


So our chart will look like this.



What we're doing is easing in or easing out of the extreme positions. 'Slowing in' or 'slowing out' is the classical terminology for it, but I prefer today's computer animators' term of 'easing in' and 'easing out'.

To make the action even slower at the ends, let's add a couple more inbetweens.

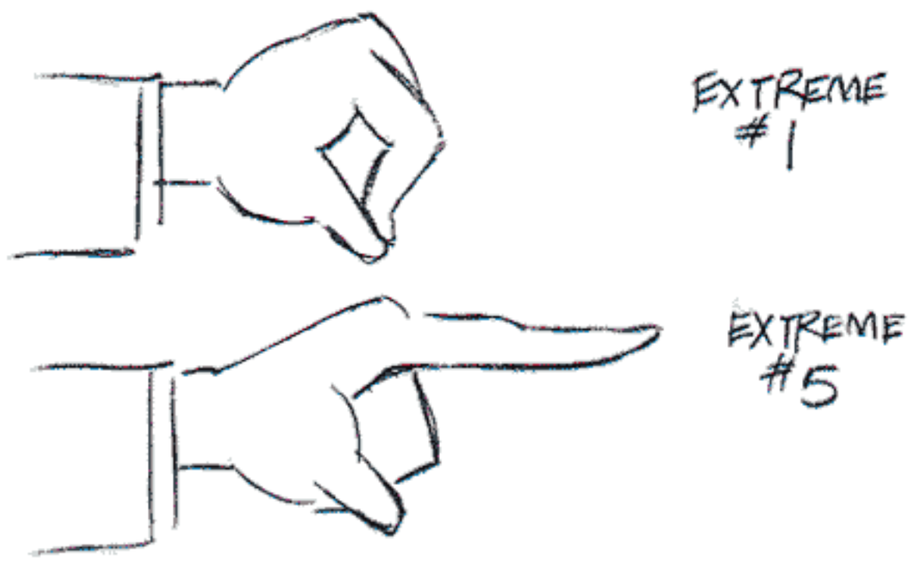


Now our chart will look like this.

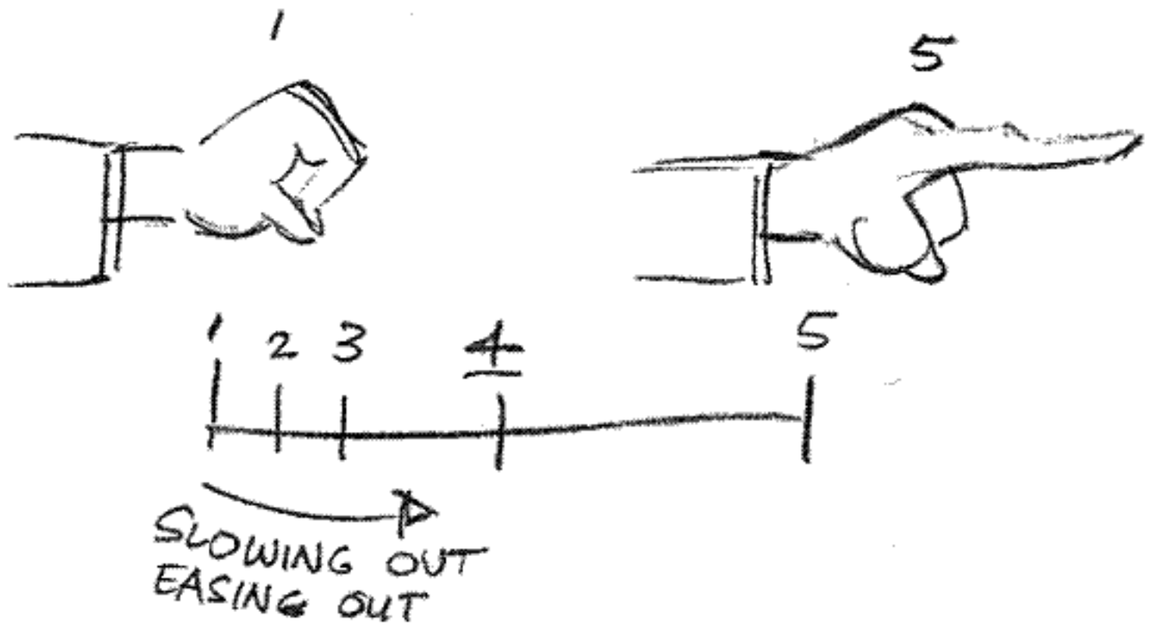
Ken Harris always called it 'cushioning' – which is a nice way to think of it.

Master animator Eric Larson – who became the instructor of the younger Disney animators – says that what animation has to have is a change of shape.

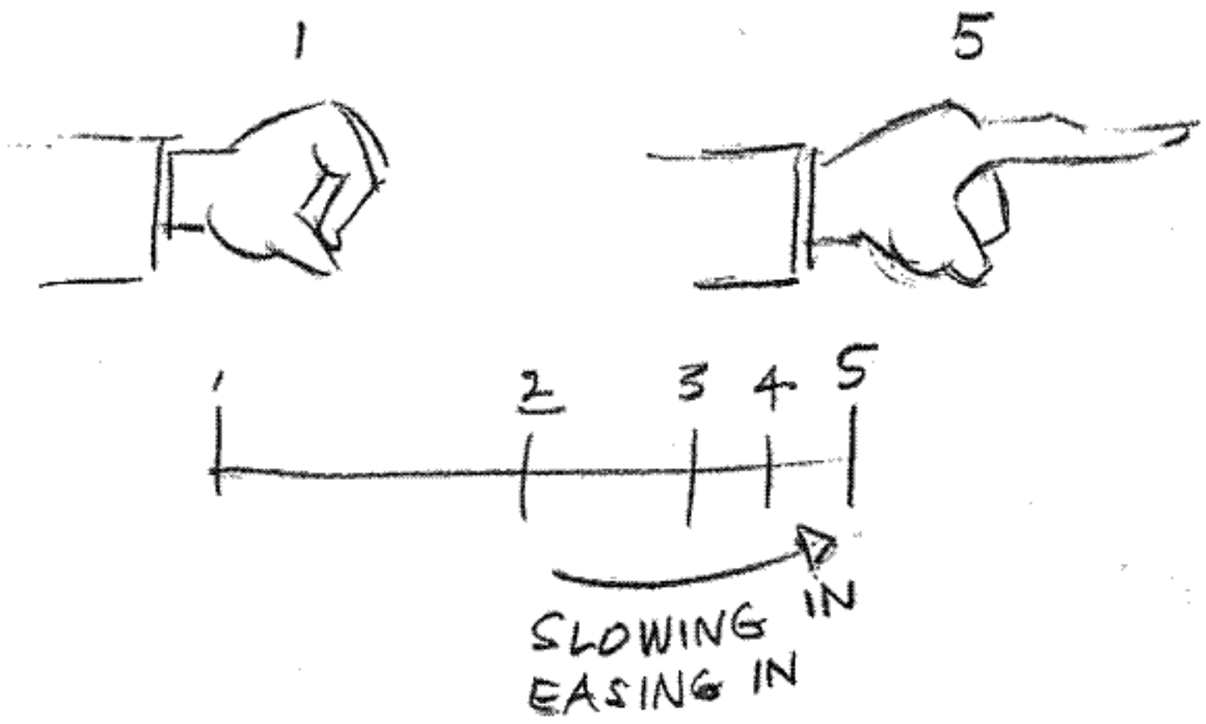
So, let's change from a closed hand to a pointing finger.



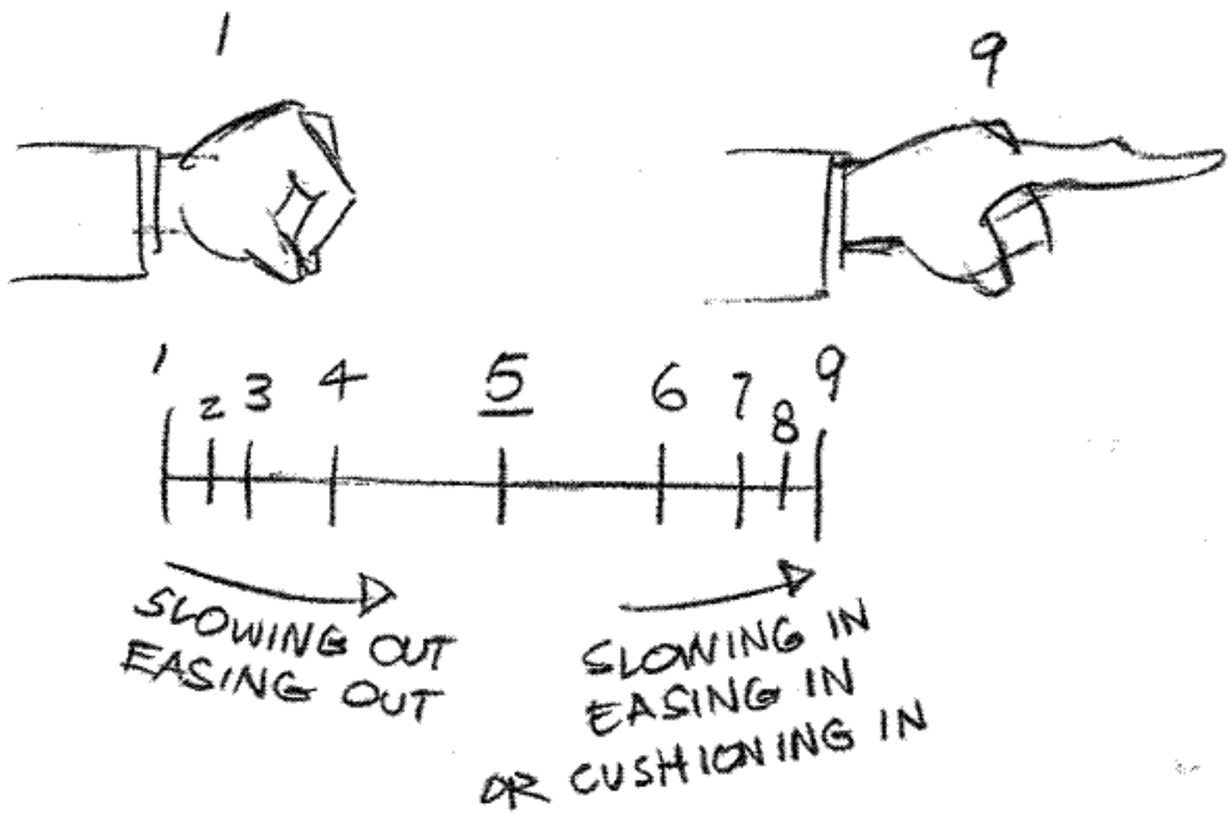
If we 'ease out' of number 1 in order to point – number 5 – the chart will be:



Alternatively, if we 'snap out' or 'speed out' of the closed hand and 'ease in' or 'cushion in' to the pointing finger the chart will be:



For a more relaxed, slower action we could add more inbetweens and ease out of the closed hand, and speed through the middle, and then ease in to the pointing finger.

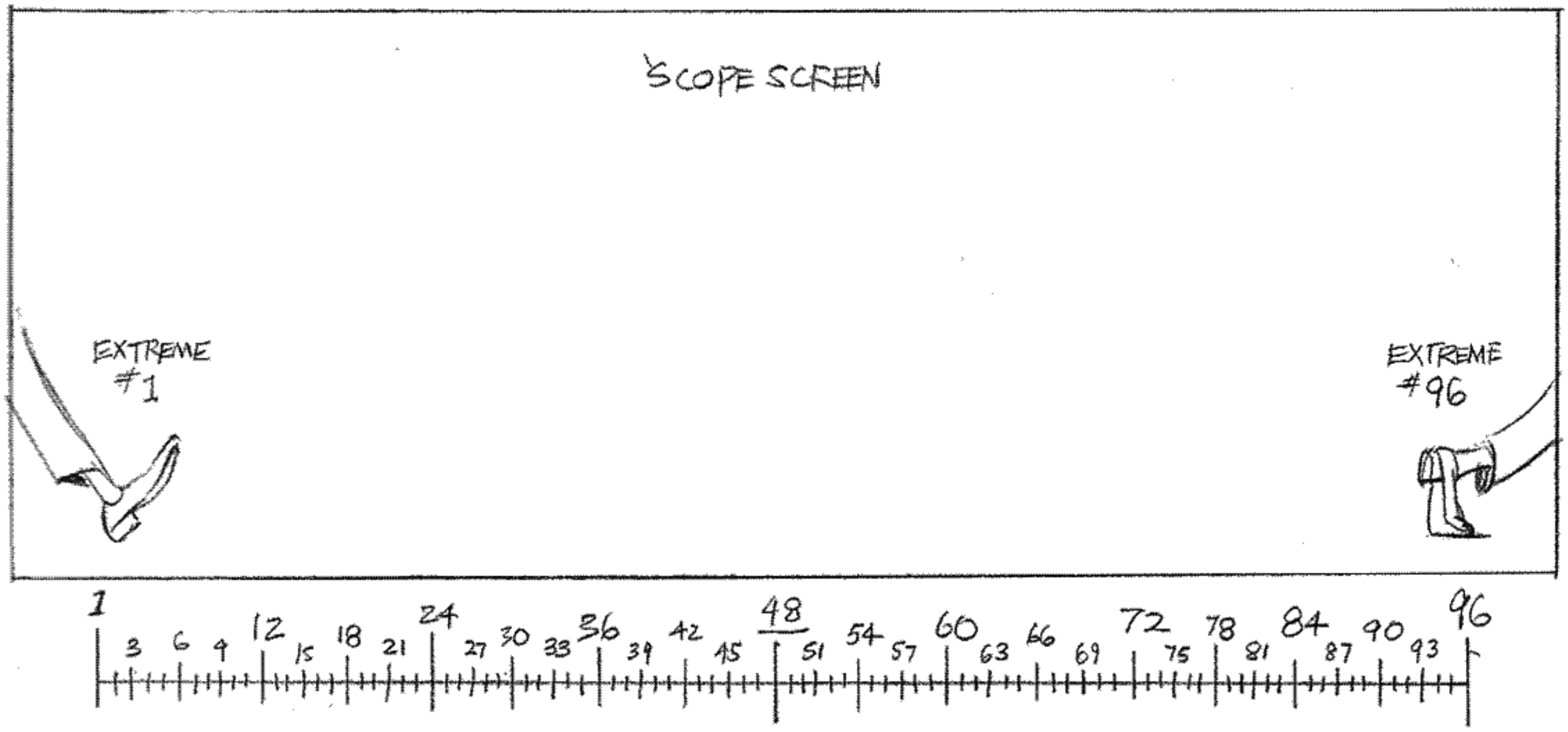


The animator can get away with just drawing the two extreme positions and making a chart for the assistant to put in all the inbetween positions.

I was spoilt by being taught by marvellous, hardworking, top Hollywood animators and I had a few shocks when I worked with some of the lesser mortals.

Here's how a Hollywood hack animator might duck the work:

A character enters screen left . . . and goes out screen right.



To walk across the screen it's going to take 4 seconds – 96 frames. So the animator does drawing number 1 and drawing number 96 and gives this chart to the assistant and goes off to play tennis. He wanders back in next day and blames the assistant for the terrible result.

This may seem far-fetched, but it does happen.

Moving on – we know the extremes and the breakdowns are crucial to the result, but the inbetweens are also very important.

The genie in the computer creates perfect inbetweens, but for 'drawing' people – getting good inbetweens can be a real problem.

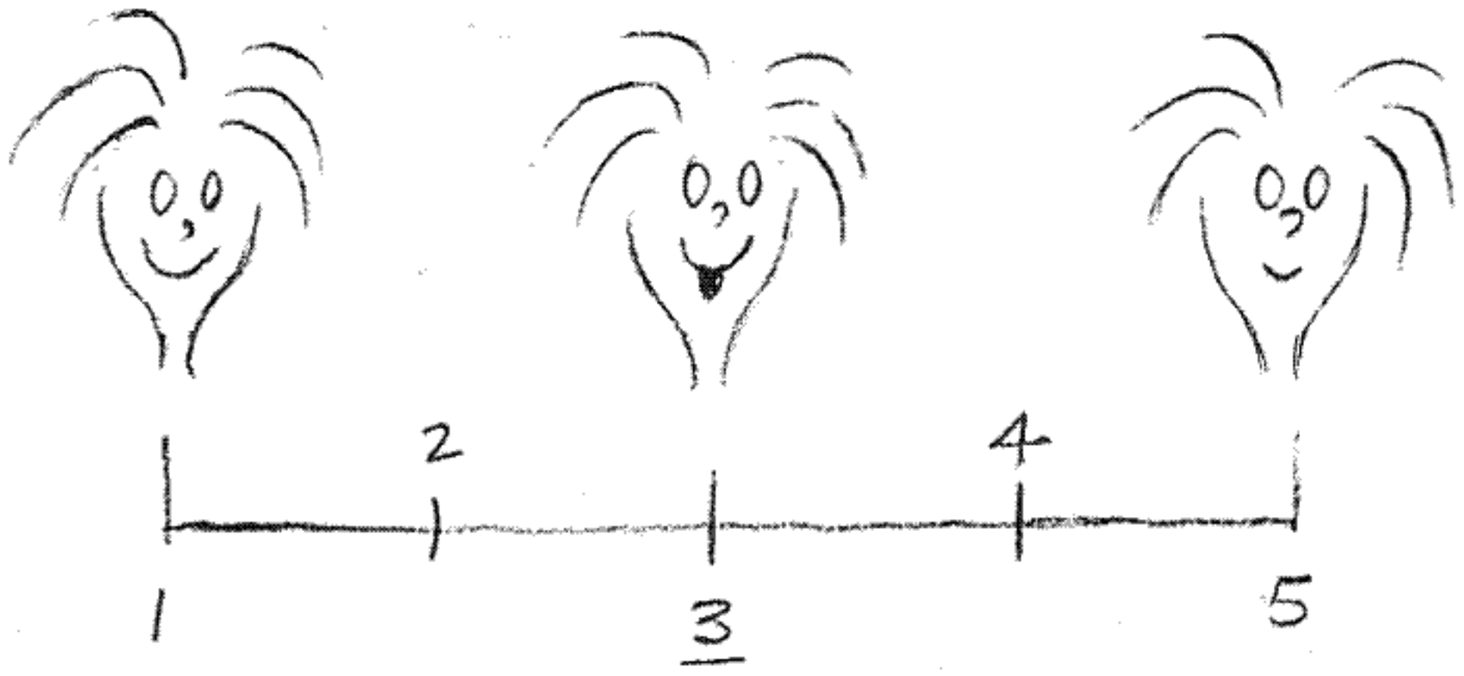
Grim Natwick constantly intoned, 'Bad inbetweens will kill the finest animation.'

In 1934, when the novice Milt Kahl – having just started work at Disney – first met the great Bill Tytla, he told Tytla that he was working in the inbetweening department. Tytla barked, 'Oh yeah? And how many scenes have you screwed up lately?'

Like most people starting out, I did all my own inbetweens. Then I got my first 'official' job animating for UPA in London. They gave me an inexperienced assistant who drew well, but this is what happened:

We had a simple character of the period, a little girl called Aurora who was advertising Kia Ora orange drink. 'Where's the Kia Ora, Aurora?'

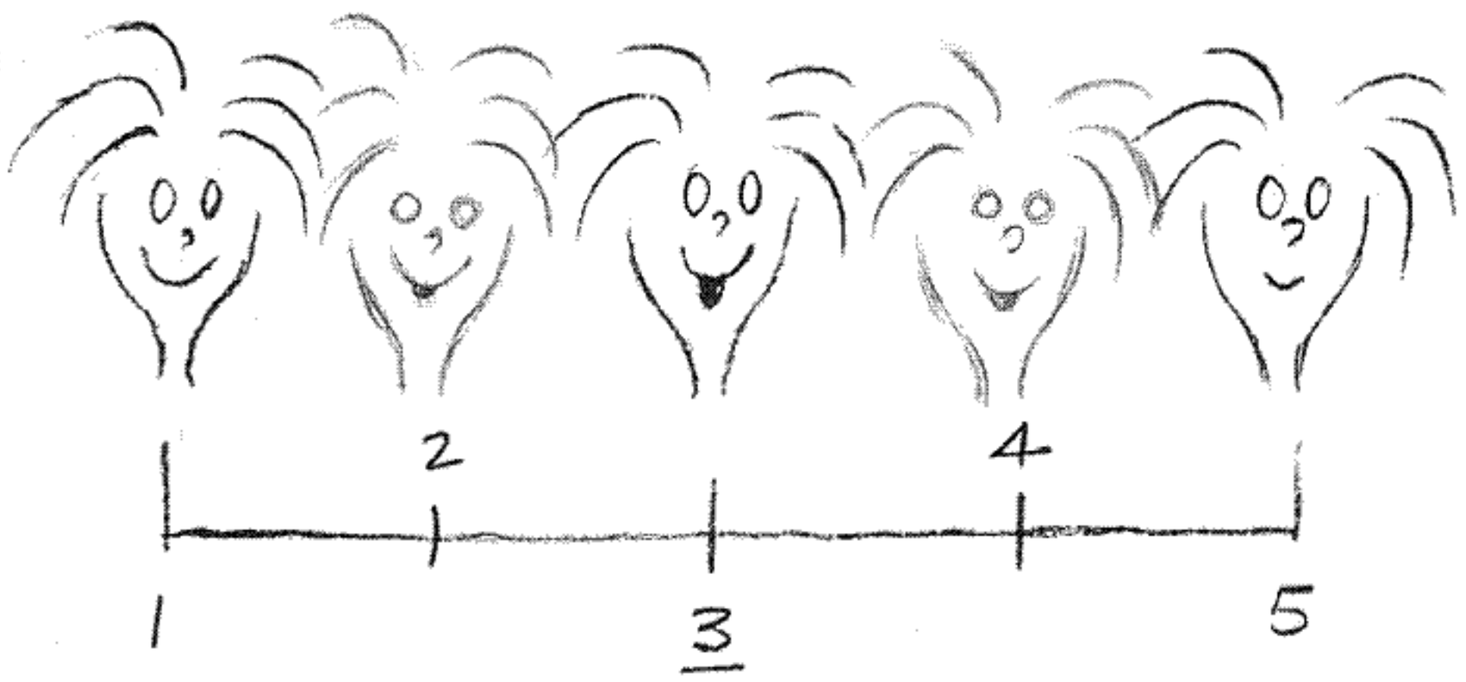
She looked like this.
I drew drawings 1 and 3 and 5, my assistant put in inbetweens 2 and 4.



He had ambitions as a designer and he didn't like egg-shaped eyes like this:

He liked circular eyes like *this*:

So the inbetweens all went in like this:



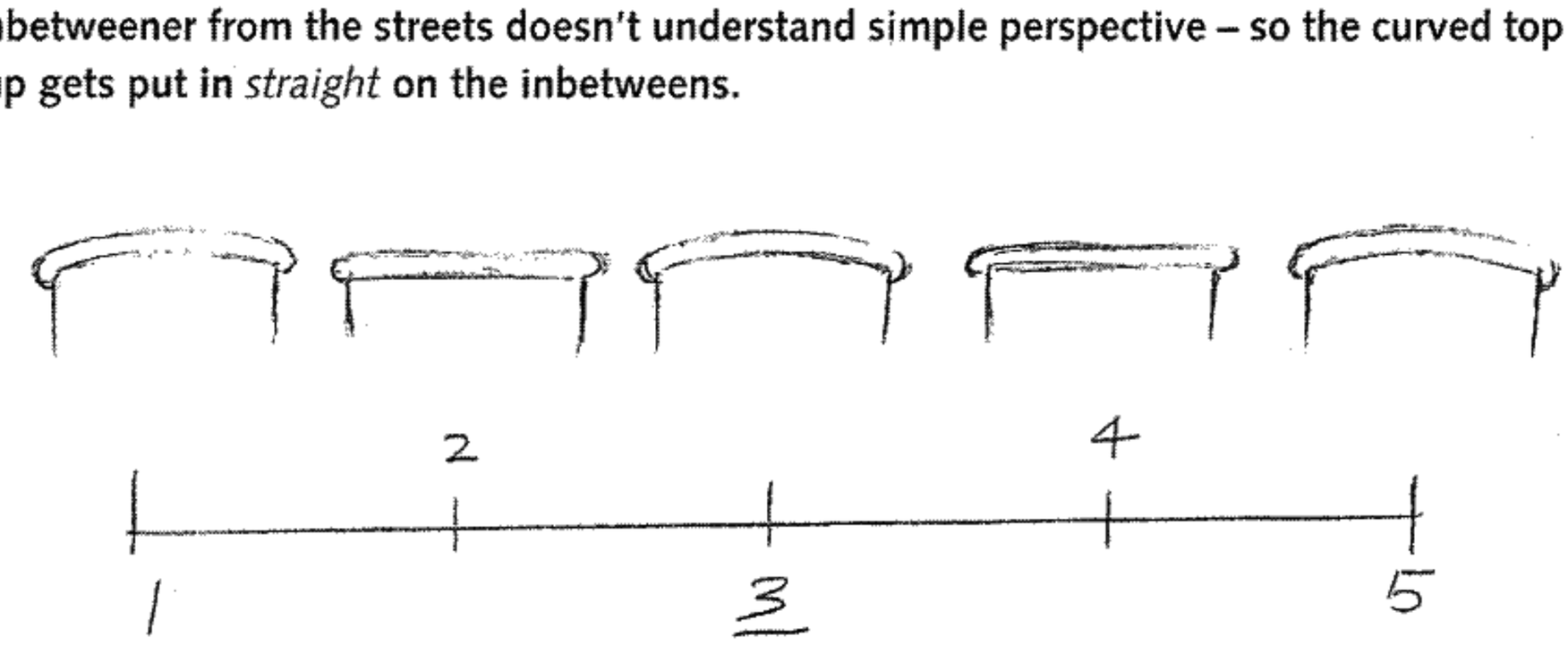
The result on the screen, of course, is this:

Wobble, wobble, wobble.

As is common in production when racing to meet the deadline, we end up hiring anybody off the street who can hold a pencil. And this is what happens:

Say a live actor is holding an animated coffee cup –

The inbetweener from the streets doesn't understand simple perspective – so the curved top of the cup gets put in *straight* on the inbetweens.



Result: 'Frying tonight.' Wobble, wobble, wobble.

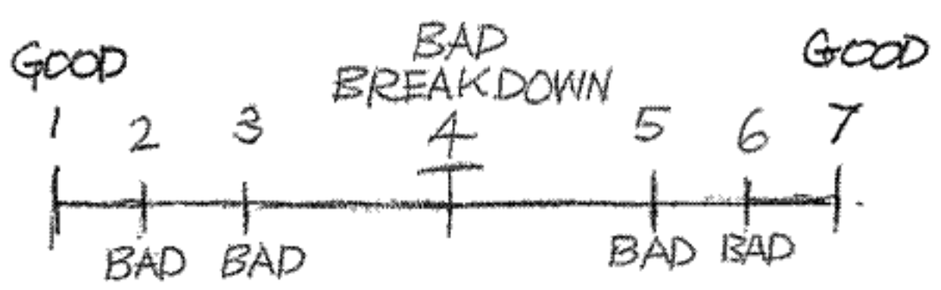
And if it's this wobbly with a simple thing, just imagine what it's going to be like when we are dealing with complex drawings. All the shapes will be doing St Vitus's dance. So the assistants' or inbetweener's job is really *volume control*.

A lot of assistants worry about the quality of their line – matching the animator's line quality. I always say never mind the line quality – just get the volumes right. Keeping the shapes and volumes consistent = volume control! When the thing is coloured in, it's the shapes that we see – it's the shapes that dominate.

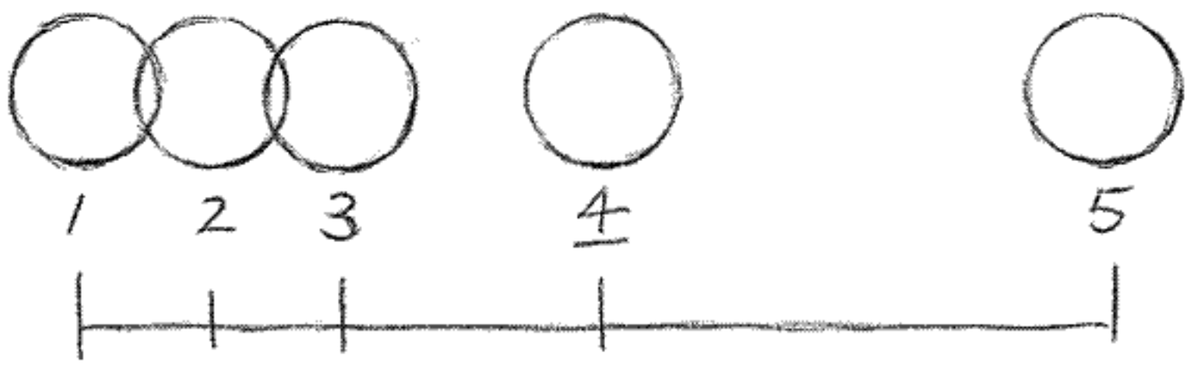
Whenever we were under the gun and short of skilled helpers, we found if we outnumbered the dodgy inbetweens by three good drawings to two bad ones – we just scraped through with an acceptable result.

When we only had two good ones with three bad ones in between them – the bad ones outnumbered the good ones and the result was lousy.

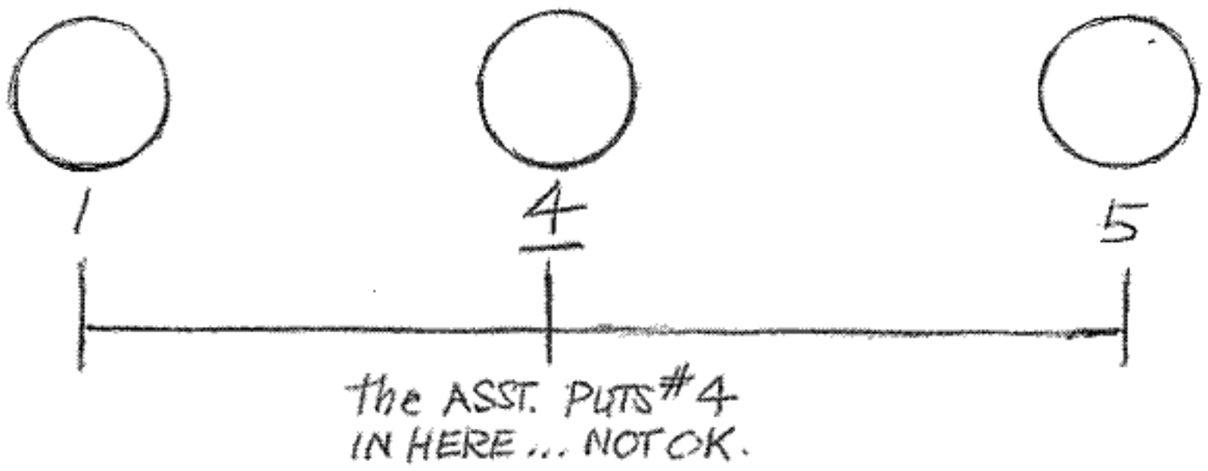
If the breakdown or passing position is wrong, all the inbetweens will be wrong too.

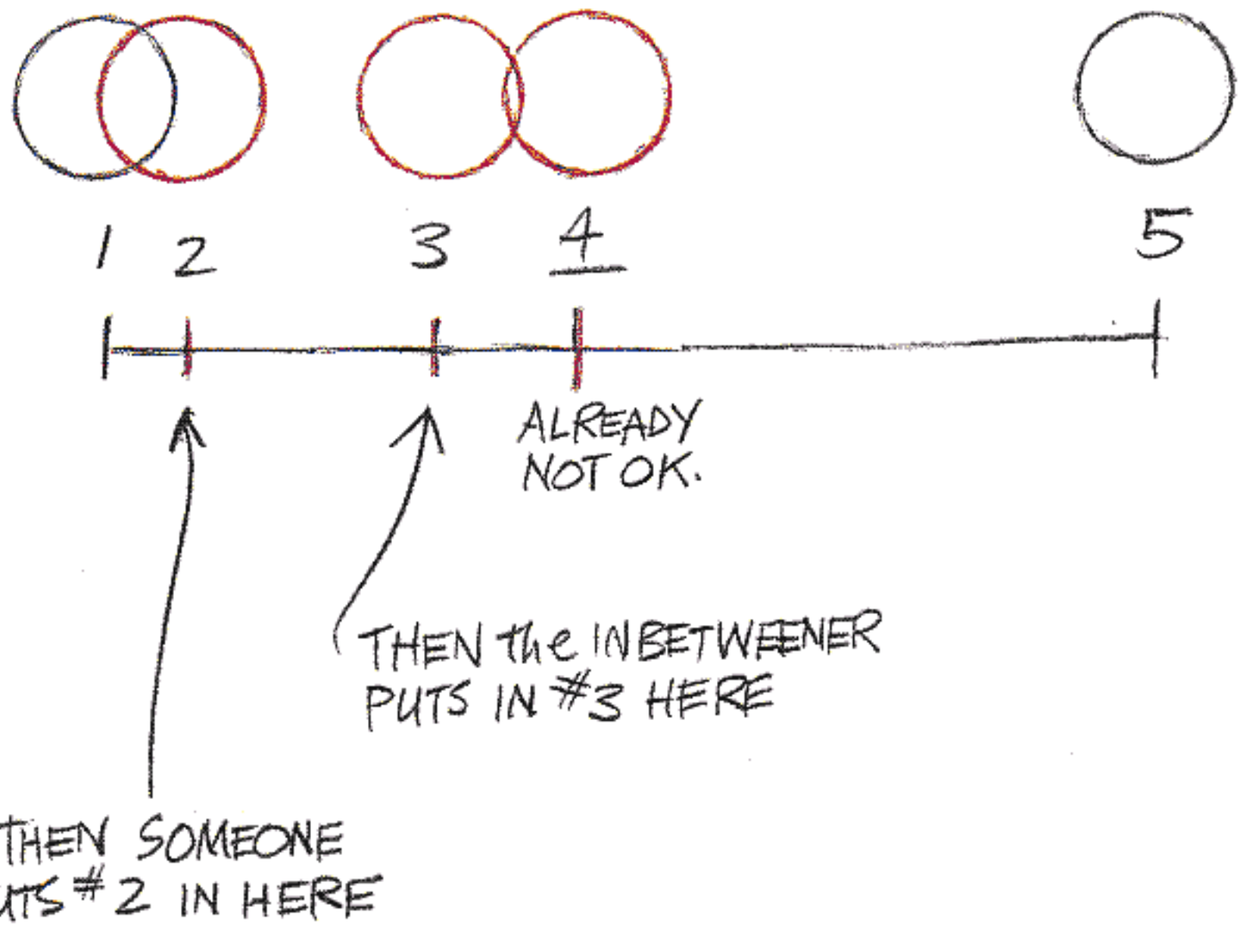


When we're not accurate, here's what happens: The animator supplies a chart and wants equal inbetweens. This is putting them in the right place.



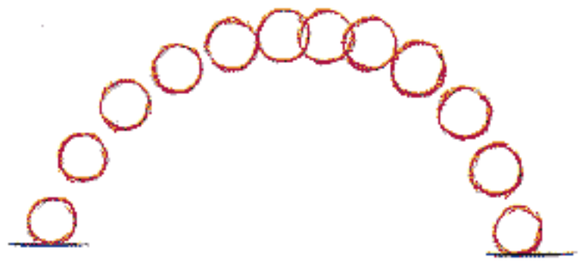
But let's say the assistant puts the breakdown or passing position slightly in the wrong place –





So: Number 4 is wrong.
3 compounds it.
2 compounds it more.

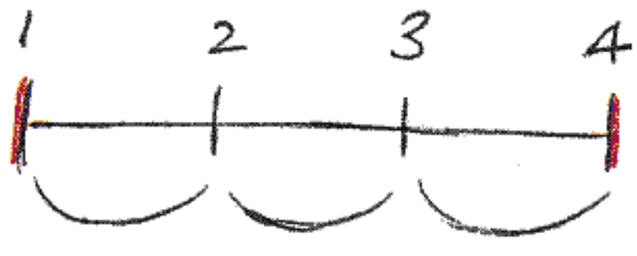
And instead of ending up with fluid actions like this –



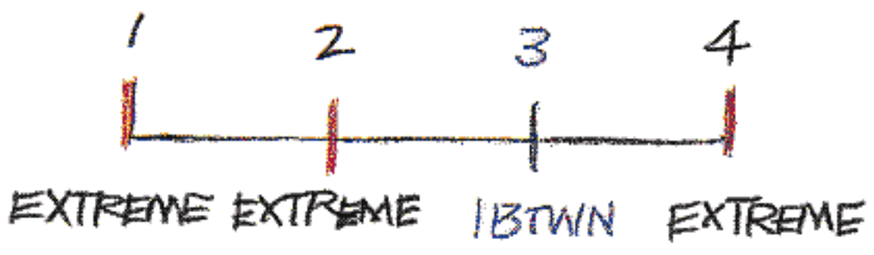
– we'll get this all-over-the-place kind of thing.

One thing an animator should *never* do is to leave his assistant to make 'thirds'.

If we need to divide the chart into thirds –

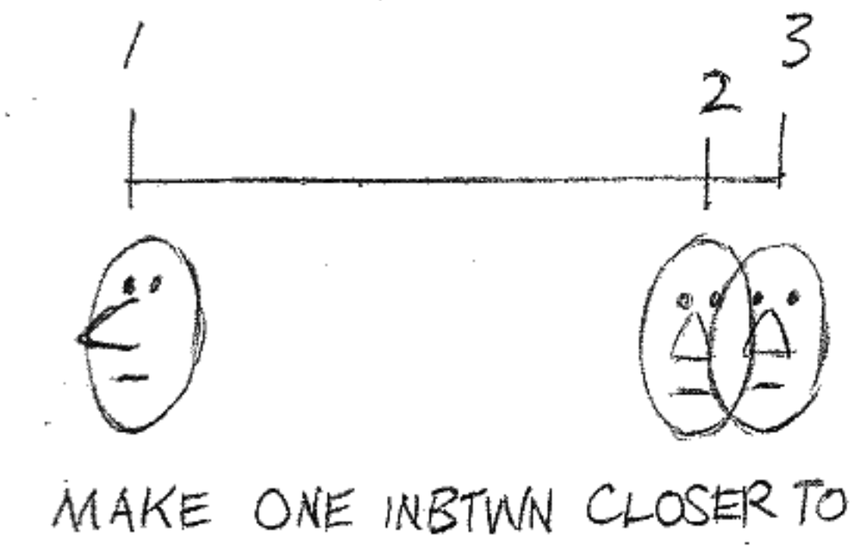


– the animator should make one of the inbetween positions himself –

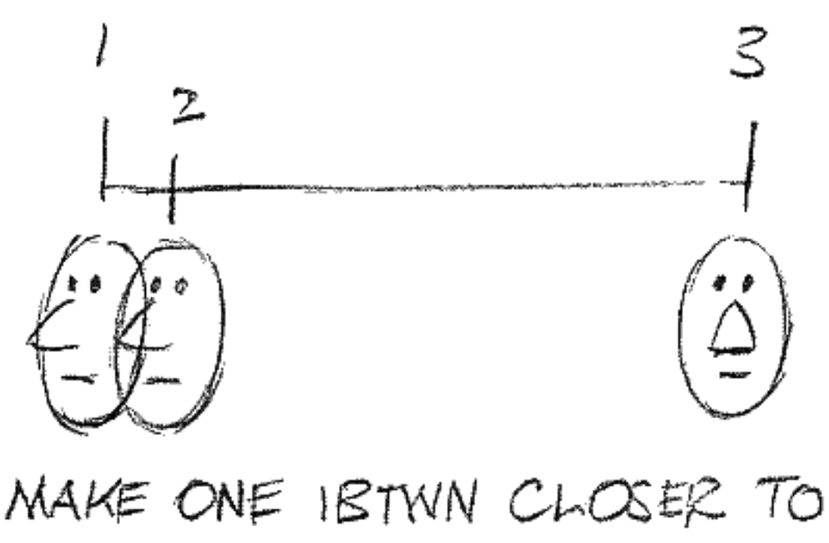


– in order to leave the assistant to put in the remaining position in the middle.

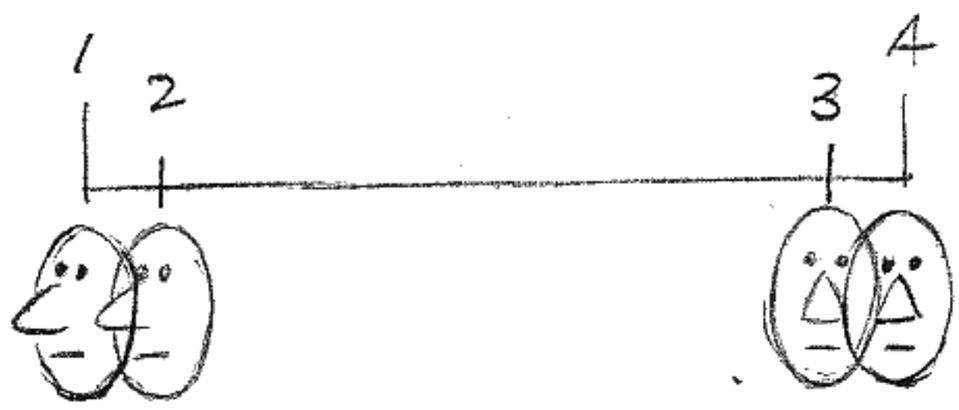
Leaving thirds to the assistant is cruel and is asking for trouble – but it's fair to make a chart like this, calling for an inbetween very close to an extreme:



MAKE ONE INBTWN CLOSER TO 3



MAKE ONE IBTWN CLOSER TO



MAKE ONE IBTWN CLOSER TO 1

MAKE ANOTHER IBTWN CLOSER TO 4

KEYS

And now we come to the Great Circling Disease. For some reason, animators just *love* circles. We love to circle the numbers on our drawings. Maybe it's because, as old Grim Natwick said, 'Curves are beautiful to watch.' Or maybe it's just a creatively playful thing.

I once worked with a Polish animator who circled every single drawing he made!

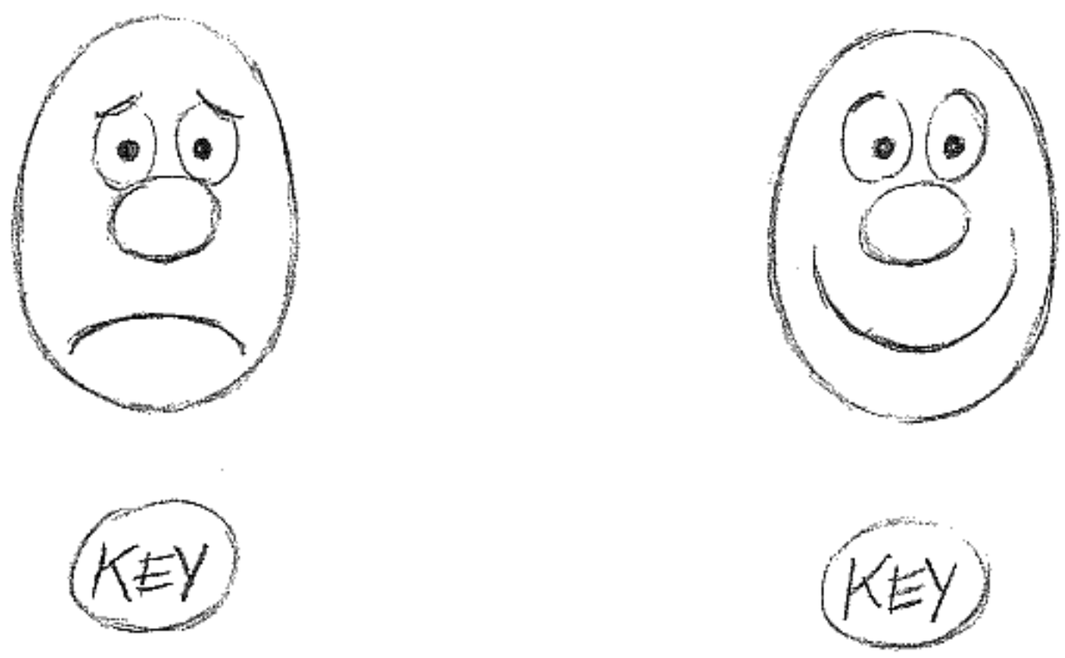
'Is animation, man! Circle! Circle! Circle!'

You'll notice that so far I haven't circled *any* extreme positions. In this clear working system and method developed by the 1940s, the extremes are *not* circled, but the key drawing *is*. The drawings which *are* circled are the 'keys'.

Question: What is a key?

Answer: The storytelling drawing. The drawing or drawings that show what's happening in the shot.

If a sad man sees or hears something that makes him happy, we'd need just two positions to tell the story.

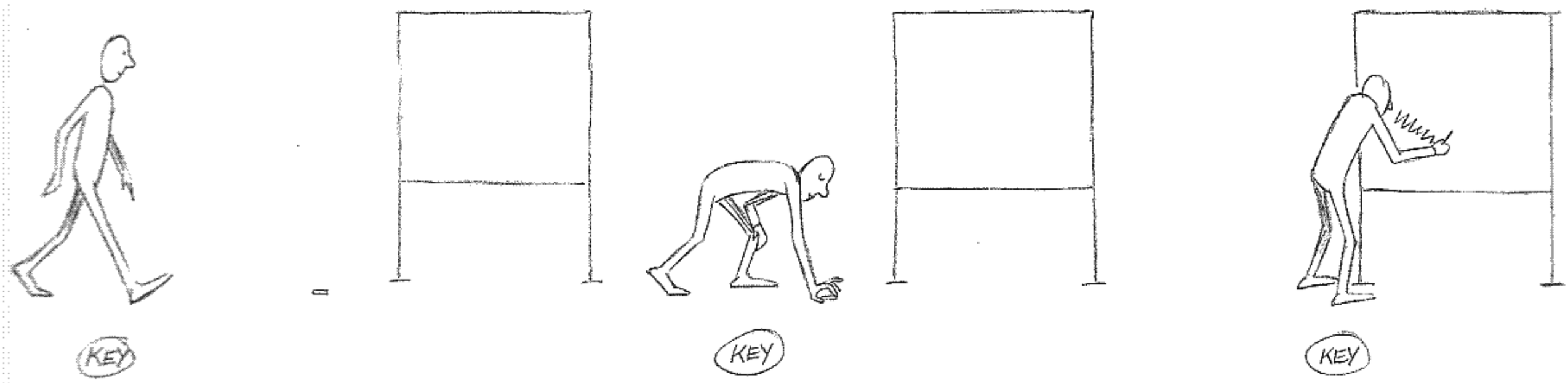


These are the keys and we circle them.

These are the drawings we make first. How we go interestingly from one to the other is what the rest of this book is about.

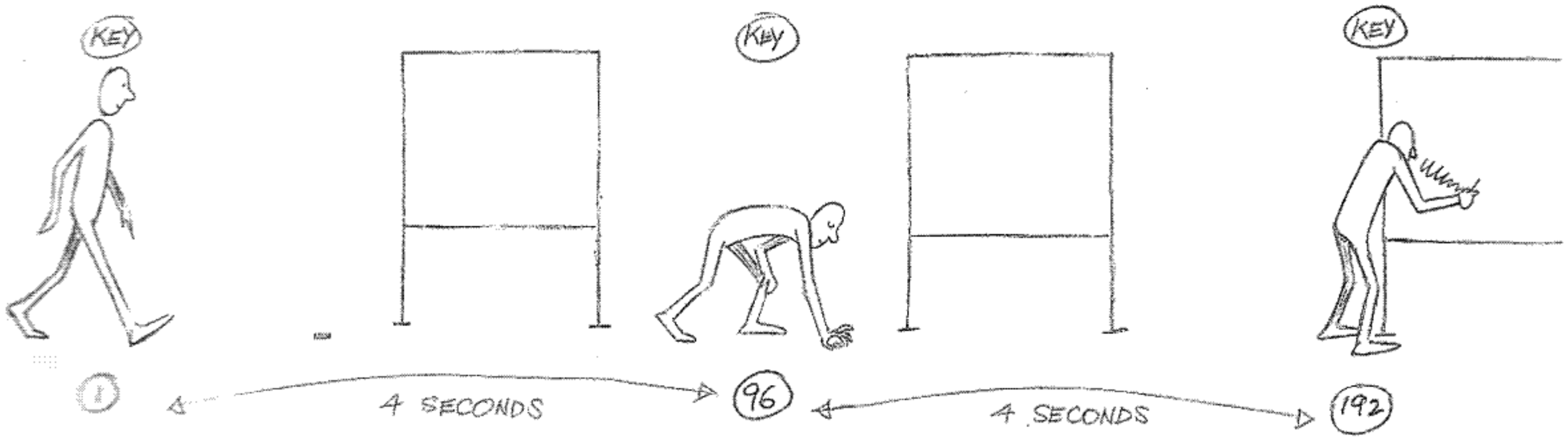
Take a more complex example:

Let's say a man walks over to a board, picks up a piece of chalk from the floor and writes something on the board.



If it was a comic strip or if we wanted to show what's happening on a storyboard, we'd need only three positions. We'll keep it simple and use stick figures so we don't get lost in detail. These three positions become our keys and we circle them.

The keys tell the story. All the other drawings or positions we'll have to make next to bring the thing to life will be the extremes (not circled): the foot 'contacts', the passing positions or breakdowns and inbetweens.



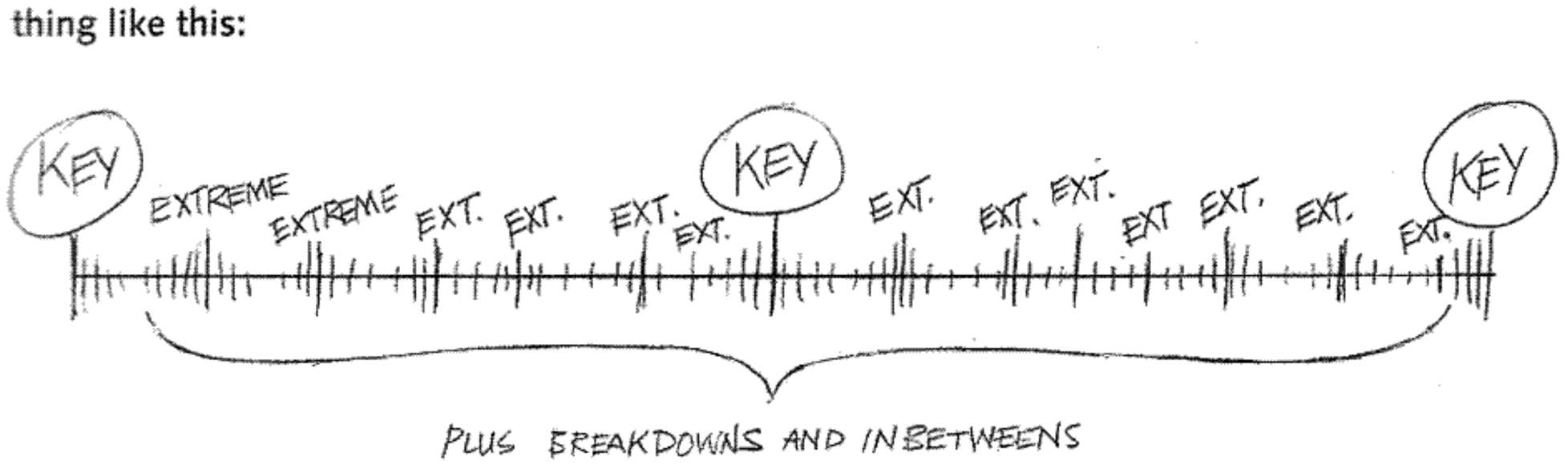
If we time this action out with a stopwatch, we might find that our first key position at the start will be drawing 1. Say it takes him 4 seconds to walk over and contact the chalk on the floor – we'd circle the second key drawing as 96. And when he's stood up, stepped over and written his stuff, it might take another 4 seconds – so our third key could be the last drawing in the shot – 192. The whole shot would then take 8 seconds.

Of course, we don't need to time it all out first, but before we dive into animatorland with all that stuff, we have to clearly set out with our keys what it is we're going to *do* – and we can test our three drawings on film, video or computer.

We haven't dealt with how he or she moves – whether the character is old or young, fat or thin, tall or short, worried or happy, beautiful or ugly, rich or poor, cautious or confident, scholarly or uneducated, quick or slow, repressed or uninhibited, limping or fit, calm or desperate, lazy or energetic, decrepit or shaking with the palsy, drunk or frightened, or whether it's a cold-hearted villain or a sympathetic person – in other words all the 'acting' stuff, plus all the trimmings – clothes, facial expressions etc.

But what we *have* done is made it very plain what *happens* in the shot before we start.

If we were to make a diagrammatic chart of the whole scene, it would end up looking something like this:



Important animators are called key animators, and word got round that they just draw the keys – anything that they draw is a key – and slaves fill in the rest according to the little charts provided by the key animators. Wrong. A key animator is simply like a key executive – an important one.

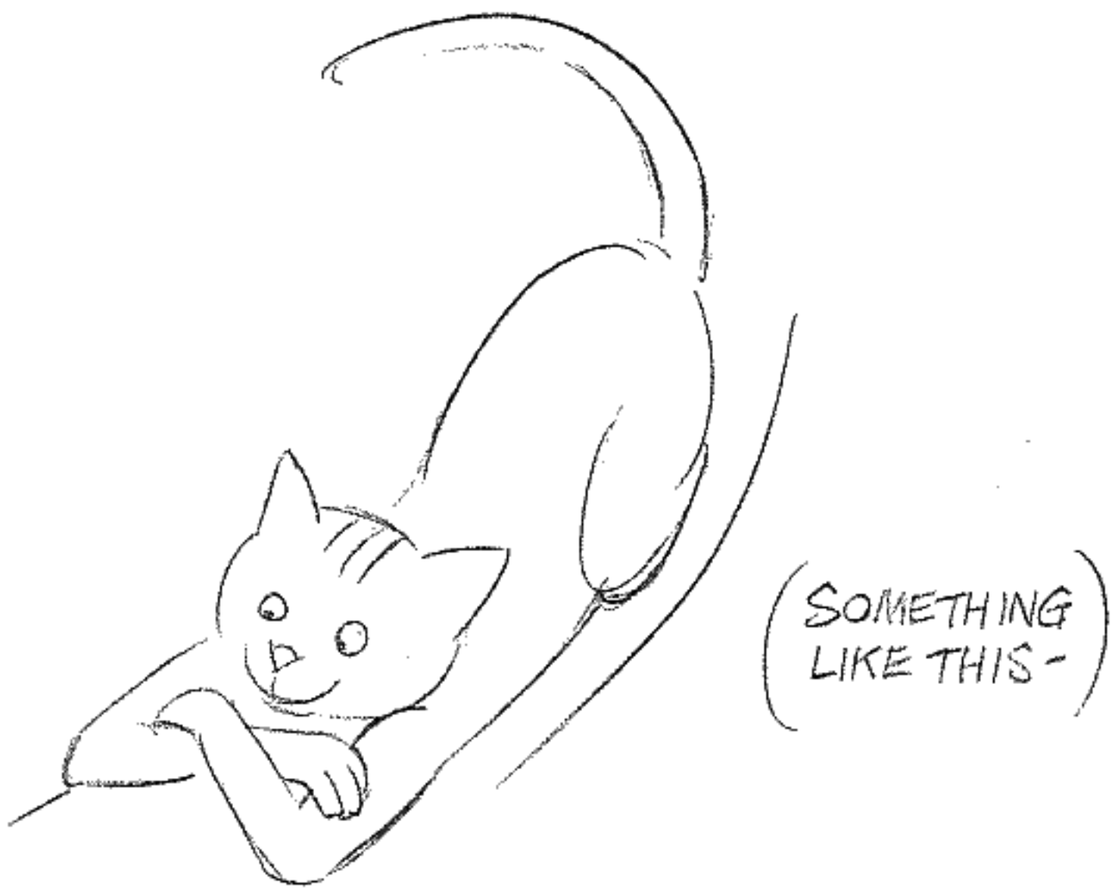
Many good animators call all their extremes 'keys' – I sure used to. But it makes life so much clearer and easier if you separate the keys from the extremes. Actually, I never heard Ken Harris ever call a drawing a key, but he would say, 'Draw *that* one first. *That's* an important drawing.' And it was a key, really.

I've worked every system, good, bad or half-baked, and experience has convinced me that it's best – even crucial – to separate the storytelling keys from the extremes and all the other stuff. (Of course, as in our example above, the three keys will also function as extremes.) Separating them out stops us getting tangled up and missing the point of the shot, as we vanish into a myriad of drawings and positions.

There may be many keys in a scene – or maybe just one or two – it depends on what it is and the length of the scene. Its whatever it takes to put it over, to read what's to occur.

You can spend time on these keys.

I remember once visiting Frank Thomas and he was drawing a cat. 'Dammit,' he said. 'I've been working all day on this damn drawing – trying to get this expression right.'



I was shocked. All day! Wow! That was the first time I ever saw anyone working so hard on a single drawing. How was he ever going to get the scene done? Finally, the penny dropped. 'Of course, stupid, its his *key*!' It's the most important thing in the scene! He's got to get *that* right!

And it was encouraging to see anyone that great struggling to get it right!

3 WAYS TO ANIMATE

1. The natural way, called STRAIGHT AHEAD

We just start drawing and see what happens – like a kid drawing in the page corners of a schoolbook – stick the numbers on afterwards.

Disney director–animator Woolie Reitherman said, 'When I didn't know what I was doing in an action, I always went straight ahead. I'd just start on ones. Half the time I didn't know what I was doing. To me, it's fun. You find out something you wouldn't have found out otherwise.'

ADVANTAGES

- WE GET A NATURAL FLOW OF FLUID, SPONTANEOUS ACTION.
- IT HAS The VITALITY OF IMPROVISATION.
- IT'S VERY 'CREATIVE' – WE GO WITH The FLOW – TAKING ALL OF The ACTION AS IT COMES ALONG.
- OFTEN The UNCONSCIOUS MIND STARTS TO KICK IN: LIKE AUTHORS SAYING THEIR CHARACTER TELLS THEM WHAT'S GOING TO HAPPEN.
- IT CAN PRODUCE SURPRISES – 'MAGIC'.
- IT'S FUN.

DISADVANTAGES

- THINGS START TO WANDER.
- TIME STRETCHES and the SHOT GETS LONGER and LONGER.
- CHARACTERS GROW and SHRINK.
- WE CAN TEND TO MISS The POINT OF The SHOT and NOT ARRIVE AT The RIGHT PLACE AT The RIGHT TIME.
- The DIRECTOR HATES US BECAUSE HE/SHE CAN'T SEE WHAT'S HAPPENING.
- IT'S LOTS OF WORK TO CLEAN UP The MESS AFTERWARDS – and IT'S HARD TO ASSIST.
- IT'S EXPENSIVE – The PRODUCER HATES US.
- IT CAN BE HARD ON The NERVES – MAD ARTIST and NERVOUS BREAK-DOWN TIME AS WE CREATIVELY LEAP IN and THRASH AROUND IN The VOID – ESPECIALLY WITH LOOMING DEADLINES.

2. The planned way, called POSE TO POSE

First we decide what are the most important drawings – the storytelling drawings, the keys – and put them in. Then we decide what are the next most important positions that have to be in the scene. These are the extremes and we put them in – and any other important poses. Then we work out how to go from one pose to another – finding the nicest transition between two poses. These are the breakdown or passing positions. Then we can clinically make clear charts to cushion and ease in and out of the positions and add any finishing touches or indications for the assistant.

To illustrate how effective the pose to pose method is, the brilliant Disney art director–designer Ken Anderson told me that when he was making layout drawings of characters for animators working on *Snow White and the Seven Dwarfs*, he drew lots and lots of key poses of Grumpy for each shot. Ken's drawings were then given to one of the Grumpy animators. Ken found out later that the guy just put charts on the drawings, handed them to his assistants and went off to lunch, and took the credit, for what in effect, was Ken's fine animation.

ADVANTAGES

- WE GET CLARITY.
- The POINT OF The SCENE IS NICE and CLEAR.
- IT'S STRUCTURED, CALCULATED, LOGICAL.
- WE CAN GET NICE DRAWINGS and CLEARLY READABLE POSITIONS.
- IT'S IN ORDER – The RIGHT THINGS HAPPEN AT The RIGHT TIME and IN The RIGHT PLACE IN The OVERALL TIME ALLOTTED.
- The DIRECTOR LOVES US.
- IT'S EASY TO ASSIST.
- IT'S A QUICK WAY TO WORK and FREES US UP TO DO MORE SCENES.
- The PRODUCER LOVES US.
- WE KEEP SANE, OUR HAIR ISN'T STANDING ON END.
- WE EARN MORE MONEY AS WE ARE SEEN TO BE RESPONSIBLE PEOPLE and CLEARLY NOT MAD ARTISTS.

PRODUCERS HAVE TO DELIVER ON TIME and ON BUDGET, SO BRILLIANCE IS NOT REWARDED AS MUCH AS RELIABILITY. I SPEAK FROM EXPERIENCE WORKING BOTH SIDES OF the FENCE. THEY DON'T PAY US FOR 'MAGIC.' THEY PAY US FOR DELIVERY.

DISADVANTAGES

- BUT – AND IT'S A BIG BUT: WE MISS the FLOW.
- The ACTION CAN BE A BIT CHOPPY A BIT UNNATURAL.
- AND IF WE CORRECT THAT BY ADDING A LOT OF OVERLAPPING ACTION TO IT IT CAN GO EASILY The OTHER WAY and BE RUBBERY and SQUISHY – EQUALLY UNNATURAL.
- IT CAN BE TOO LITERAL - A BIT COLD-BLOODED. NO SURPRISES
- WHERE'S the MAGIC?

So it's pretty obvious the best way to work is going to be:

3. The COMBINATION OF STRAIGHT AHEAD and POSE TO POSE

First we plan out what we're going to do in small thumbnail sketches. (It's also a good idea to have done this with the other two methods.)

Then we make the big drawings – the storytelling drawings, the keys. Then we put in any other important drawings that *have* to be there, like anticipations or where hands or feet contact things – the extremes. Now we have the structure, just as we had with the pose-to-pose system.

But now we use these keys and important extremes as *guides* for things and places we want to aim at. After you get your overall thing – go again. *Do one thing at a time.* We'll work straight ahead on top of these guideposts, improvising freely as we go along.

We'll do *several* straight ahead runs on different parts – taking the most important thing first. We may have to change and revise parts of the keys and extremes as we go along, rubbing bits off and re-drawing or replacing them.

So: we make a straight ahead run on the primary thing.

Then take a secondary thing and do a straight ahead run on that.

Then take the third thing and work straight ahead on that.

Then the fourth thing, etc.

Then add the hair or tail or drapery or flapping bits at the end.

ADVANTAGES

— WORKING THIS WAY COMBINES the STRUCTURED PLANNING OF WORKING FROM POSE TO POSE WITH The NATURAL FREE FLOW OF The STRAIGHT AHEAD APPROACH.

— IT'S A BALANCE BETWEEN PLANNING and SPONTANEITY.

— IT'S A BALANCE BETWEEN COLD BLOODEDNESS and PASSION.

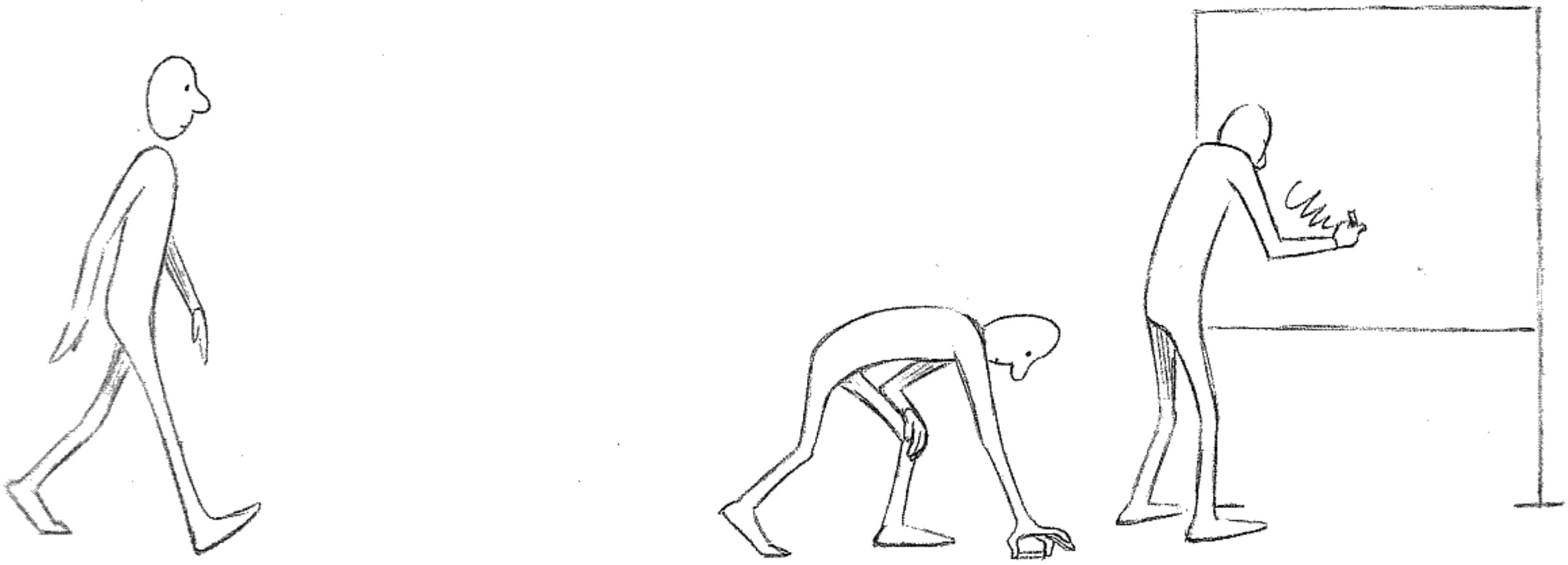
DISADVANTAGES

— NONE THAT I KNOW OF...

Let's take our man going over to the blackboard again.

What do I do first?

Answer: The keys – the storytelling drawings or positions that *have* to be there to show what's happening. Put it where you can see it . . . so it *reads*.



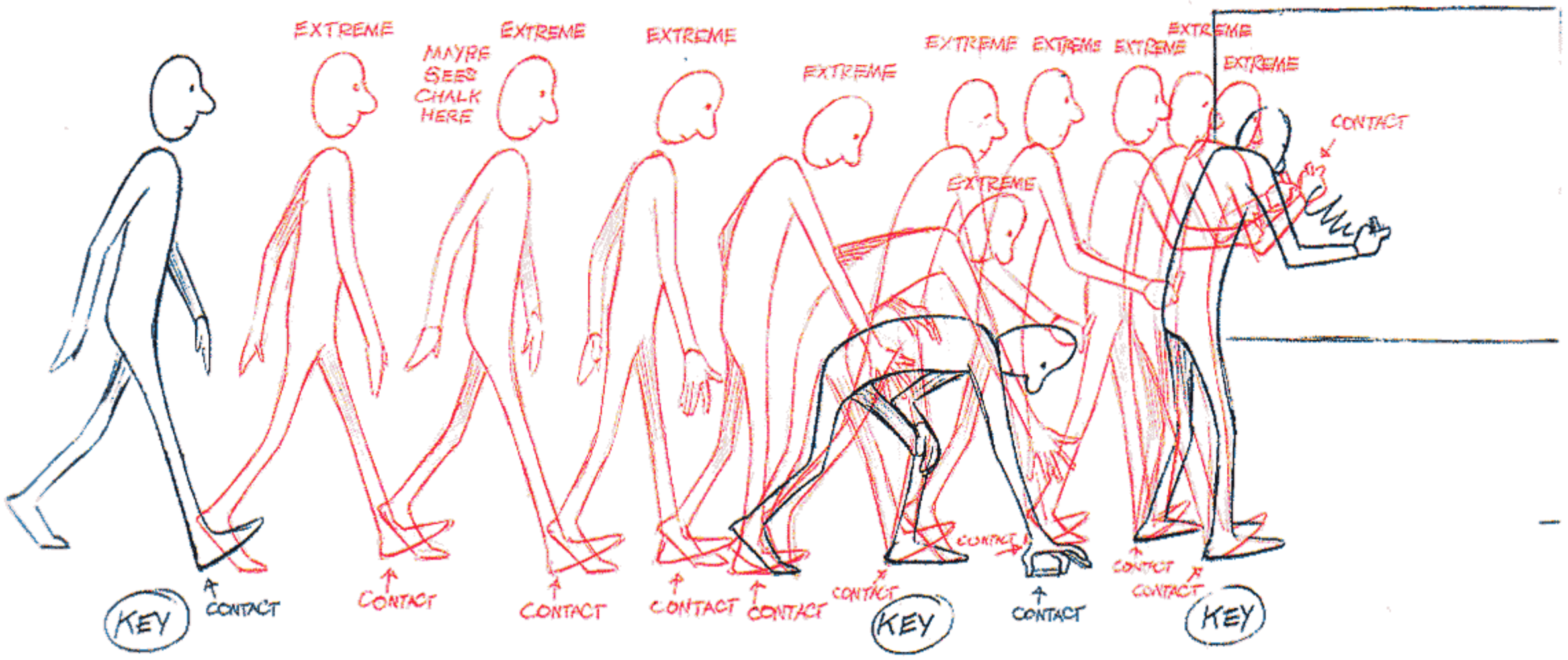
What do we do next?

Answer: Any other drawings that *have* to be in the shot. Obviously, he has to take steps to get over to the chalk – so we make the 'contact' positions on the steps where the feet are just touching the ground.

There's no weight on them yet – the heel is just contacting the ground. As with the fingers just contacting the chalk – they haven't closed on the chalk yet.

If we act all this out, we might find he takes five steps to get to the chalk and bend down. I notice that when I act it out, I automatically pull up my left pant leg as I bend down, then I put my hand on my knee before my other hand contacts the chalk. I would make an extreme where the hand just contacts the pant leg – before it pulls up the pants.

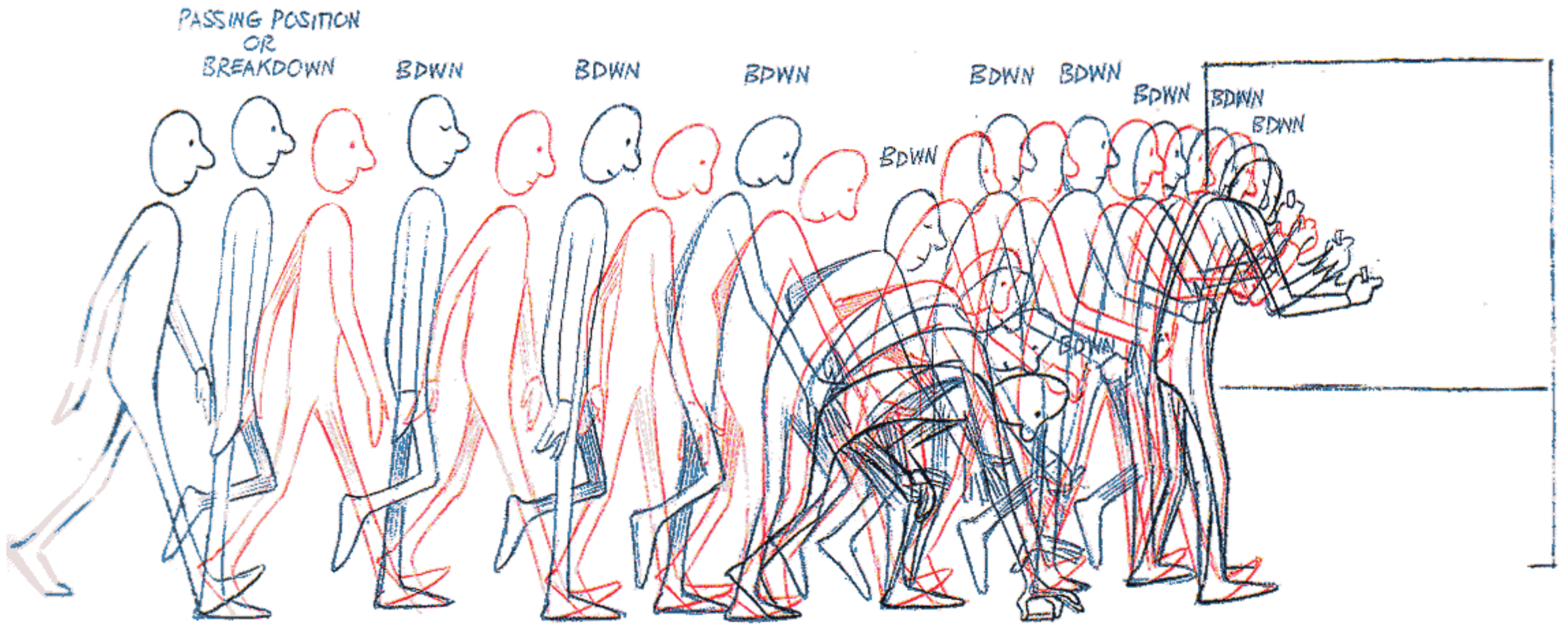
These will be our extremes. We're working rough, sketching things in lightly – although we probably have made rather good drawings of the keys. (I haven't here, because I'm trying to keep it simple, for clarity).



We could act it out, timing the steps and putting numbers on the extremes or we could leave the numbering till later. I would probably put numbers on it now and test it on the video to see how the timing feels as his steps get shorter – and make any adjustments.

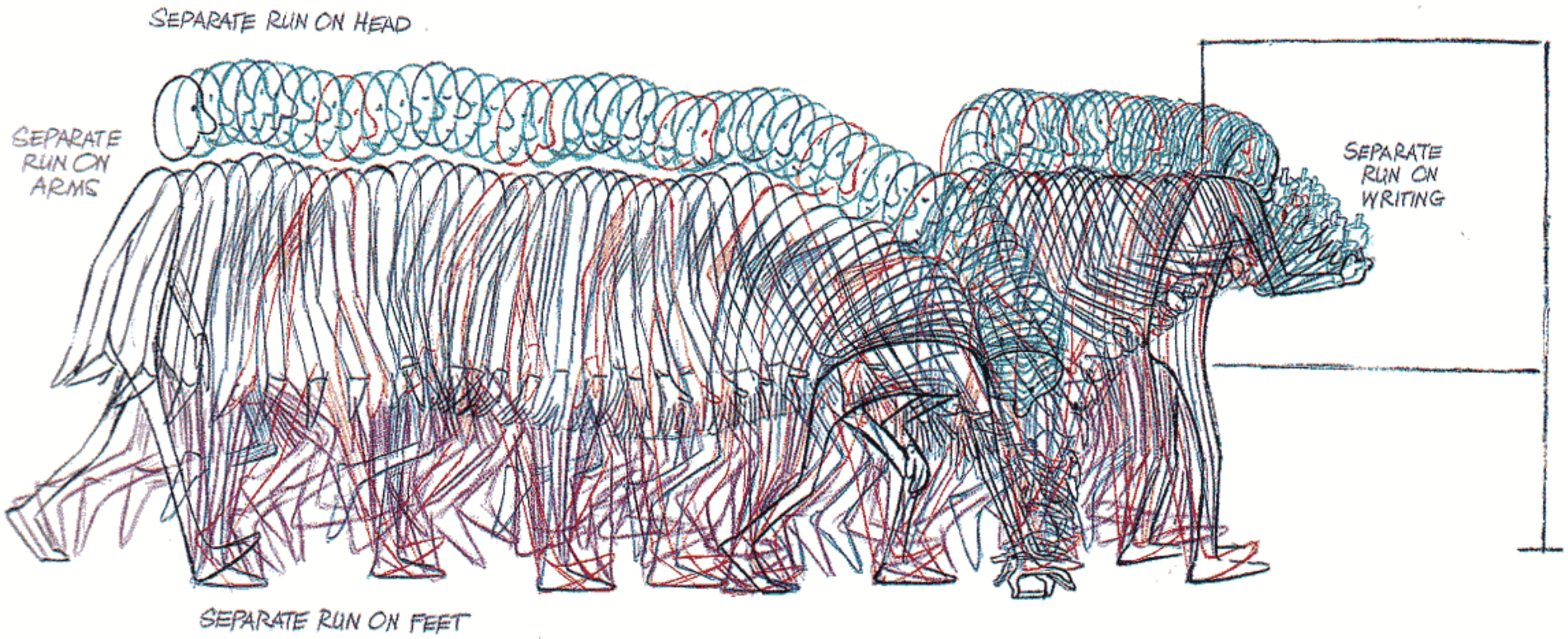
What next?

We'll break it down, lightly sketching in our passing positions or 'breakdowns'. We won't get fancy about it now – the fancy stuff comes later in the book. For now, we'll just make the head and body raise up slightly on the passing positions of the steps – like it does on a normal walk.



We'd probably have numbers on the drawings by now, and when we test it, we've got three or four positions for every second – so it's easy to see what our timing is. And to make any adjustments. And if the director wants to see how we're doing – it looks almost animated.

Now we'll make straight ahead runs on the different parts – using our extremes and breakdown positions as a guide – and altering them, or parts of them, if we need to as we go along. Take one thing at a time and animate it straight ahead.



Maybe he's mumbling to himself, or maybe he's talking – maybe his head just wobbles around with self love. Whatever it is, we'll treat it as a separate straight-ahead run, working on top of what we already have.

We'll make another straight-ahead run on the arms and hands. Maybe they'll swing freely in a figure eight or a pendulum movement; or maybe they hardly move before he reaches for the chalk. Maybe he pulls up his pants as he moves along – or scratches or snaps his fingers nervously, or cracks his knuckles. When we arrive at our key, we might rub out the arm and alter it to suit our arm action. Or delay his head. Or raise it early to look at the board.

We can do lots of interesting things with the legs and feet, but for now we just want them to function smoothly. (I'm avoiding the problem of weight at this stage because the up and down on the head and body that we have at the moment will be adequate for now, and the figure won't just float along.)

When he writes on the board, we'll treat that as a separate run. If he has long hair or a pony tail, we'll do that as a separate straight-ahead run. His clothes could be a separate run, baggy pant legs following along. If he'd grown a tail, that would be the last thing we'd put on.

I've shown these things in different colours to be as clear as possible. In my own work I sometimes use different coloured pencils for the separate runs – then pull it all together in black at the end. I was delighted to find that the great Bill Tytla often used colours for the separate bits, then pulled them all together afterwards.

To recap:
Having made the keys, put in the extremes, then put in the breakdowns or passing positions.
Now that we've got our main thing – we go again, taking one thing at a time.

First, the most important thing.

Then, the secondary thing.

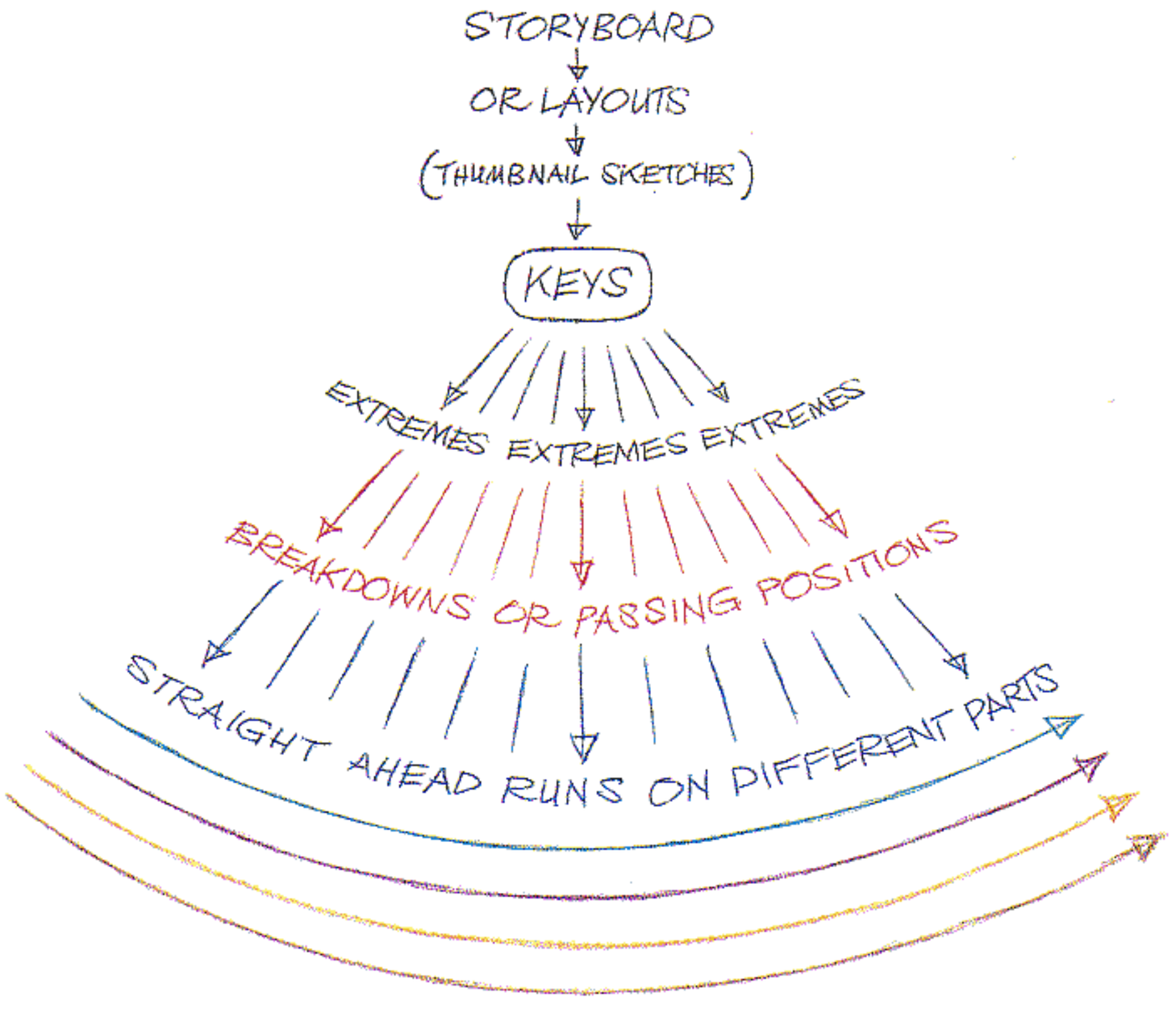
Then, the third thing.

Then, the fourth thing etc.

Then, add any flapping bits, drapery, hair, fat, breasts, tails etc.

The general principle is:
After you've got your first overall thing – go again. Do one thing at a time (testing as you go along). Then pull it all together and polish it up. Make clear charts for the assistant to follow up or do it all yourself.

It's like this:



Of course, you can work any way you want. There are no rules – only methods. You might feel like ignoring all of this and just work straight ahead or work from pose-to-pose, or start one way and switch to the other – why not?

What's to stop us re-inventing the wheel? Lots of people are busy doing it. But on the other hand, why bother?

This method of going at it was developed through concentrated trial and error by geniuses and it's a wonderful basis on which to operate. Having used just about every approach going – including no system – I've found this is the best working method by far. Get it in your blood-stream and it frees you to express yourself. Use this technique to get past the technique!

Milt Kahl worked this way. Near the end of his life I told him, 'Now that I've been working the same way, I really do think that – apart from your talent, brain and skill – fifty per cent of the excellence in your work comes from your working method: the *way* you think about it, and the *way* you go about it.'

'Well . . .' he said thoughtfully, 'you're right. Hey, you've gotten smart!' Milt often told me that by the time he'd plotted everything out this way, he'd pretty much animated the scene – even including the lip sync. Then he'd finish putting numbers on the drawings, add bits and make little clinical charts for the assistant – easing things in and out. He complained he never really got to animate because when he'd finished plotting out all the important stuff – it *was* animated. He'd already done it.

I rest my case.

TESTING, TESTING, TESTING...

I always use the video to test my stuff at each stage – even the first scribbles – time them and test them. In the 1970s and 80s, Art Babbitt used to get mad at me for it – 'Goddamit, you're using that video as a crutch!' 'Yes,' I'd say, 'but is it not true that Disney first instituted pencil tests and that's what changed and developed animation? And don't you always say that pencil tests are our rehearsals?'

Assenting grunt.

'And what's the difference between rushing a test in to the cameraman at the end of the day when he's trying to get home, and if he does stay to shoot it, hang around the next day till the lab delivers the print and mid-morning interrupt the editor, who's busy cutting in the main shots, and then finally see your test – when we can use today's video and get a test in ten minutes?'

Art would turn away, 'I am not a Luddite.' (Machine wreckers protesting the Industrial Revolution.)

Whenever Ken Harris had to animate a walk, he would sketch out a quick walk cycle test and we'd shoot it, pop the negative in a bucket of developer, pull out the wet negative (black film with white lines on it), make a loop and run it on the moviola.

'I've done hundreds of walks,' Ken would say, 'all kinds of walks, but I still want to get a test of my basic thing before I start to build on it.'

Bill Tytla said, 'If you do a piece of animation and run over it enough times, you must see what's wrong with it.'

I actually think the video and computer have saved animation!

Certainly the success of *Who Framed Roger Rabbit* contributed substantially to the renaissance of animation, and having the video to test everything as we went along was crucial to us. We had a lot of talented but inexperienced young people, and with a handful of lead animators we were able to say, 'Take that drawing out, change that one, and put more drawings in here' etc. This enabled us to keep improving everything as we raced along, so we were able to collectively hit the target.

Milt always said he would never bother to look at his tests. 'Hell, I know what it looks like – I *did* it!' He would wait to see several of his shots cut together in a sequence but only to see 'how it's getting over'.

But that was his way. I have never reached that stage and probably never will. I test everything as I go along and it really helps. We're building these performances, so why not test our foundations and structure and decorations as we proceed? And since it reveals our mistakes – mistakes are very important since we *do* learn from our mistakes – we make our corrections and improvements as we build.

Of course, at this stage I wouldn't have a problem routining my way through a job without testing – but why?

The video or computer is there, so let's use it.

An interesting thing I've noticed is that when animators get older their perception of time slows up. They move slower and animate things slower. The young guys zip stuff around. So, the video is a useful corrective to us old bastards. And young ones when it's *too* fast.

Before we dive into walks and all the articulation stuff, there are some other important camera techniques we should know about.

The X-SHEET

On the next page is a 'classic' exposure sheet called the X-sheet or dope sheet – the first sight of which is guaranteed to put any beginner or artist off the whole business. When I was a kid and first saw one of these I thought, 'Oh no, I don't want to be an animator anymore. I'll just make the designs for other people to move around.'

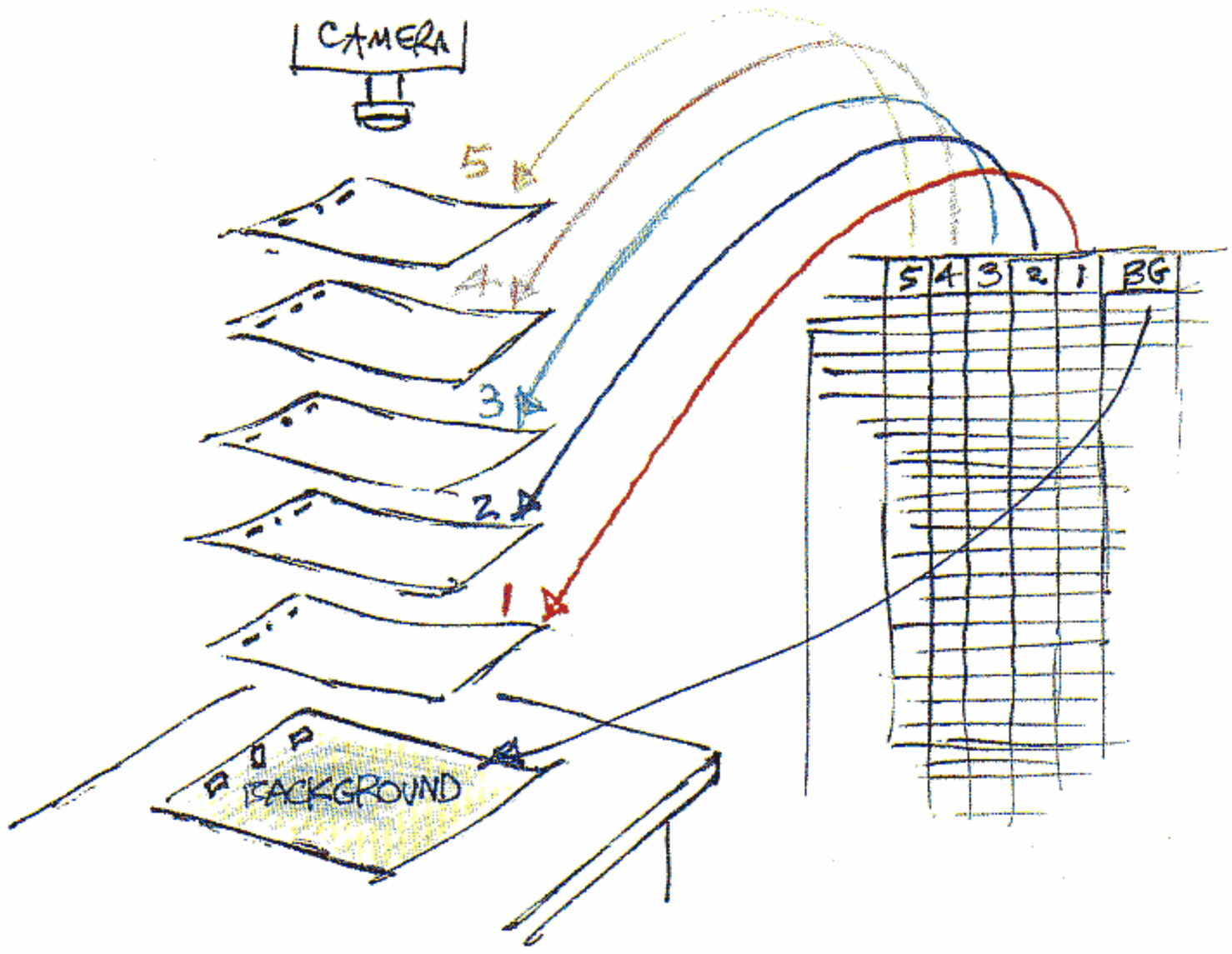
Actually, it's awfully simple when you make friends with it.

It's just a simple and efficient form where animators write down the action and dialogue (or music beats) for a scene or shot – plus the information for shooting.

Each horizontal line represents a frame of film.

The columns 1 to 5 show five cel levels of animation we can use if we need them. (Usually you need just one or two.)

ACTION	DIAL	5	4	3	2	1	B G	CAMERA



The ACTION column is for us to plan out our timing – how long we want things to take.

The DIAL column is for the measurement of the pre-recorded dialogue and sometimes the breakdown of music into beats etc.

This 'classic' X-sheet is designed to hold 4 seconds of action (1 second = 24 frames).

It has darker lines to show the footage, which is 6 feet of film (1 foot = 16 frames). Many animators always number the footage going down the page.

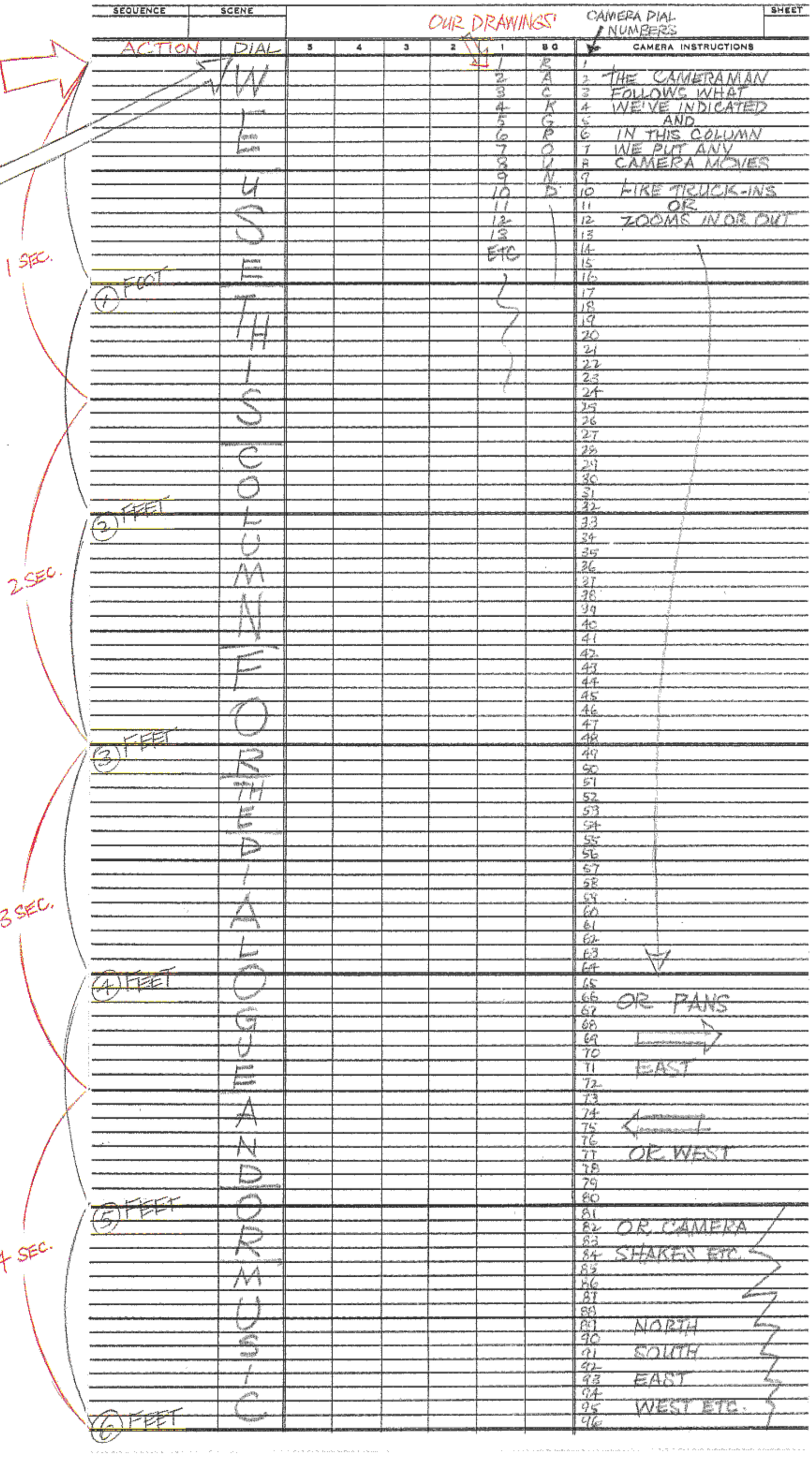
I've also written in the camera dial numbers – the frame numbers in the camera column.

Some animators time things out by thinking in seconds. Others think in feet = 2/3 of a second.

Ken Harris thought in feet and would tap the end of his pencil every foot. I think in both seconds and feet, but seconds is easier for me.

Also, you can think in 1/2 seconds = 12 frames to a half second. That's march time, which is quite easy.

(Computer animators please bear with me here – you obviously have your own systems of timing.)



We'll plan out the action using the action column.

Ken Harris always said, 'Come on, now, you can have fun doing the drawings later, but do the important part first – time it all out.'

So we'd use a metronome or a stopwatch and I'd act it out several times, and we'd mark down on the sheet where things would happen.

Let's take our man walking over to pick up the chalk:

We've got him taking five steps to reach the chalk.

When I act it out, the first two steps are leisurely – 16 frames long (2/3 of a second).

Then during step 3 he sees the chalk, and this step is slightly quicker – 14 frames.

His fourth step is quickest – 12 frames.

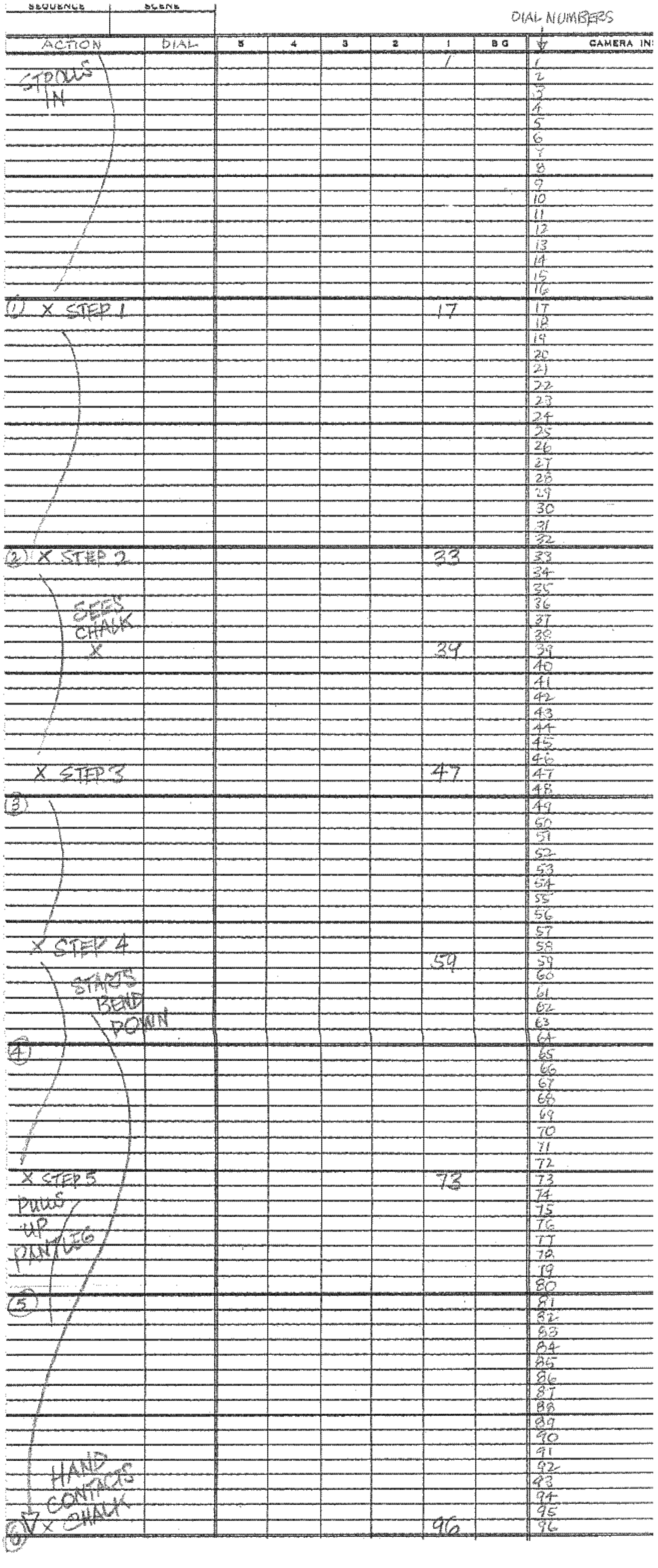
On step 5 he slows up slightly – 14 frames and he's already started bending down, which takes over 2 feet till his hand contacts the chalk.

I've got him tucking up his pant leg above the knee as he goes down – which takes 8 or 10 frames.

Of course, we can change all this as we work, but this becomes our guide and the points to aim for as we go along.

Now we can put the numbers of these drawings on the page as I've done here.

Incidentally, although numbers 1 and 96 are keys and we've circled them, we don't circle the numbers on the X-sheet.



The five available 'cel' levels on this X-sheet are there so we can treat each character or element separately.

Why have different levels – why not draw everything on one level?

Answer: You can, but what do you do if you want to change the timing on one or two parts of the action and leave the other bits as they are? However, it's a good idea to try to keep to just one or two levels for simplicity.

If we wish to use all five levels, start with the main action on level 1. Say a man walks in from one side of the screen and a cat walks in from the other. We animate our main action man on level 1, and the cat on level 2, adding a 'C' after the cat numbers: 1-C, 2-C, 3-C etc., so as not to confuse it with the man drawing. The man drawings, or main action, don't need an identifying letter.

If a woman passes in front of them, we'd put her on level 3, adding a 'W' behind her numbers.

If a truck was to stop in front of them, we'd use level 4 for the truck and add a 'T' to the truck drawings.

If it's raining, we'd put the rain drawings on level 5, adding an 'R' after the numbers.

The X-sheet would look something like this:

RAIN TRUCK WOMAN CAT MAN

ACTION	DIAL	5	4	3	2	1	BG	CAMERA INSTRUCTIONS
		1-R	1-T	1-W	1-C	1	BG# 1	1
		2	2	2	2	2		2
		3	3	3	3	3		3
		4	4	4	4	4		4
		5	5	5	5	5		5
TRUCK X		6	6-T	6	6	6		6
STOPS		7		7	7	7		7
		8		8	8	8		8
		etc	etc	etc	etc	etc		9

This system obviously enables the cameraman to stack his levels correctly – working from the bottom up – and take a frame of film with all the numbers across matching the dial number on his camera.

But there is one very important thing here:

ARE YOU A MEMBER OF K·I·S·S?

Keep It Simple, Stupid!

Use simple numerical sequences! Animation is complicated enough without making it any worse.

My years in England taught me that the English just love complexity. A very brilliant friend, who is a top Oxford mathematician, called me up and said, 'We're about to penetrate your principality.' I said, 'You mean you're coming to visit?' 'Indeed.' 'Wow,' I said. 'You just used nine syllables to say what a North American would say in two! Vi-sit!'

We sure used to pen-e-trate-our-prin-ci-pal-it-y with our exposure sheets until Ken Harris joined the team.

They looked something like this:

CAR WINDSHIELD OVERLAY
BABY YAK
YAK RUNNING
TRUCK AND ZEBRA

ACTION	DIAL	5	4	3	2	1	BG	CAMERA INSTRUCTIONS
			WOL-1	BY-1	Y2B-1	TxB-1	BG-1A	1
			|	|	Y2B-2	TxB-1A	|	2
			|	|	Y2B-2½	TxB-2	|	3
			|	BY-2	Y2B-3	|	|	4
			|	|	|	TxB-2½	|	5
			|	|	Y2B-4	TxB-2¾	|	6
			|	BY-3	Y2B-4A	|	|	7
			|	|	Y2B-4B	TxB-3	|	8
			|	|	Y2B-4C	TxB-3A	|	9

Can you imagine trying to make any changes or improvements when you're weighed down with numbers like this? It would be like re-numbering the *Encyclopaedia Britannica*.

Not only were our numbers complicated, but our action went from two frames to three frames then to four frames, bumping along then back to two frames etc., giving a jerky stop-start result to the movements.

When we had just one level of action – say it's a tiger – everyone would call the drawings T1-1 and T1-2 and T1-3 etc. One day I asked, 'Why are we doing this?' The answer from the head of the department came, 'So we know it's a tiger.' 'But we can *see* it's a tiger! Why not number it simply 1 and 2 and 3?' Answer: 'That will just confuse the painting department.'

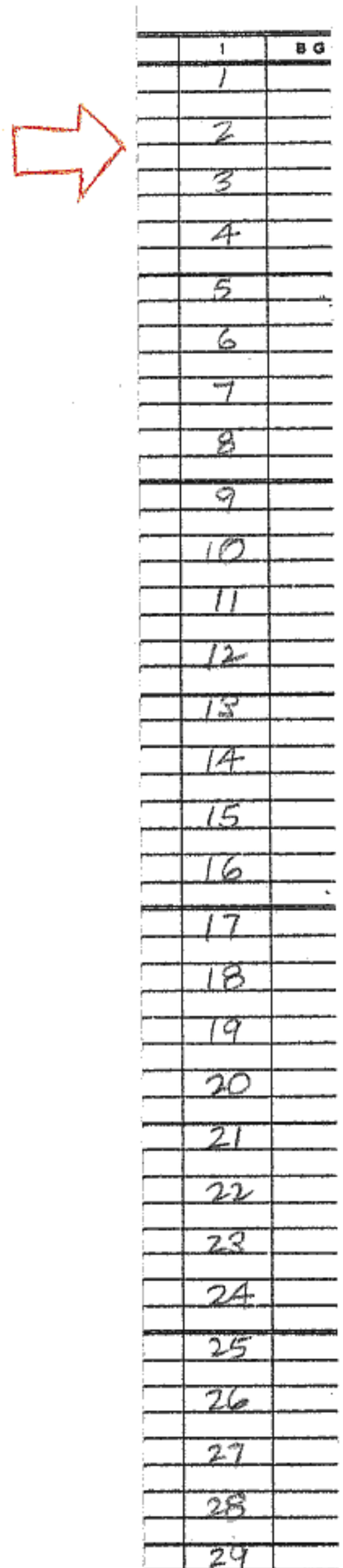
And it's not just the English who can overcomplicate! I once saw the working sheets of an established American animator who's written two books on the subject, and his numbers looked like this:

All smudged and rubbed out and re-entered . . .

30 A	104
BX-31x	104⅛
BLANKS	104¼
384	104½
BLANK	104¾
(10)	104⅞
11	X-1
11-B	X-1A

CAME THE DAWN...

And then the first real live master animator arrived to work with us. On his first day Ken Harris lightly pencilled in simple numbers going down the page on 'twos', that is, two exposures per drawing. That was the first time I ever saw anyone go down the page on twos!

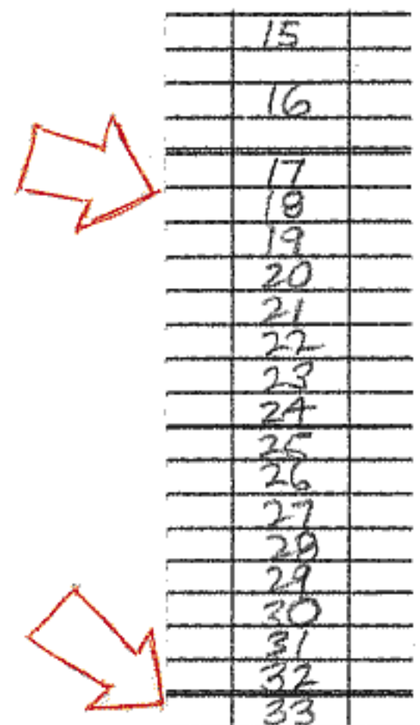


Ken usually planned his action on twos: twelve drawings per second, shooting each drawing for two exposures, instead of working on 'ones', one exposure for each drawing, which is twenty-four drawings per second – twice the amount of work.

Ken was from Warner Bros – used to tight budgets; the animators had to produce an average of 30 feet (20 seconds) a week or be fired.

Since most normal actions work well on twos, Warner animators tried to avoid putting actions on ones.

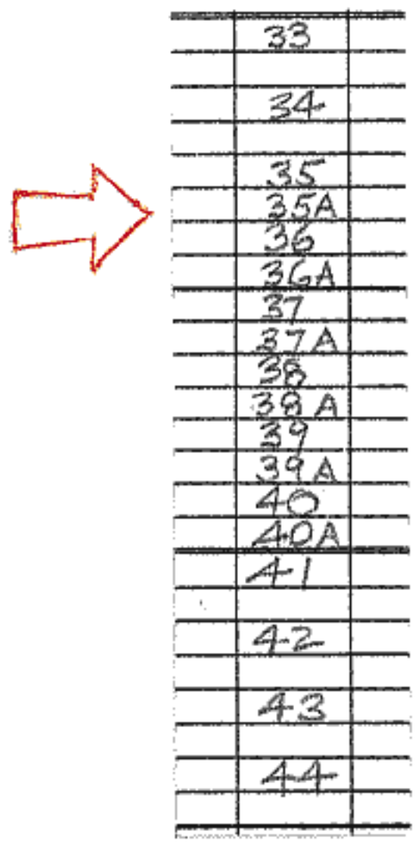
When he needed to go onto ones for fast actions (runs etc.), he'd just number it in on ones. i.e.



Then he'd go back on to twos

'Ok, Ken, but what do you do when you've worked it out on twos, but you find you want to add in ones to smooth it out more?'

Answer: Add 'A' drawings.



Great, so now all this TXL-1 and PP-2 3/4 stuff goes out the window. We're not weighed down with meaningless technology. It becomes simpler to work and easy to make changes and improvements and we start getting better.

But there is an even better and simpler system!

The BEST NUMBERING SYSTEM

Milt Kahl called it his system, but I suspect that the good guys at Disney all discovered it around the same time – it's so logical.

Just use the camera dial numbers for the drawings. Go down the page on twos but use odd numbers.

Then if we do need to smooth something out or we need very fast action, we just add in the ones.

Milt told me, 'Whenever I see my drawings with odd numbers on them, I know I'm on twos and when I see even numbers, I know I'm on ones.'

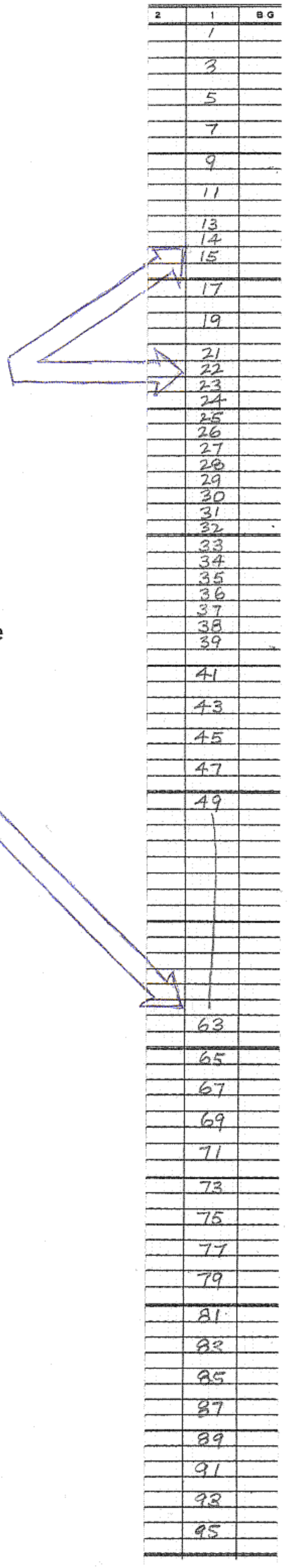
I asked, 'What do you do when you want to get into a hold – just indicate you're holding that drawing with a line? And when you come back in do you start again on the dial number?'

Answer: 'Yes. Come back in on the dial number.'

Not only does this make it easy for shooting, but it's easier when you *do* need several levels of action. We've now got the same dial numbers horizontally across the frame of film.

5	4	3	2	1	
1-E	1 D	1-C	1-B	1	1
			2		2
3	3		3	3	3
		4-C	4		4
5	5		5	5	5
			6		6
7	7	7-C	7	7	7
			8		8

CAMERA DIAL NUMBERS

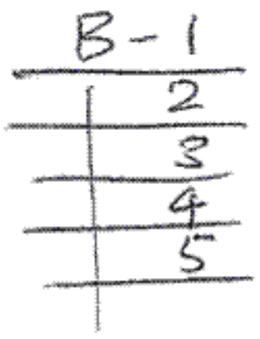


So, just go down the page with odd numbers – on twos – and drop in ones when you need them.

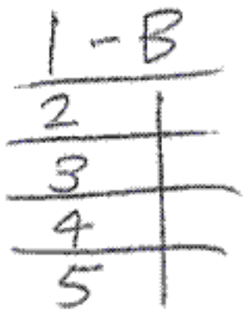
It's simpler and frees you to concentrate on the work. Boy, did my output and quality improve!

There are a couple of other things to mention before we start in on the great argument of ones versus twos.

There's a very important thing I learned from Ken Harris. I know it sounds crazy – but if you have a series of B drawings – don't put the B in front of the number. i.e.



Put the B *after* the number. i.e.

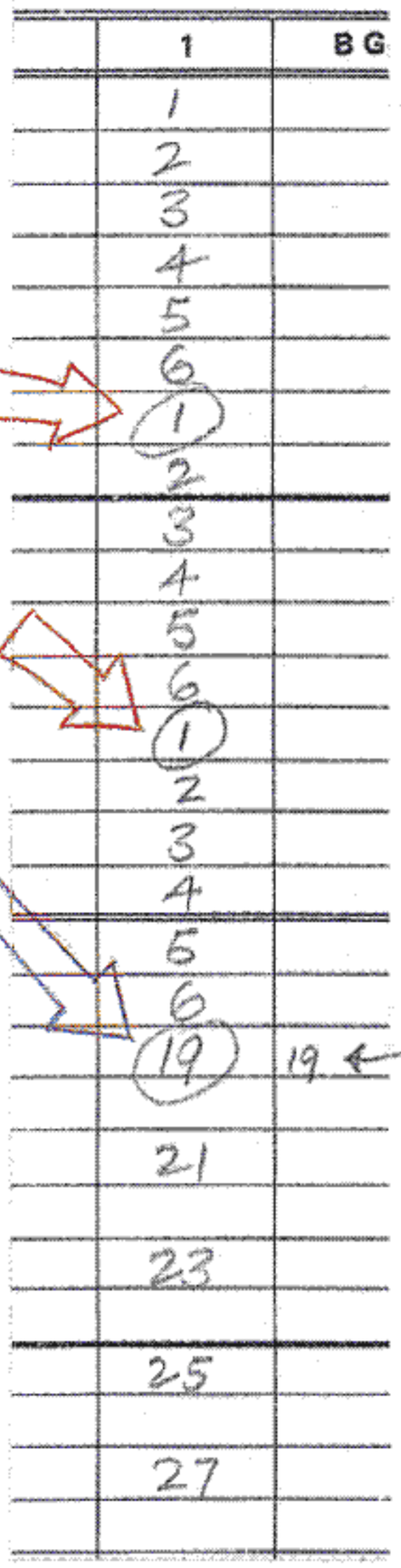


We want to think as simply as we can. Ken said, 'Look, you don't call me *Mister* Ken. Put the letter behind so all you think of is the numbers.' Put any formality or whatever behind. It may seem mad but it helps you do more work. Try it. All we're really doing is thinking of series of numbers from 1 to 10. Anything to keep it simple. Nobody could figure out how this sick old man could produce so much work – and of such high quality. He just kept everything as simple as could be.

Two more things:

The *only* time you should circle a drawing on the X-sheet is when a cycle of action re-starts – when we're repeating the same set of drawings. We circle drawing (1) to alert the cameraman that it's out of sequence with the normal dial numbers.

Then we circle the drawing in the correct dial number when we come back to a normal sequence.



My rule is: The only time you ever put a letter in front of a number is when you have an overlay cel (of something in front of the characters).

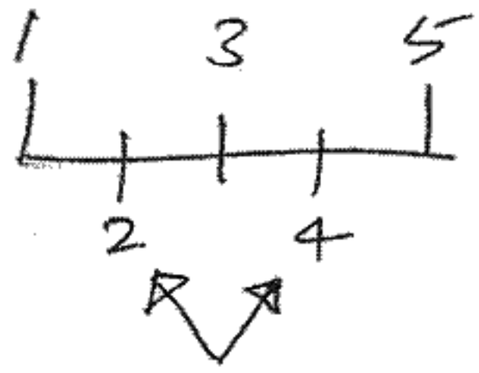
Then you put O-1 (for the overlay cel) or for a held cel (somebody's stationary feet, for example) and call it H-1.

TABLE HELD
OVERLAY FEET ACTION

3	2	1	BG
O-1	H-1	1	
〃	〃	2	
〃	〃	3	
〃	〃	4	

The GREAT ONES and TWOS BATTLE

Some people always complicate the numbering by calling ones and twos, 'singles' and 'doubles'. In fact 'singles' is from a 1940s term for inbetweening when the animator did drawings 1 and 3 and 5, made an evenly-spaced chart and said to the assistant, 'I've left you singles.'



i.e. single in betweens

But when to use ones and when to use twos?
The rule of thumb is – use twos for normal actions and ones for very fast actions. For instance, runs always have to be on ones – normal 'acting' on twos.

Walks can function nicely on twos, but they're going to look better on ones.

Obviously, life is on ones (or whatever speed we film it on), but twos work well for most actions and, of course, it's half as much work as doing it on ones. And half as expensive! Working on ones is twice as much work and expense all the way down the production line.

Apparently, in the early 1930s as Disney's animators got better and better, costs were skyrocketing, and since twos work for most things, they tried to stay on twos whenever they could.

A lot of great animators even say that twos are really better than ones, that ones lead to a mushy result, that broad, fast actions on twos 'sparkle' and adding ones diminishes that vitality. Well, yes, this is true if the ones are just dumb, mechanical inbetweens.

My experience is different. I've found that if you *plan* for ones, the result is usually superior to twos.

I feel that twos are an economic answer to an artistic question. With twos being half the work, everybody gets to go home on time, and why would *I* make a case for ones? Hell, I was a studio *owner*.

When I was re-learning all this stuff, I would wait till my animation on ones was traced and painted, then I'd shoot it on ones as planned and then I'd take out every other cel and shoot the rest on twos to see if it 'sparkled' and was better.

In all but one case, ones worked better. The time the twos worked better was when I had an old lady pulling out a doctor's stethoscope from her pocket. The ones produced a very smooth movement.

It worked just fine, but then I removed every other painted inbetween and shot it on twos. It was better on twos! I cannot figure out why – it just was better.
So they're partly right, I guess. But I became addicted to using ones whenever I could – ones seem to make for compulsive viewing and that's what we're after.

Art Babbitt used to nag at me for using ones. 'That's too realistic – one of the things about animation is that it's *not* like life!' But I would often add ones to Art's work when he wasn't looking and it came out better – and *he* liked it better.

Computer animators have everything on ones – with perfect inbetweens – and it hasn't diminished the appeal of their work – rather the reverse. And twos tire the eye after a few minutes.
I feel that ones are twice as much work, but the result is three times as good. Compulsive viewing, easy to watch.

I think my co-animator Neil Boyle said it best :

'Twos work – ones *fly*.'

And Ken Harris, who spent most of his life working on twos, would say to me when I'd be putting ones into his stuff, 'Oh, it's *always* better on ones.'

There's one thing that always makes me crazy. When you have a character animated on twos and the camera is panning with it on ones you get stroboscopic jitter. Either pan with it on twos (not great) or add in single inbetweens so it doesn't strobe!

Some of the really good guys do this. It's a mystery to me. Why don't they add single inbetweens so it doesn't strobe?

Maybe its because a lot of things don't show up on the pencil test. It's when it's coloured in that we see the bumps.

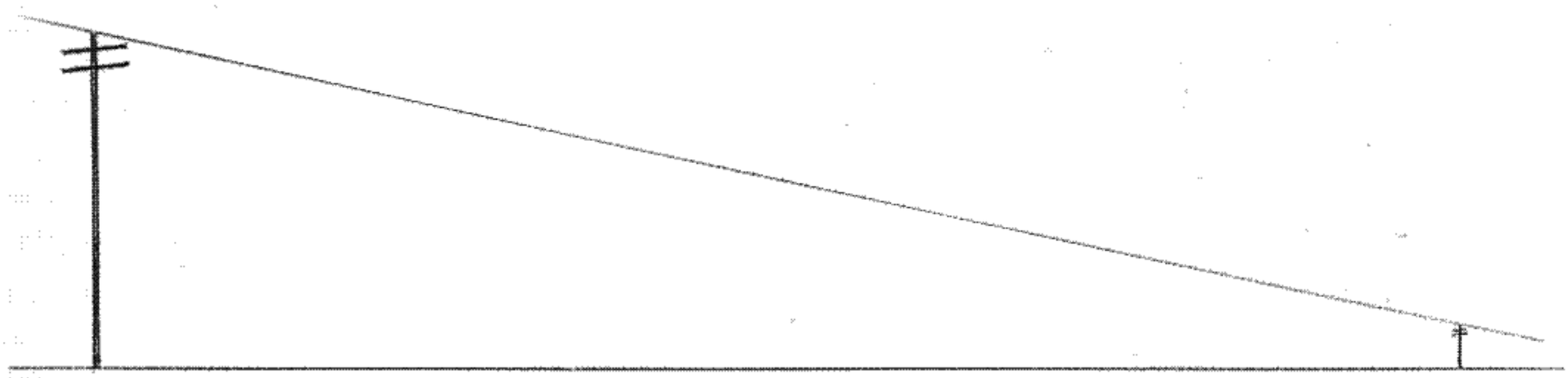
CONCLUSION:

It's a combination of twos and ones. Not only but also.
Normal actions on twos – which is the bulk of our work anyway.
Fast or very smooth actions on ones.
Normal spacing on twos. Far apart spacing on ones.

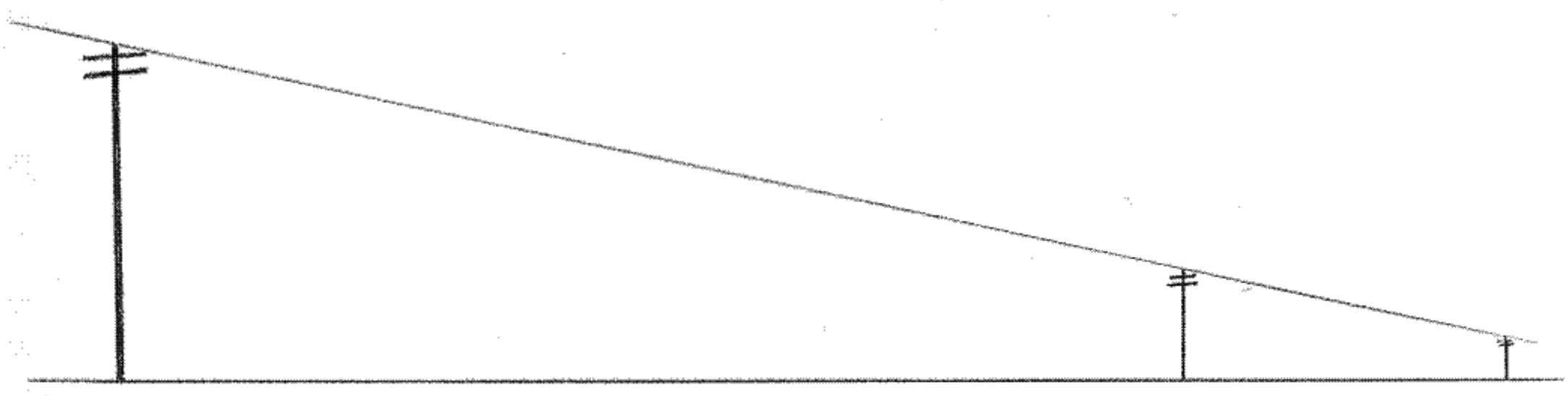
MORE ON SPACING

Somebody once said an animator is something between an artist and a garage mechanic. Here's more nuts and bolts from the garage – but very interesting ones, and it really helps to know them.

Ken Harris showed me this one:



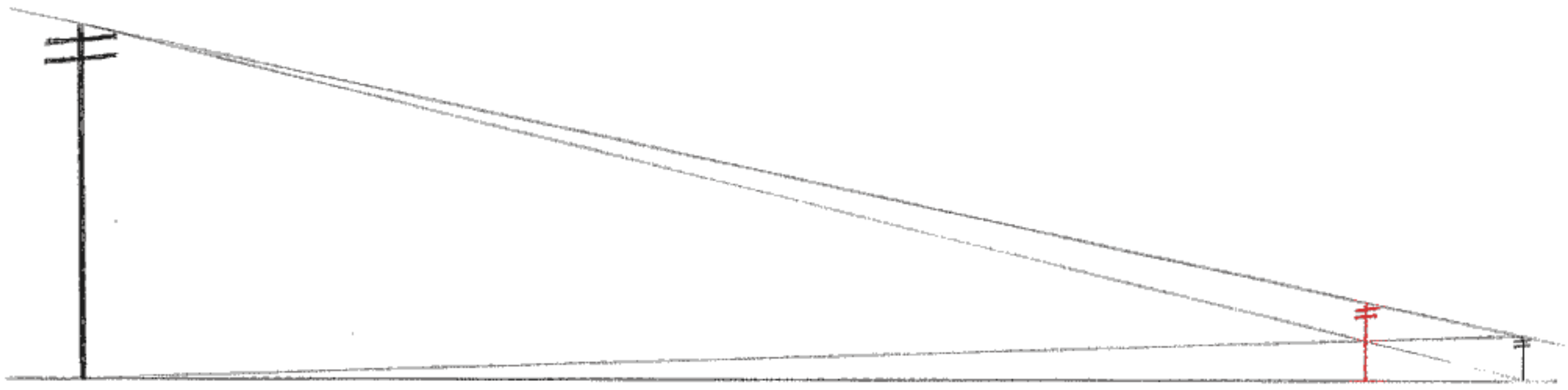
Say we've got a telephone pole moving up quickly in perspective. Where do we put our middle position?



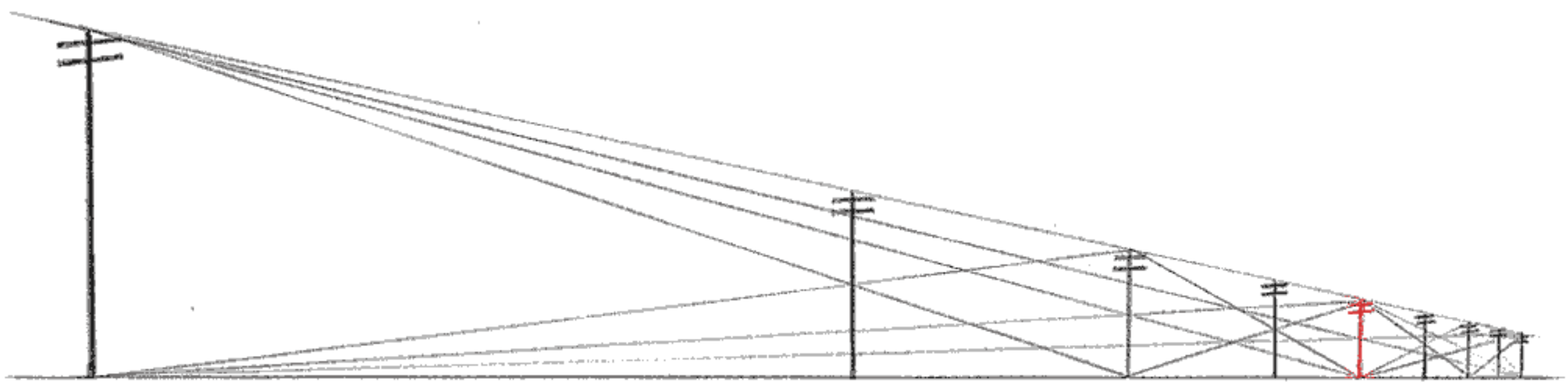
You'd put it in about here, right?

Wrong. Even after fifteen years' experience I got it wrong. And nearly every professional I've asked since has gotten it wrong.

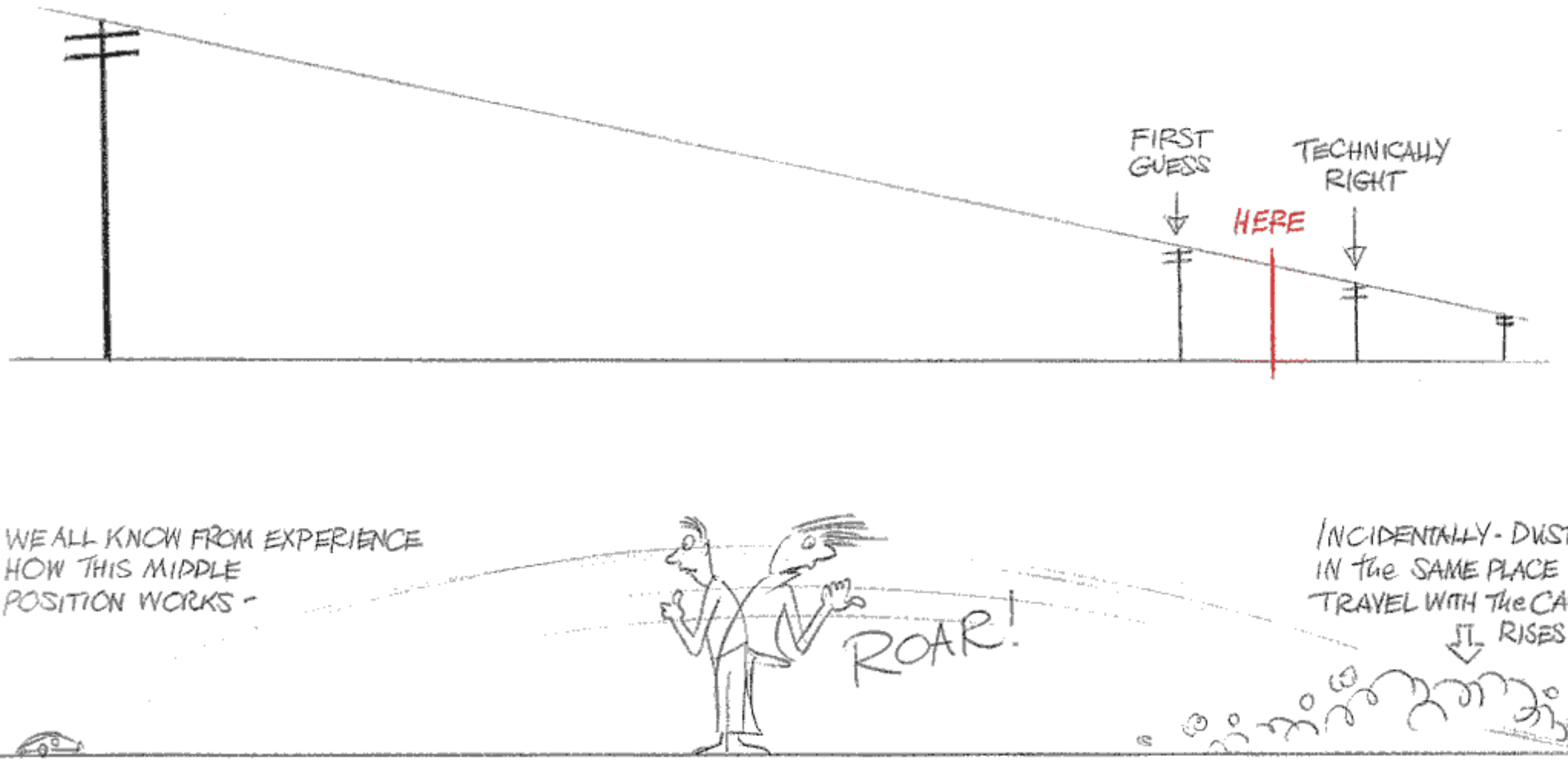
Here's where the middle position is:



Rule in the lines like this and the cross point tells us it's here. At least technically. And just keep doing it:

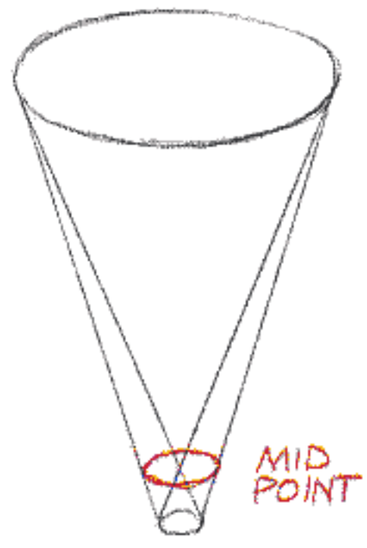


This works well for fast moves. However, for more normal moves it's best to cheat it – split the difference – and come back about half way to where our first guess was. Do that throughout and you'll get a better result.

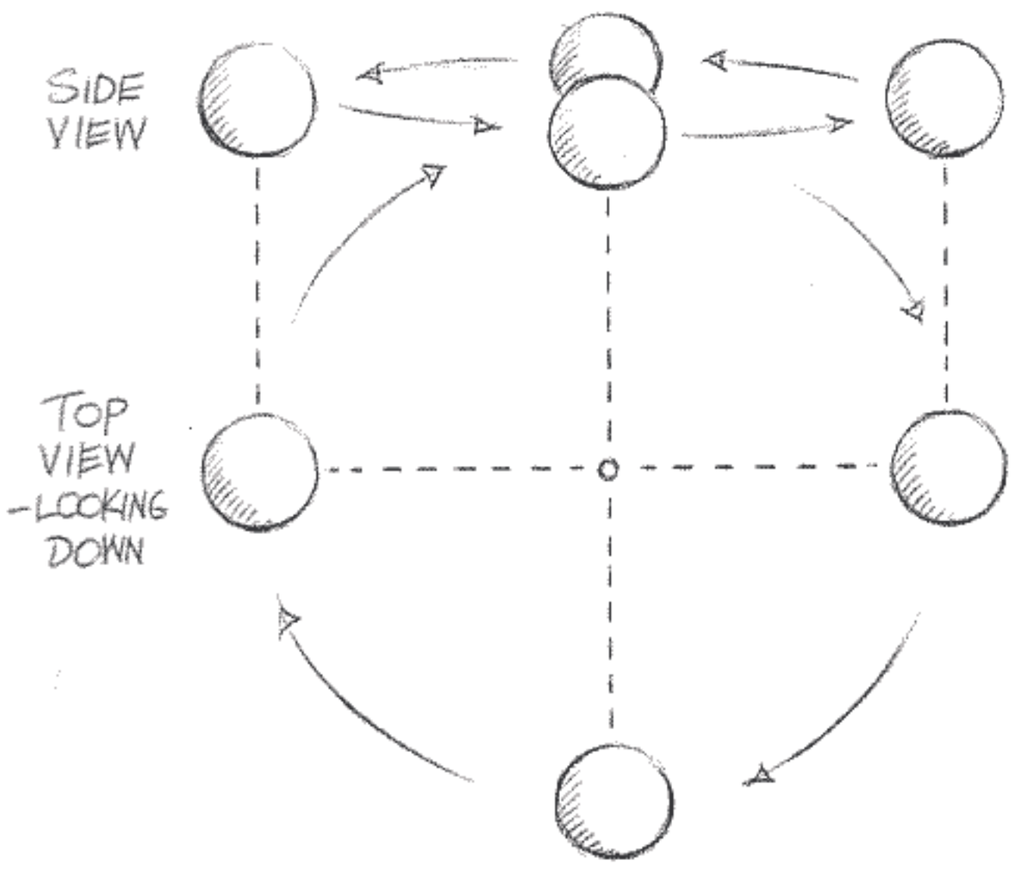


The SAME THING APPLIES TO A FRONT VIEW OF SOMEBODY OR SOMETHING COMING UP AT US - FAST.

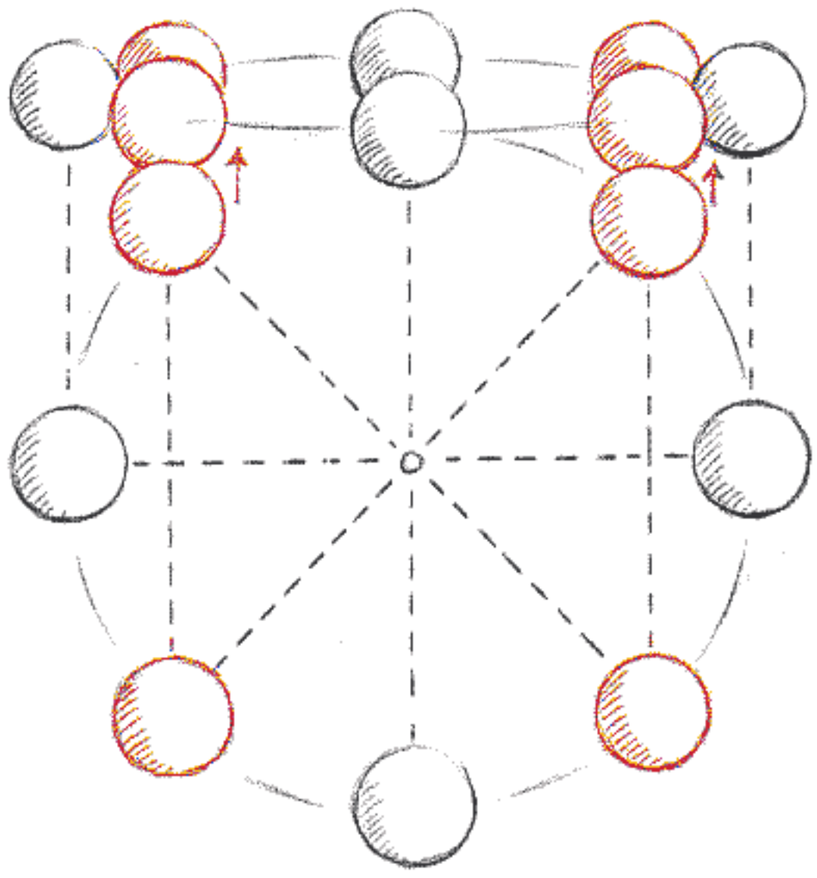
SAY A DISC IS SPINNING UP TOWARDS US -



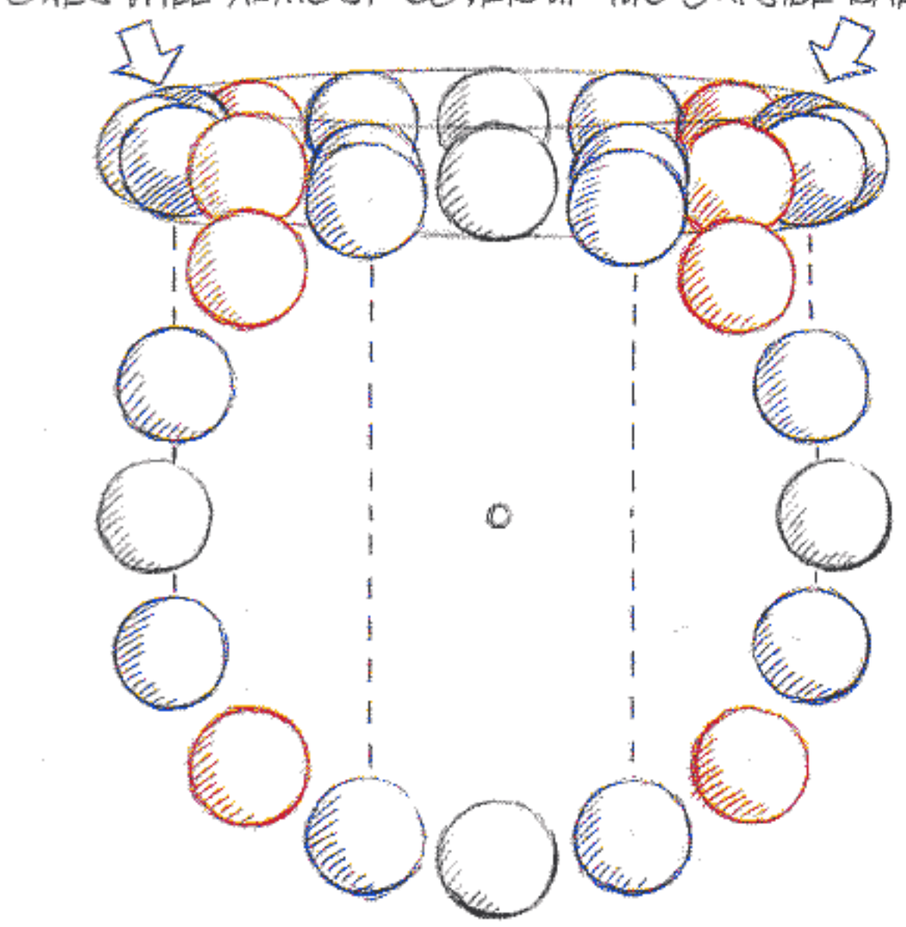
AND TO DO WITH the SAME SORT OF THING: TAKE 4 POSITIONS OF A BALL REVOLVING AROUND A CENTRAL POINT -



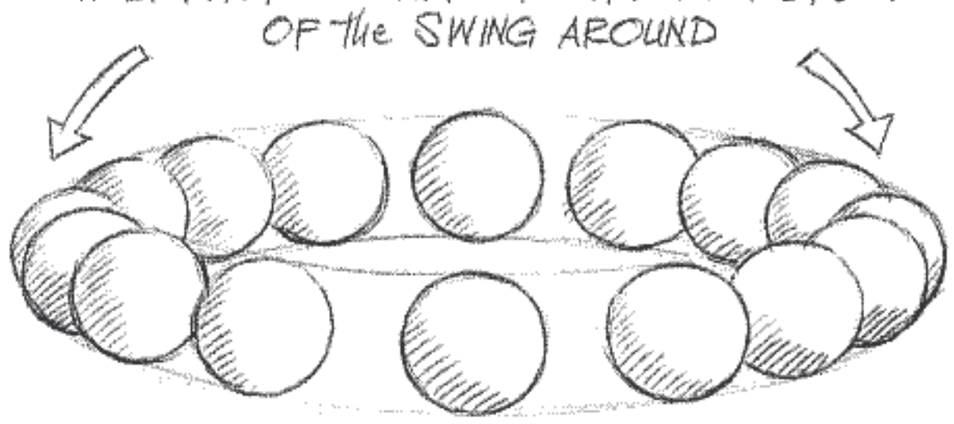
NOW ADD IN the MIDDLE POSITIONS and SEE HOW CLOSE THEY ARE TO the OUTSIDE OF the ARC.



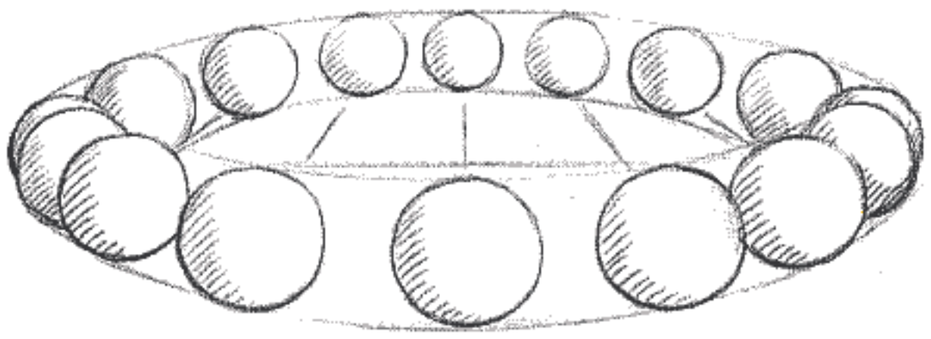
ADD IN the NEXT MID POSITIONS and the FURTHEST ONES WILL ALMOST COVER UP the OUTSIDE BALLS.



The POINT IS THAT the SPACING OF the INBETWEENS WILL CLUSTER AT the EDGES OF the SWING AROUND

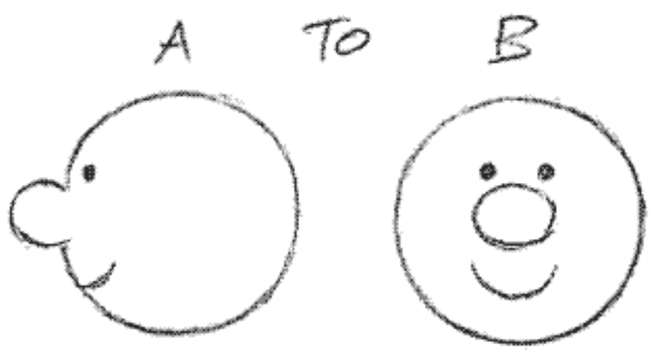


WE CAN INCREASE the PERSPECTIVE BUT IT STILL CLUSTERS AT the EDGES OF the ARC AROUND



So when we're going to turn a head, it's going to be the same kind of thing:

ART BABBITT SHOWED US THIS –



IF WE JUST INBETWEEN IT – IT WILL LOOK LIKE the FEATURES SLIDE AROUND the HEAD WHILE the HEAD REMAINS STATIC –

SO WE DISPLACE THE MIDDLE POSITION TO MAKE IT CONVINCING –

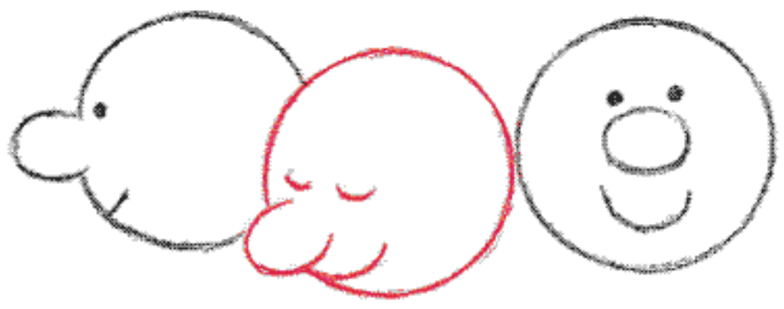
ALSO WE TEND TO LOWER OUR HEAD ON A TURN.

(PULLED APART FOR CLARITY)

Incidentally – on a head turn, Ken Harris showed me this:

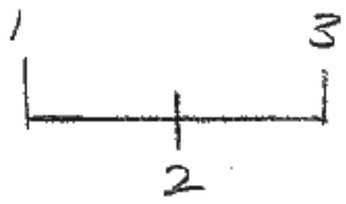
Do it yourself or have somebody else hold up two fingers. Look first at one, relax, then turn the head round to look at the other finger. During the head turn, something interesting will happen. The person will blink. The eye, switching focus from one side to the other, will blink en route. (Unless they're frightened – then the eyes will stay open.)

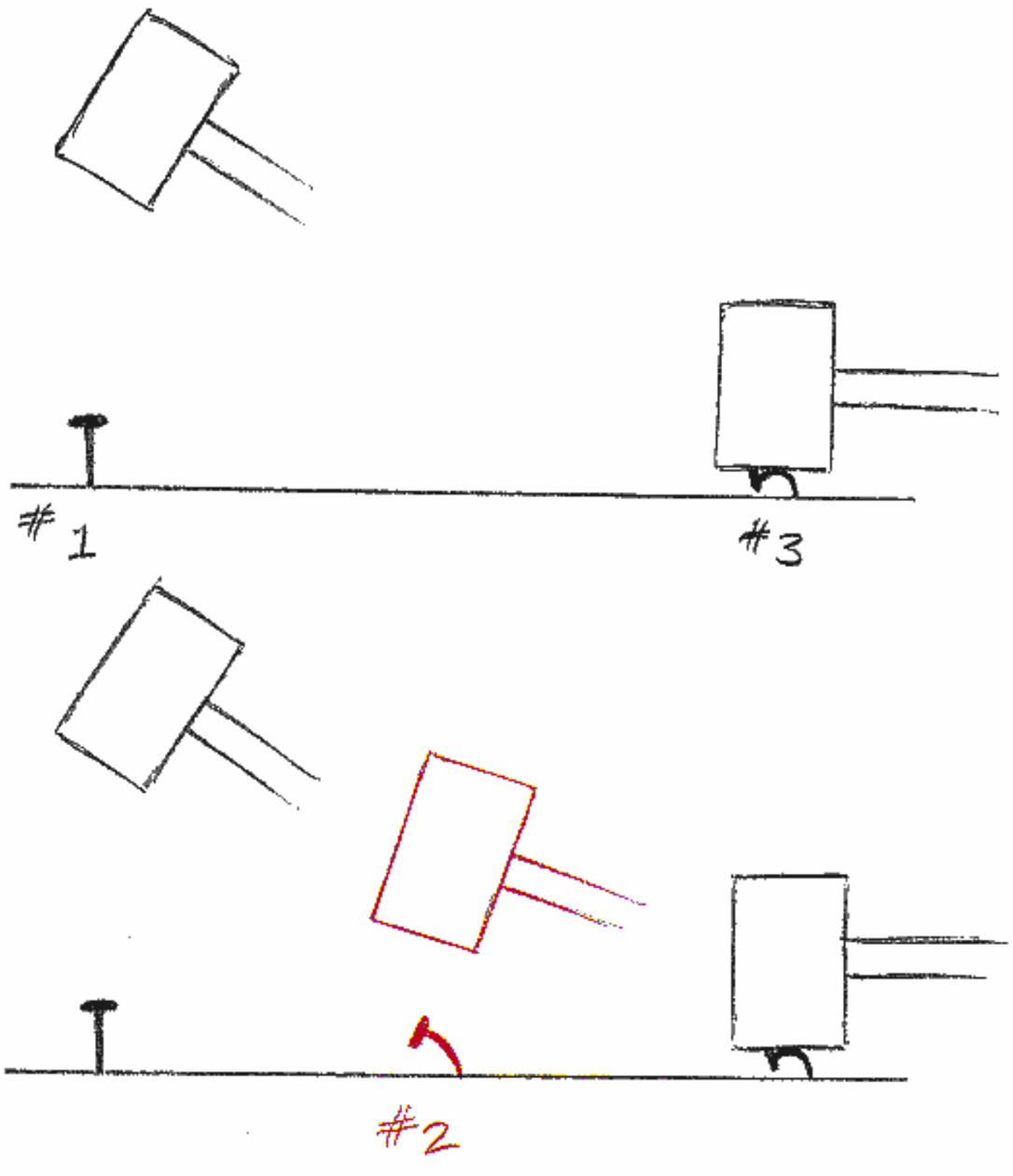
SO WE'LL PROBABLY BLINK DURING the TURN –



CLASSIC INBETWEEN MISTAKES

A MALLET HITS A NAIL
WHICH BENDS -
AND WE WANT ONE INBETWEEN
RIGHT IN THE MIDDLE.

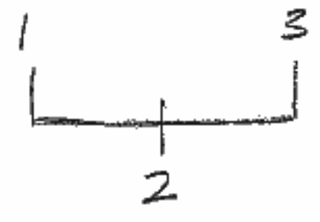


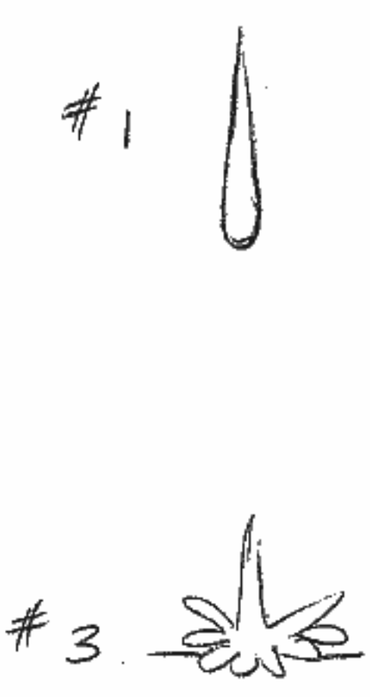


OUR HELPER, WHO IS
PLUGGED IN TO A CD,
PHONE OR WHATEVER,
DOES PRECISELY
WHAT'S REQUESTED AND
PUTS IT RIGHT
IN THE MIDDLE...

"WELL, I FOLLOWED
YOUR CHART."

LATER THE SAME
PLUGGED-IN PERSON
PUTS IN A DROP OF
WATER BETWEEN
THESE TWO POSITIONS.





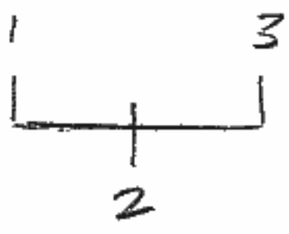
AND PUTS IT
RIGHT IN THE
MIDDLE →
AGAIN

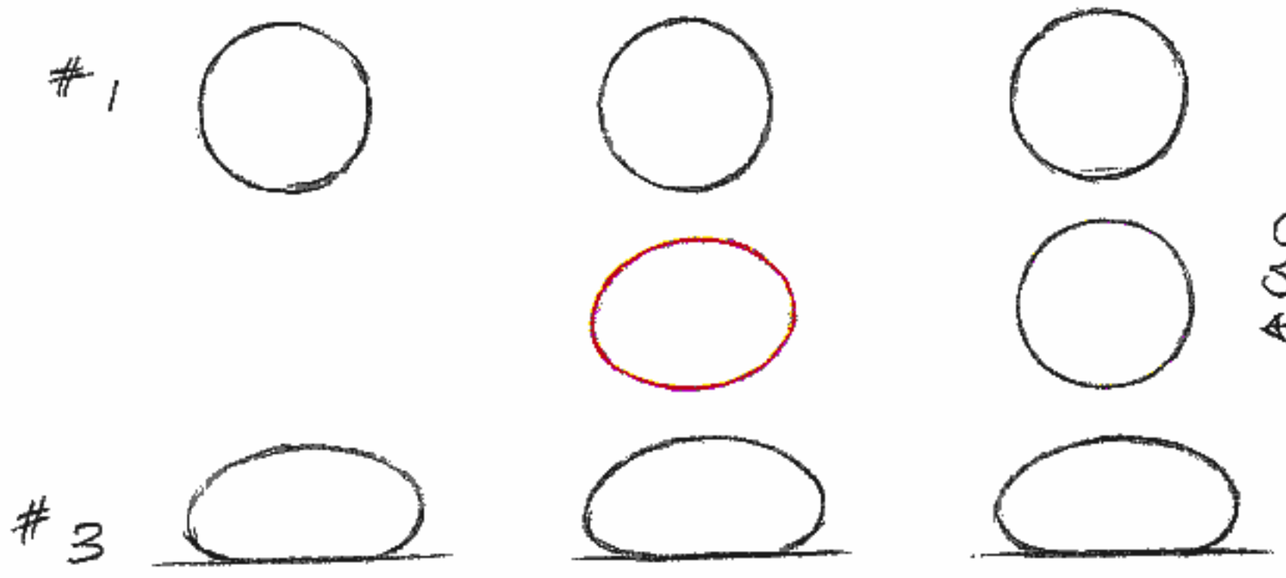
OBVIOUSLY
THE CHANGE
ONLY TAKES
PLACE ON THE
CONTACT.

GOT TO USE
COMMON
SENSE.

IT GOES ON AND ON:

SOFT RUBBER
BALL FALLING -

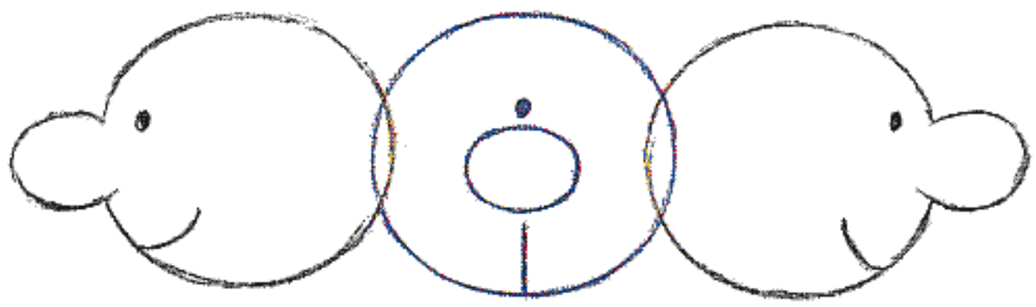




OF COURSE
SHOULD BE..
←

OFTEN WHEN FACED WITH A BREAKDOWN HALF WAY BETWEEN -

WE GET THIS -

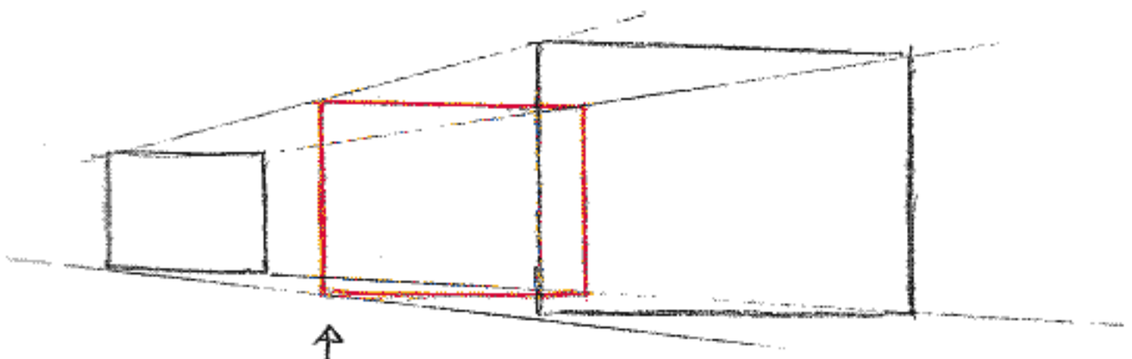


'WELL, I PUT IT RIGHT IN the MIDDLE LIKE YOU SAID'-

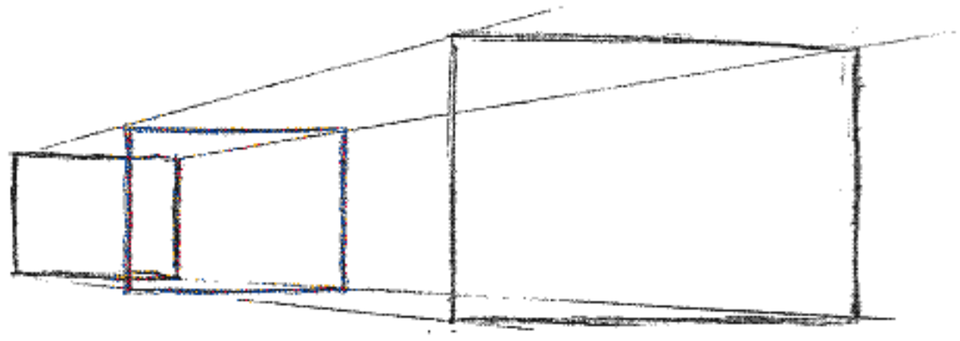
THIS IS RIDICULOUS BUT the EQUIVALENT OFTEN HAPPENS WITH COMPLEX INBETWEENS.

Every **drawing is important. We can't just have brainless drawings joining things up. In one sense there *are* no inbetweens – all the drawings are on the screen for the same amount of time.**

AND, IGNORING OUR TELEPHONE POLE PRINCIPLE...

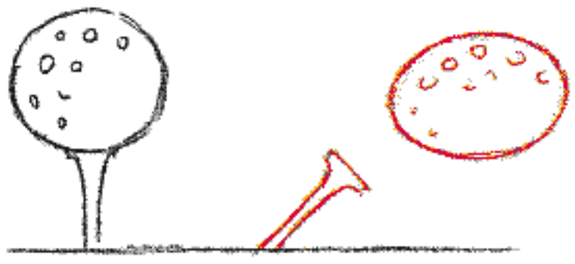


'BUT I PUT IT RIGHT IN the MIDDLE'...

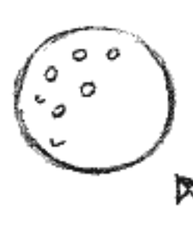


IT'S NOT LINES - GOT TO THINK IN TERMS OF MASSES!

WHEN A GOLF CLUB HITS A HARD GOLF BALL-

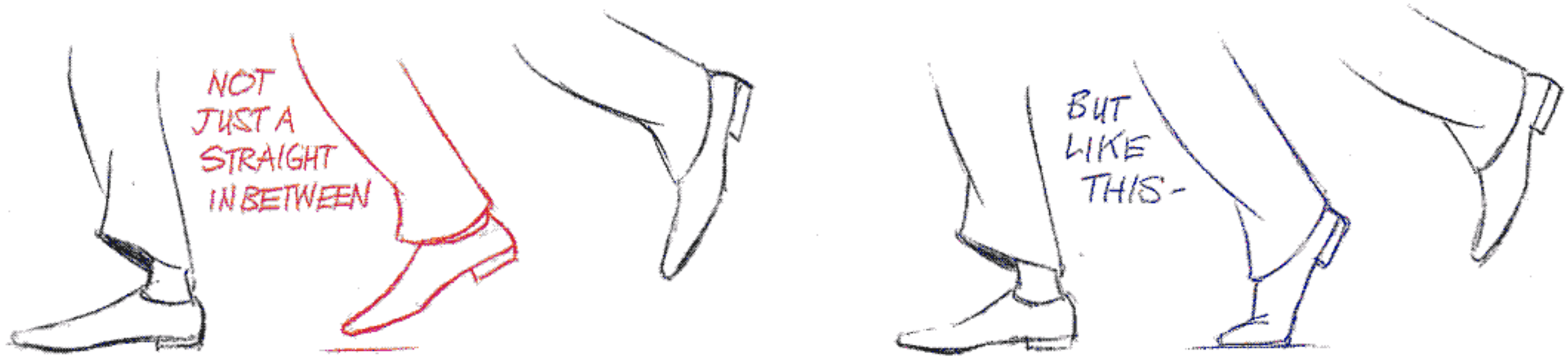


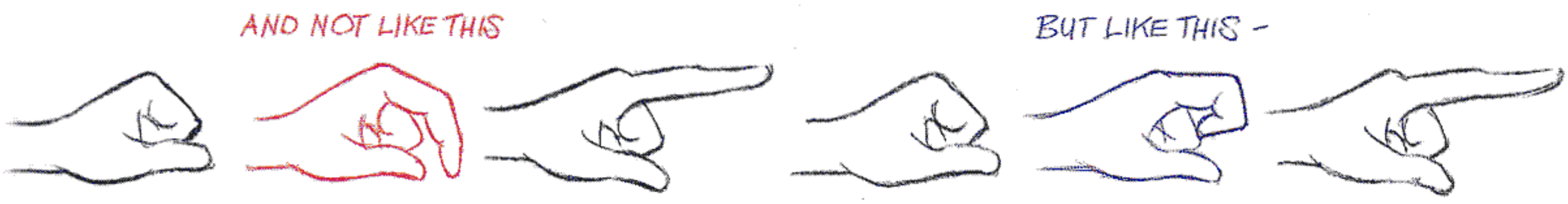
AT the MOMENT OF IMPACT WE MIGHT DISTEND the SHAPE



BUT IT WOULD GO BACK TO IT'S OWN SHAPE WITHIN VERY FEW FRAMES.

Ideally the inbetweener should understand and be able to complete eccentric actions.

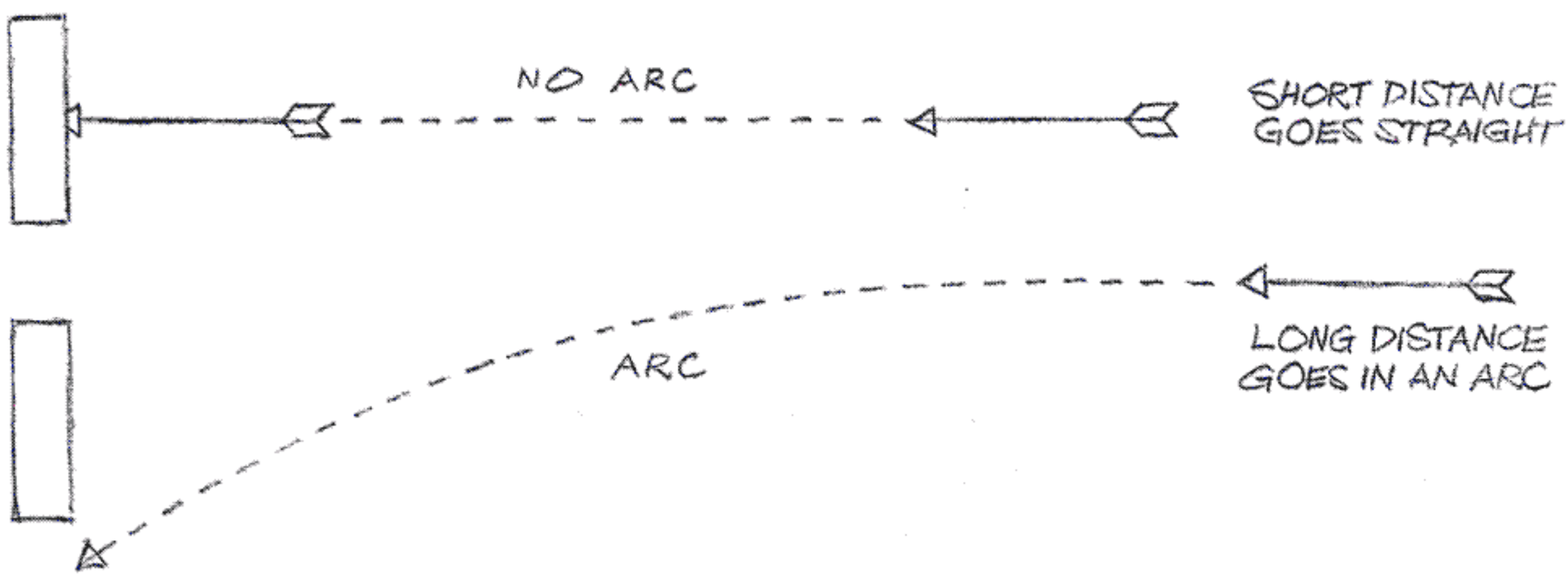




WATCH YOUR ARCS

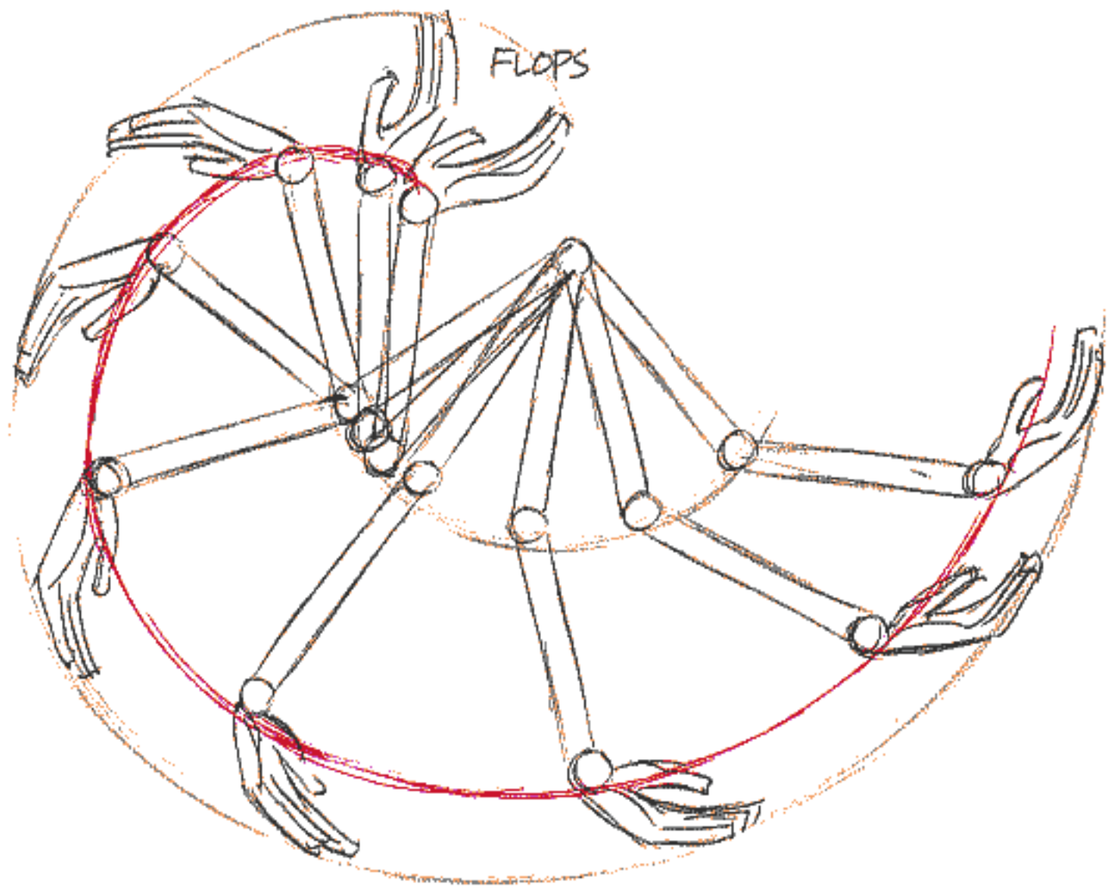
Most actions follow arcs. Generally, an action is in an arc. Most of the time the path of action is either in a wavelike arc or in a sort of figure 8:

But sometimes it is angular or straight. Straight lines give power.

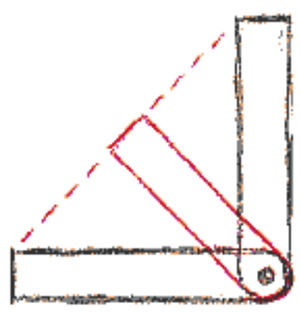


THE ARC OF THE ACTION GIVES US THE CONTINUOUS FLOW

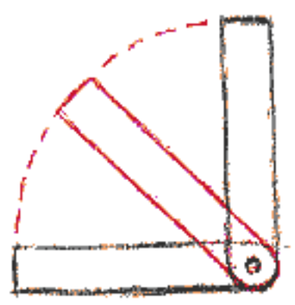
IN THIS ARM SWING THE WRIST IS LEADING THE ARC AND THE HAND DRAGS.



AND OF COURSE THE BONES DON'T SHRINK AND GROW - THEY MAINTAIN THEIR LENGTH

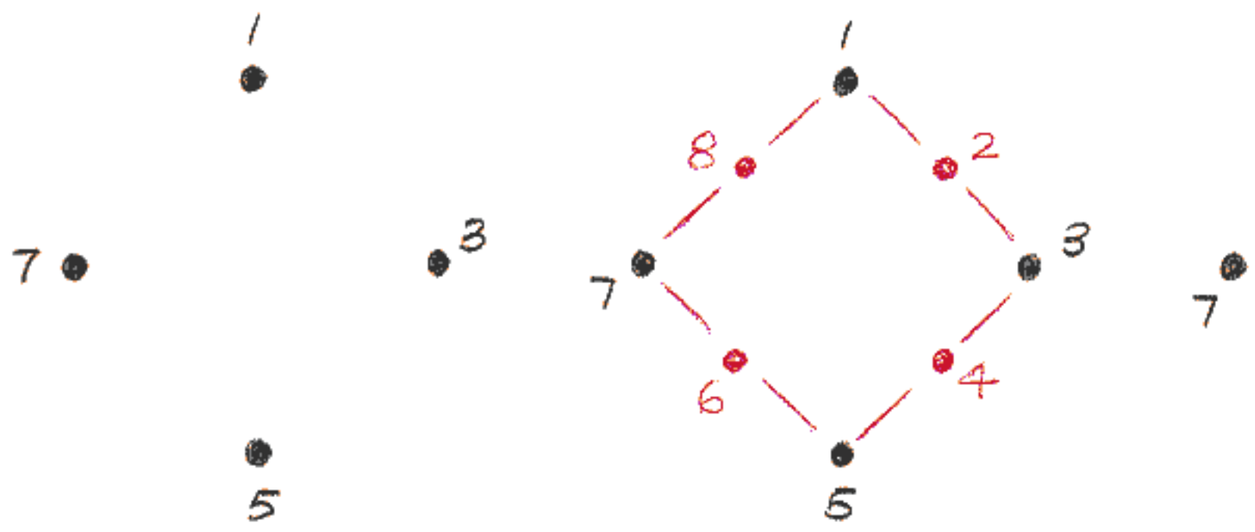


OBVIOUSLY WRONG

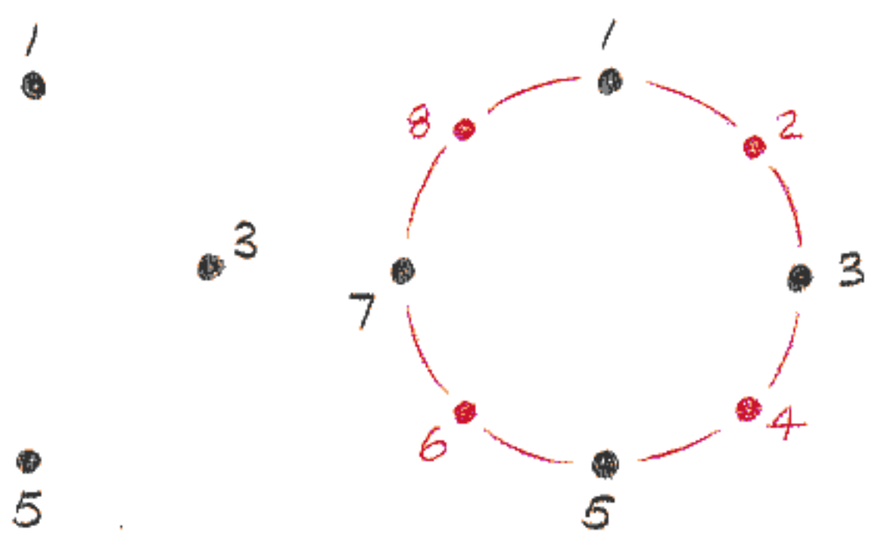


OBVIOUSLY RIGHT

THE ARC IS SO IMPORTANT! SAY WE HAVE POSITIONS 1, 3, 5 AND 7 -



DO WE JOIN THEM UP LIKE THIS?



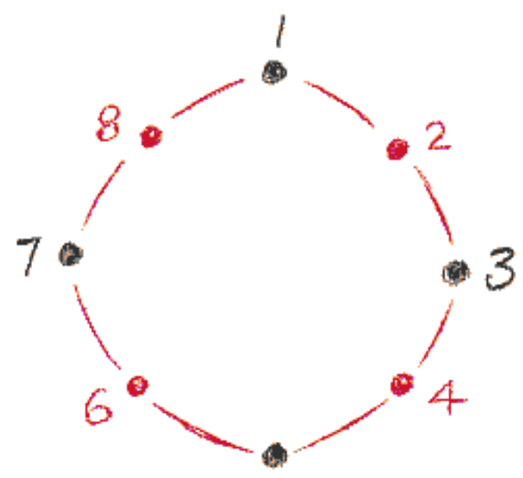
—OR LIKE THIS?

WE'LL GET AN UTTERLY DIFFERENT RESULT - SO WE ROLL OR FLIP THE DRAWINGS TO MAKE SURE WHAT THE ARC OF THE ACTION OR PATH OF ACTION SHOULD BE.

OFTEN WE GET THIS -

USUALLY WE GET THIS -

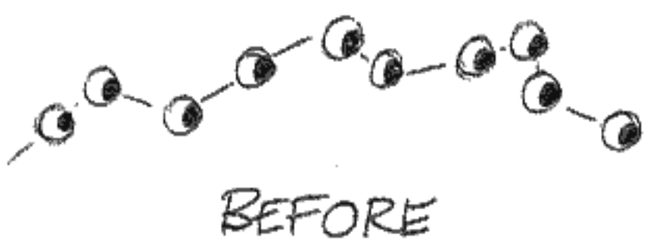
NEITHER ONE THING NOR THE OTHER

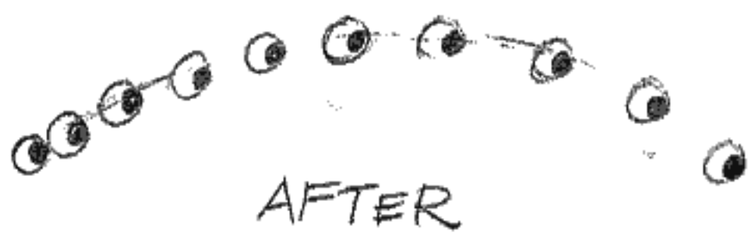


IF IT ISN'T IN THE ARC OR PATH OF ACTION - THE ANIMATION WILL NOT FLOW. GOT TO GO WITH THE FLOW, USING ARCS (UNLESS A STRAIGHT IS REQUIRED.)

The stuff on these pages looks awfully simple set out like this – 'Oh, I knew that.' But as soon as we get into sophisticated images and actions this all tends to go out the window.

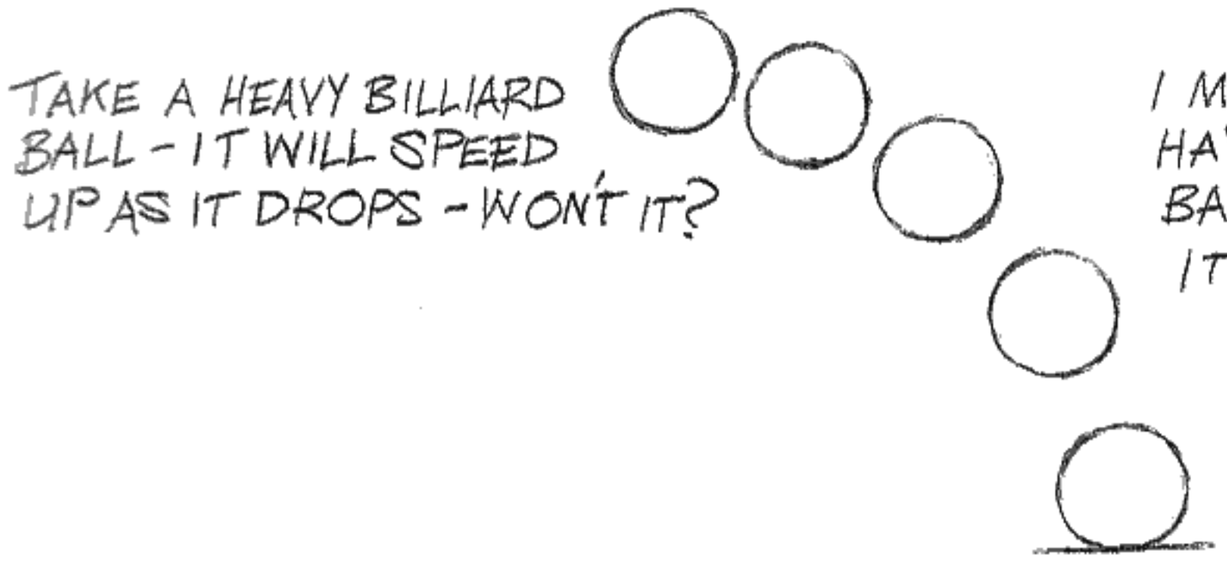
I recently heard about a Hollywood assistant, a talented draftsman who was working on realistic horses (about the hardest thing there is to animate). He drew the stuff beautifully, but he just couldn't get the hang of keeping things in the right arcs. His directing animator, James Baxter, finally suggested he take a blue pencil and just trace the horse's eye positions separately and look what was happening to the flow. Clink! The penny dropped.





So we're back to the old bouncing ball again.

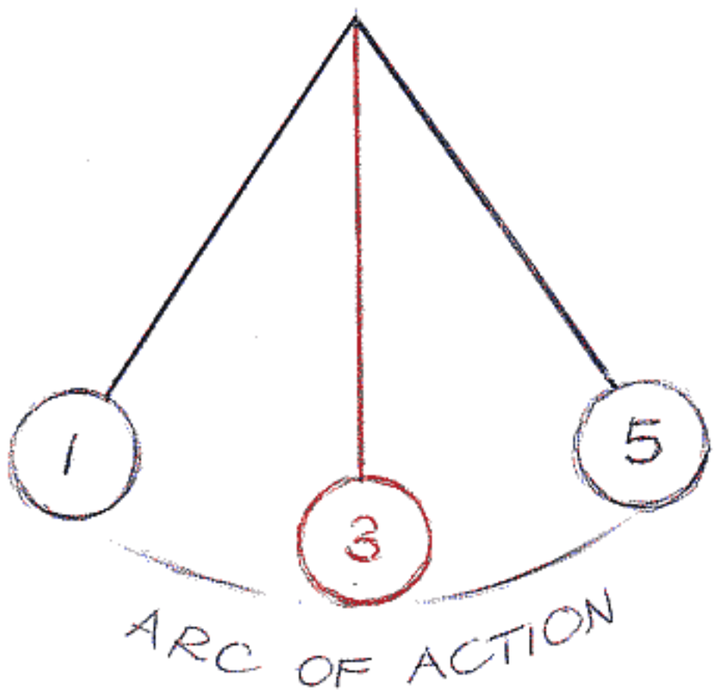
These basic things are so important. Most animators would say scornfully – 'Oh sure, the bouncing ball – everyone knows that.' But do they?

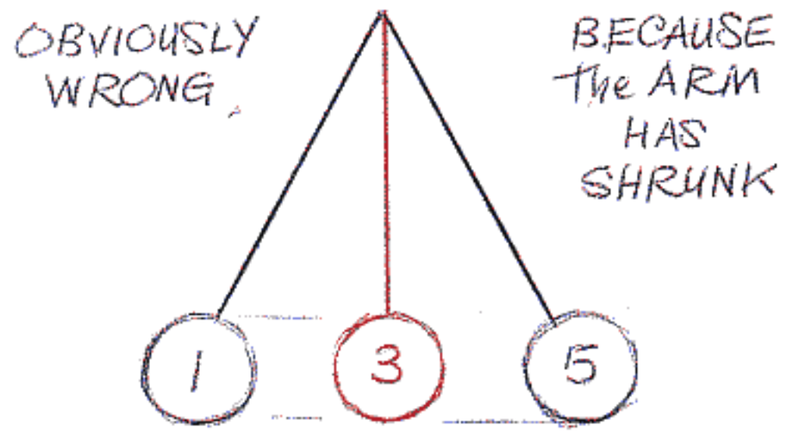


GETTING MORE MOVEMENT WITHIN THE MASS

Now we can start getting more sophisticated. We're going to keep finding ways to get movement *within* movement, action within action – getting more 'change', more bang for the buck.

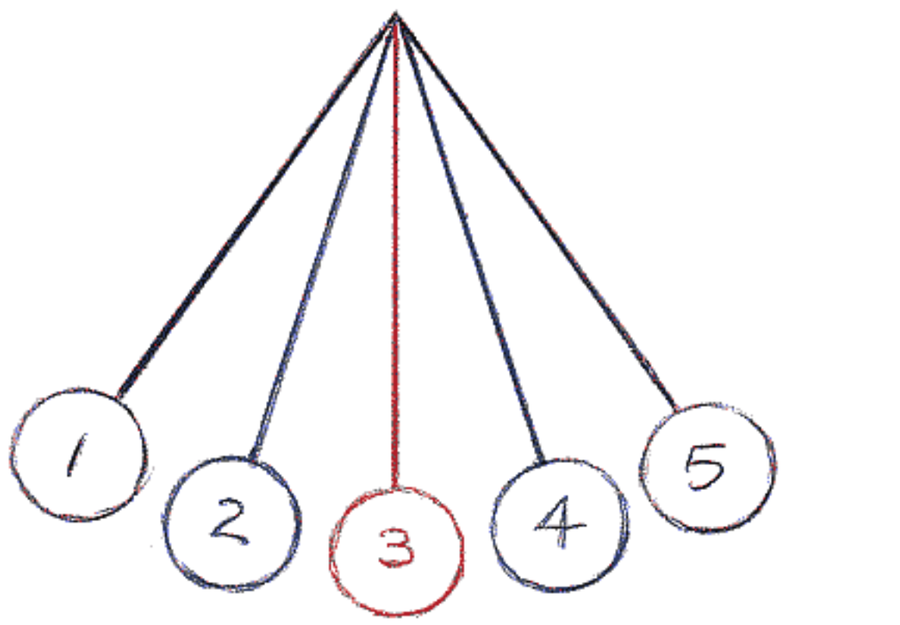
Because the pendulum's arm maintains its length as it swings, the middle position creates an arc in the action. We can see how important that middle position between the two extremes is going to be to us.

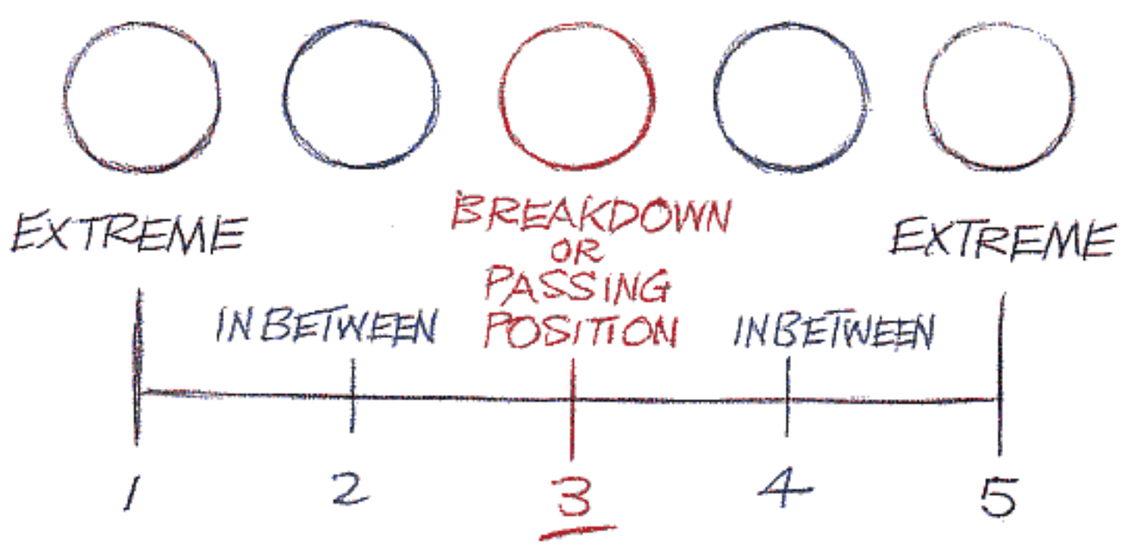




It's obvious how important this middle position is. In the 1930s they called this the 'break-down' drawing or 'passing position' between two extremes.

We'll add two inbetweens.

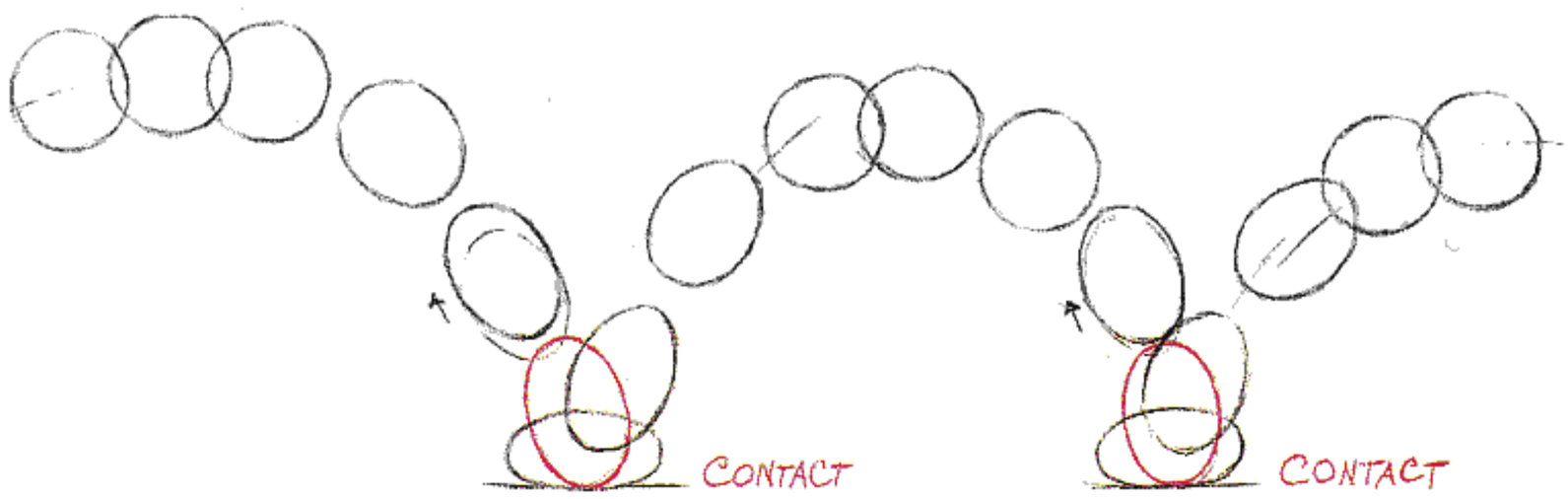




Some animators <u>underline</u> the breakdown or passing position because it's so important to the action. I have the habit of doing this because it's a position which is crucial to helping us invent. We're going to make tremendous use of this middle position later . . .

I had the page open on the bouncing ball. It was like this – which certainly works OK.

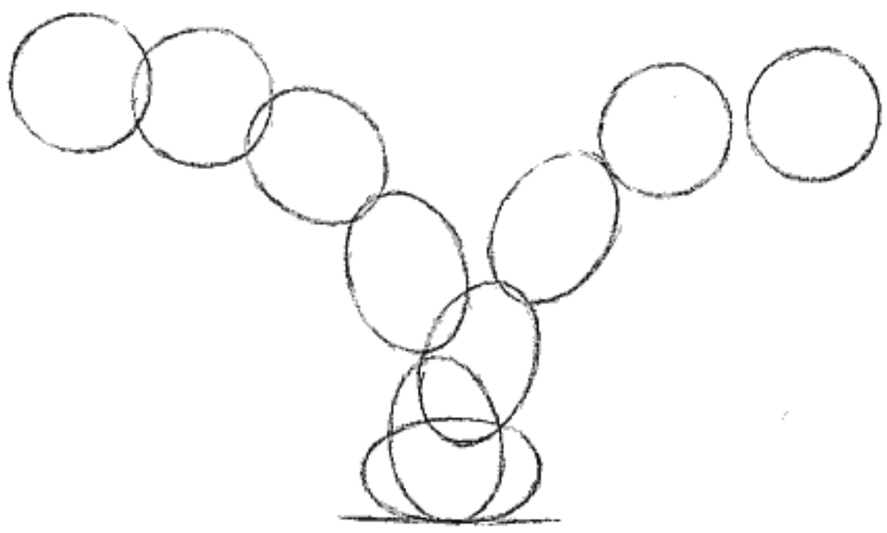
Ken said, 'Yeah, sure, but wait a minute – never mind that. We can make this much better. We need to have a contact in here before the squash.'



'Put in a contact where the ball just touches the ground and *then* it squashes. That'll give it more life.' (Move the preceding drawing back a bit to accommodate it.)

'And do we do the same when it takes off again?' Answer: 'Not in this case – just when it contacts. You get the "change", then it's off again.'

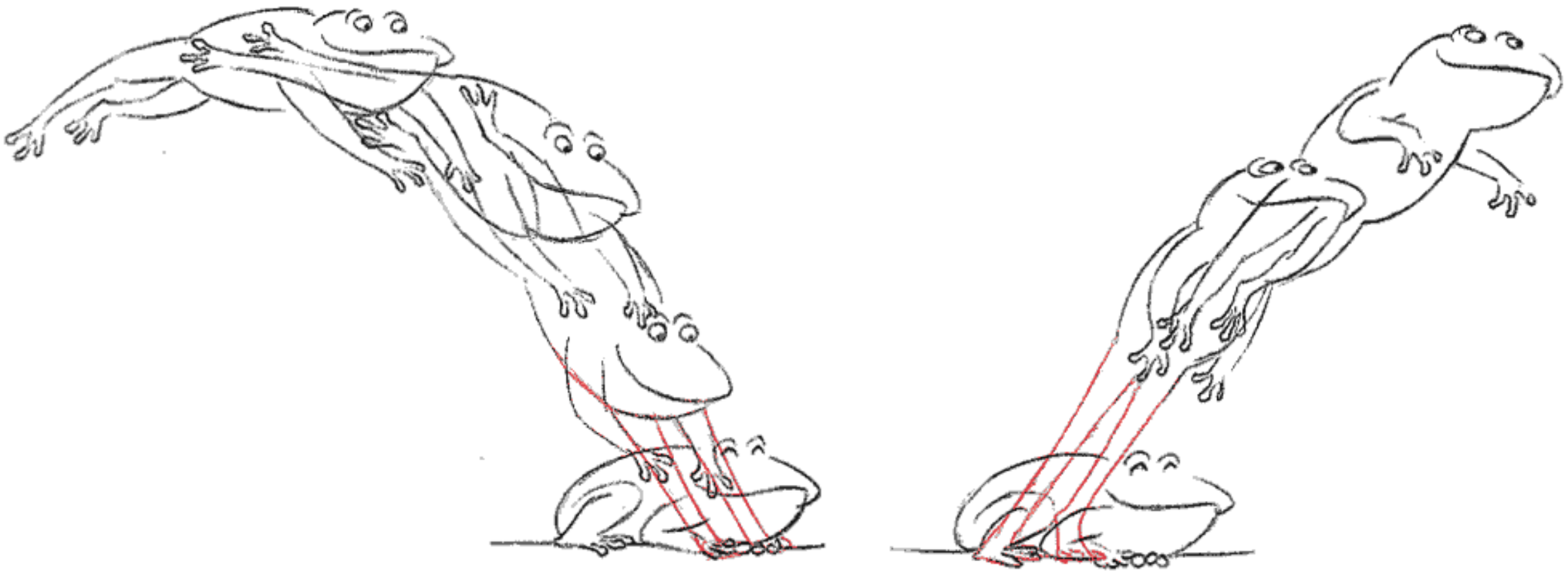
The animation grapevine flows like lightning: 'Did you know Ken Harris in London has corrected Preston Blair's bouncing ball?' Preston's next edition came out like this:



Perfect.

This is not done to show disrespect for a skilled animator like Preston, who was the first classical animator to make real animation knowledge accessible, or to put him down in any way. Ken was just showing an important device to get more action within the movement.

Ken continued, showing the same idea with a frog.



'Have him contact the ground before he squashes down. Then keep his feet contacting the ground as he takes off. That'll give more change to the action.'

Next, a jumping figure.

'Have at least one foot contacting the ground before the squash down, then leave at least one leg still contacting the ground as he takes off again.'

This is great because we're getting more 'change' – more contrast – straight lines playing against curves. We're doing it with bones as well as round masses. We can use straight lines and still get a limber result. More on this later. We don't have to be stuck with rubbery shapes to get smooth movement. This will also free us from having to draw in a prescribed cartoony style because it 'suits animation' and is 'animatable'.

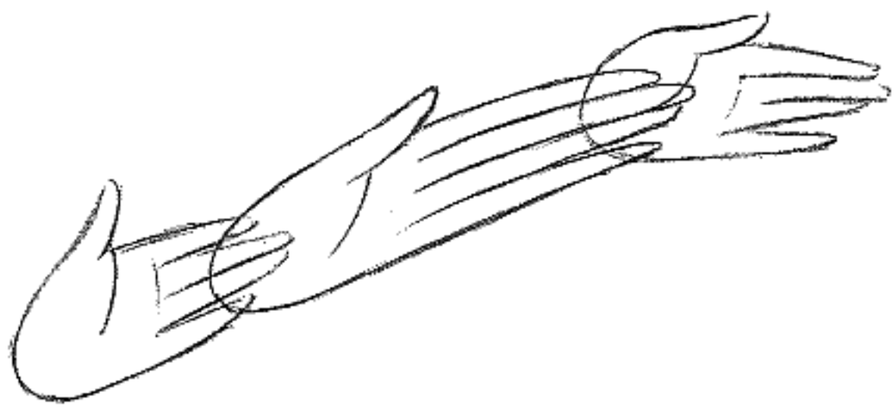
I'm using crude drawings here because I want everything to be crystal clear. I just want to show the structure and not get lost in an overlay of attractive detail.

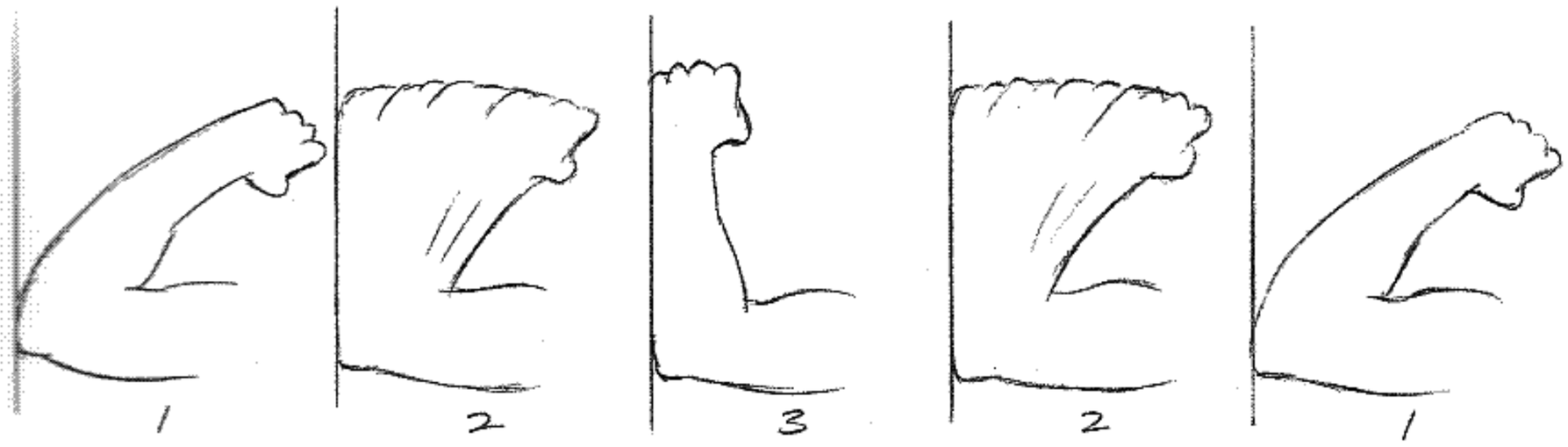
The ELONGATED INBETWEEN

In the 1930s, when animators started studying live action film frame by frame, they were startled by the amount of transparent blurs in the live images. In order to make their movements more convincing, they started using stretched inbetweens. Ken used to call them 'long-headed inbetweens'.

For a zip turn – on ones – although it also works for two frames:

BY DISTENDING
the HAND ON A FAST
MOVEMENT
WE CAN CREATE
AN OVERLAP.



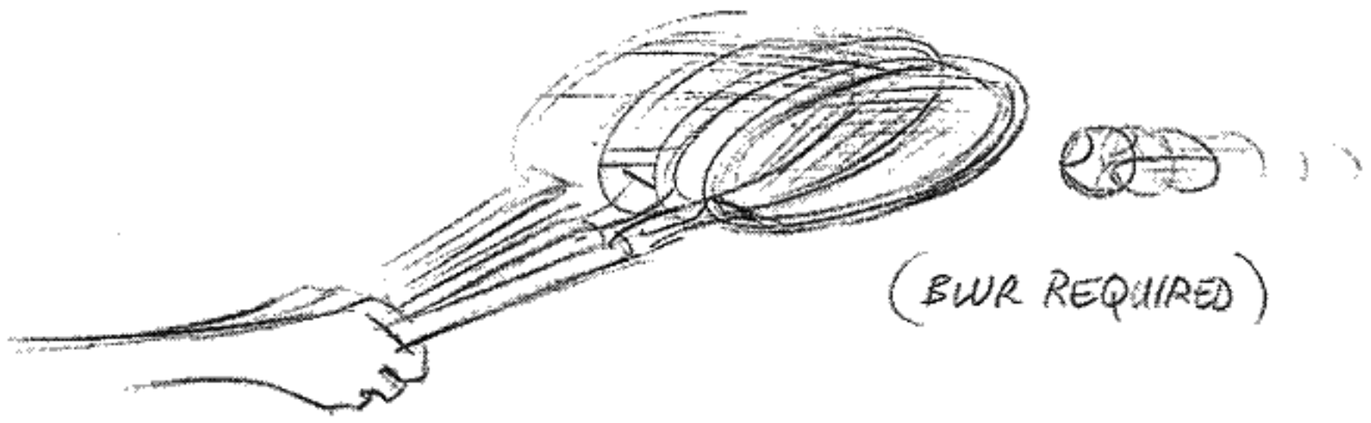


EITHER OR:

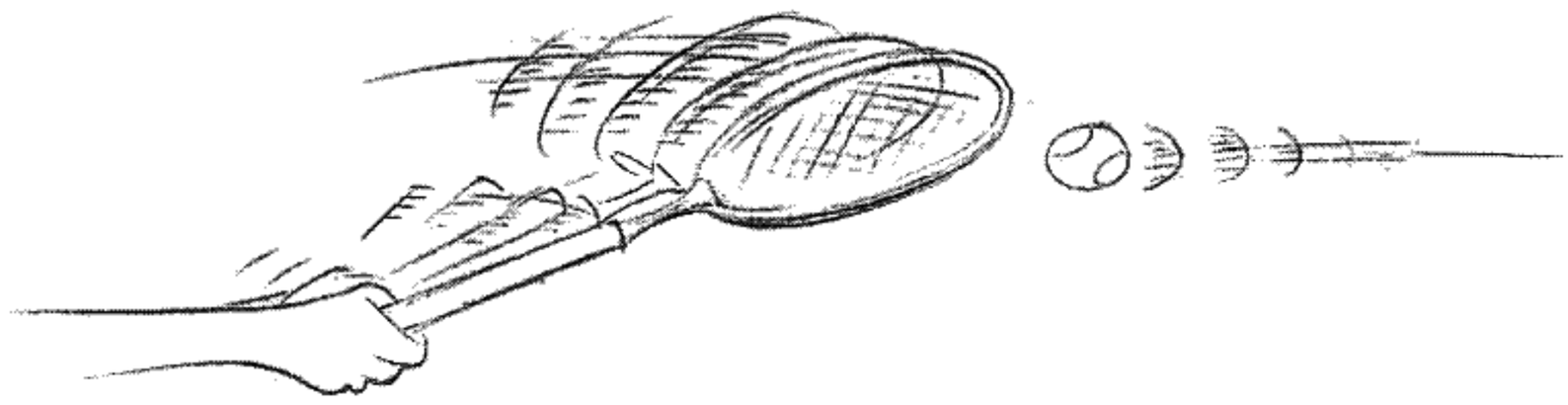
1	1
2	2
3	3
2	2
1	1
2	2
3	3
2	2
1	1
2	2
3	

Let's take these drawings of pounding a door. Shoot the inbetween (2) on ones. This is one of the very few cases where you can shoot the sequence in reverse. It will work on ones – or with just the inbetween on ones and the extremes – (1) and (3), on twos.

In the late 1930s when tracing and painting the drawings on to cels was all done by hand, many painters became very adept at 'dry brushing' the desired transparent live action blur effect. Animators indicated the blur on their pencil drawings and the 'dry brushers' would cleverly blend the colours together to simulate the transparency in the blur.



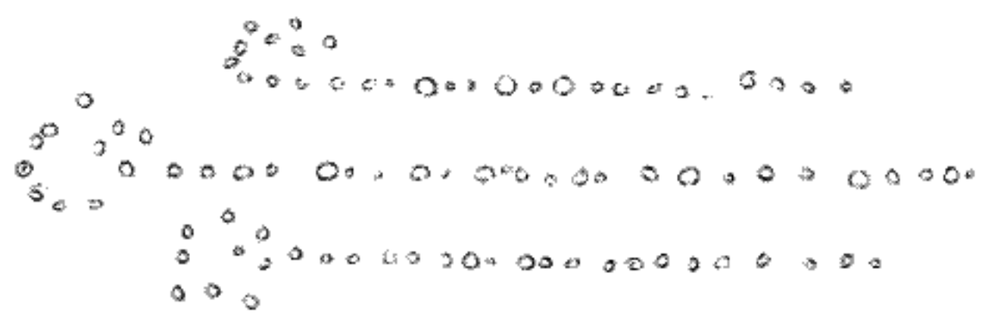
After the 1941 animators' strike and World War II, budgets shrank and so did the use of skilled backup painters. But a lot of animators just kept on indicating blurs and it became a cartoon convention to just trace this in heavy black lines – ignoring the fact that the dry brush artists were long gone.



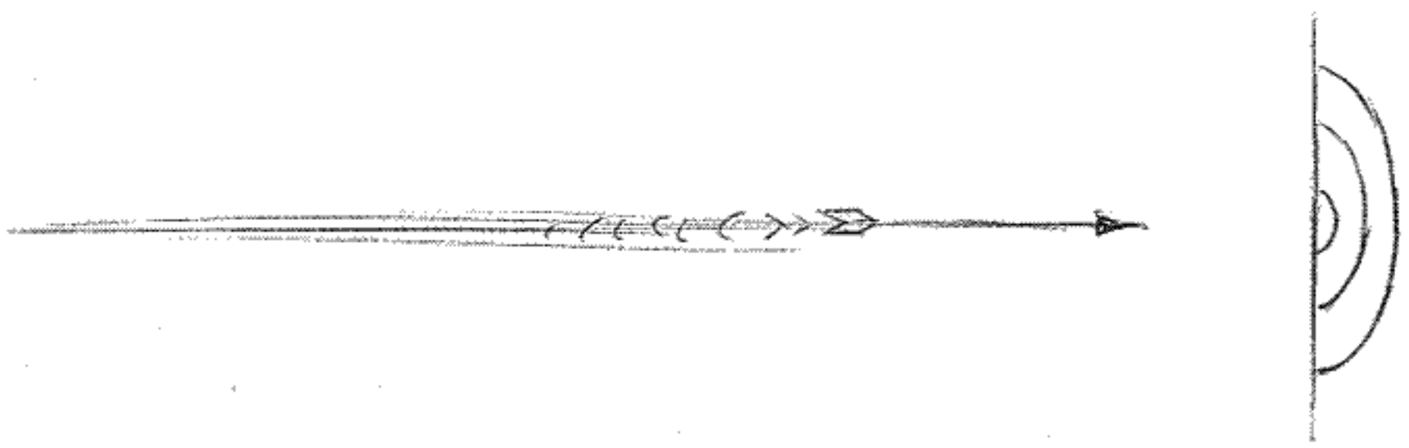
Now it's become a cartoon cliché. A cartoon of a cartoon:

With characters just vanishing from the screen, Ken told me:
'We'd have this witch up in the air laughing and then she's *gone*. Instead of making a blur we just used to leave hairpins where she was.'

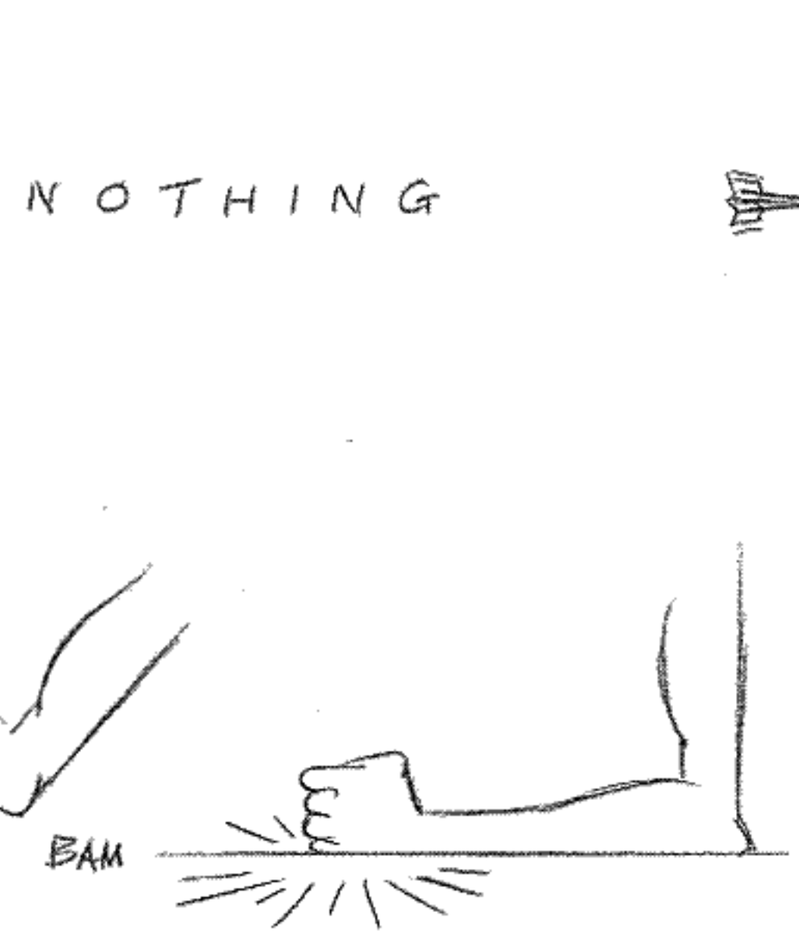
'We learned that from the Disney guys in a fish picture. They'd have these little fish swimming around and something would scare them and they were *gone* – that's all – with just a few bubbles for the path they took.'

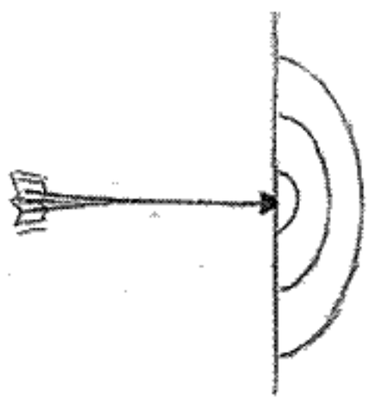


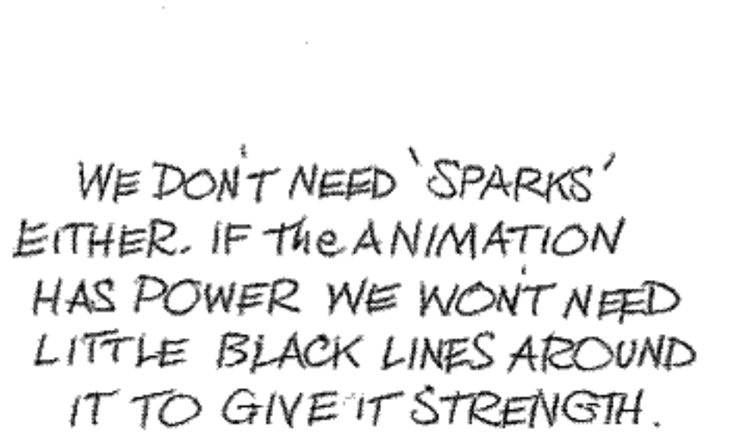
In the early days, speed lines were a hangover from old newspaper strips:



Then they were used in animation to help carry your eye. But they're still around now when we don't really need them. You don't even need to show the arrow entering. We have nothing and then it's just there – maybe with the tail vibrating.







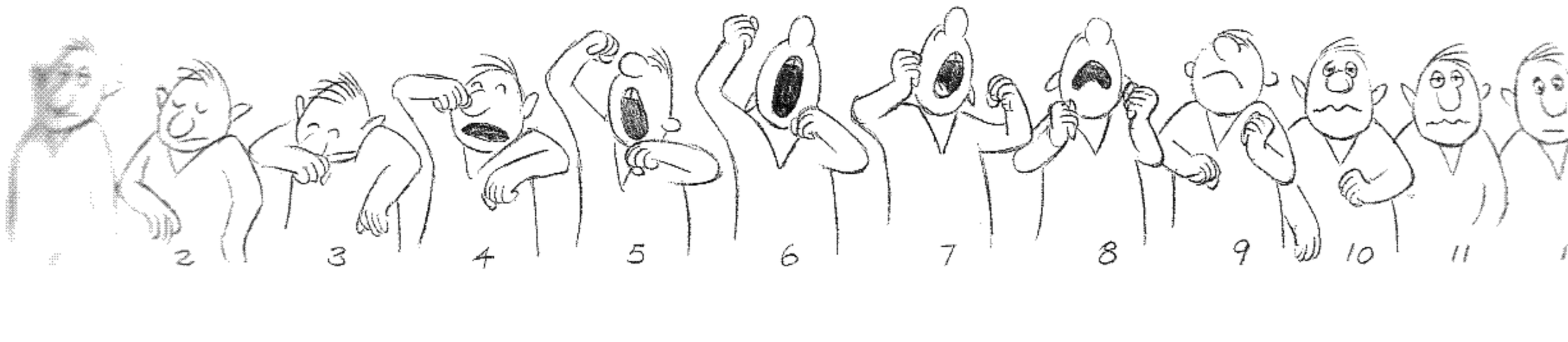
However, I find the elongated or 'long-headed' inbetween is *very* useful – not just for a zippy cartoon effect, but also for use in realistic fast actions:

Again, we're returning to the original purpose – emulating the transparency of broad, live action blur movements. It's especially suitable with 'soft edge' loose drawings – where the outlines aren't sharp and enclosed like colouring book drawings.

The MAJOR BEGINNER'S MISTAKE

Doing too much action in too short a space of time, i.e. too great arm and leg swings in a run. The remedy: go twice as slow. Add in drawings to slow it down – take out drawings to speed it up.

Ken Harris told me that when Ben Washam was starting out at Warner's, he became famous in the industry for 'Benny's Twelve Frame Yawn'. Ben drew well and made twelve elaborate drawings of someone going through the broad positions of a yawn – an action something like this:



Then he shot it on ones. Zip! It flashed through in half a second!

So then he shot it on twos. ZZZip! It went through in one second!

So then he inbetweened it (twenty-four drawings now) and shot it on twos. ZZZZZZ! It went through in two seconds – almost right.

Then Ken showed him how to add some cushioning drawings at the beginning and end – and bingo, Ben's on his way to being a fine animator.

The "RUFF" APPROACH

Some animators want to save themselves a lot of the work so they draw very rough. ('Ruff' – they don't even want to spend the time spelling 'rough'. Too many letters in it to waste our valuable time . . .) And they leave lots and lots of work for the assistants.

I've never understood why some people in animation are so desperate to save work. If you want to save work, what on earth are you doing in animation? It's nothing *but* work!

In the early days at The Disney Studio, when animation was being transformed from its crude beginnings into a sophisticated art form, they used to say, take at least a day to *think* about what you're going to do – *then* do it.

One old animator, writing about the subject forty years later, advises that we should spend *days* thinking about it. He's read up on Freud and Jung and the unconscious mind and he writes seductively about how you should ruminate until the last minute and then explode into a frenzy of flowing creativity.

He told me that in a week's work he'd spend Monday, Tuesday, Wednesday and Thursday thinking about it and planning it in his mind. Then on Friday he'd *do* it. The only problem is that it then takes three weeks for somebody else to make sense of it.

I knew this guy pretty well – and he made it sound so creatively attractive that, though I felt it was artistic b.s., I thought I better try it out. I managed to ruminate, stewing and marinating my juices for about a day and a half and then couldn't stand it any more. I exploded into creative frenzy for a day, drawing into the night like a maniac. The result was pretty interesting, but it really did take three weeks to straighten it all out afterwards. And I don't think it was any better than if I had worked normally – maybe just a bit different.

I think Milt Kahl has the correct approach: 'I do it a lot. I think about it a lot, and I do it a lot.'

Ken Harris worked intensely from 7.30 am till noon, relaxed at lunch, hung around doing bits for a while, went home to watch TV (or play tennis when he was younger) and thought about what he was going to do the next day – then came in early, avoided social contact and did it.

He worked carefully and thought very hard about his stuff. He said he was surprised when he saw some of Ward Kimball's working drawings because they were exactly the same as his – very neat – very carefully done – usually something on every drawing in the shot.

When I first saw Milt's work on his desk I was startled by how much work he did. His drawings were finished, really. There was no 'clean up' – just 'touch up', and completing details and simple inbetweens or parts of them. Ditto Frank Thomas, ditto Ollie Johnston, ditto Art Babbitt. The two exceptions to this were Cliff Nordberg, a marvellous 'action' animator who worked with me for a while, and Grim Natwick. Cliff did work very roughly – so he was awfully dependent on having a good assistant and it always caused him a lot of concern. And Grim was a law unto himself.

There's an animation myth about the assistant always being able to draw better than the animator. (I never met one who did.) The myth is that the animator creates the 'acting' and the fine draftsperson improves the look of everything and nails it all down. Well, there aren't that many fine draftspeople around and if they're good enough to nail all the details down and draw well, they really should be animating – and probably are. (An exception to this is the assistant 'stylist' on commercials where the 'look' of the thing is it's raison d'être. There are a few excellent ones around.)

Rough drawings have lots of seductive vitality, blurs, pressure of line, etc. But when they're polished and tidied up you usually find there wasn't that much there to begin with.

As we go along through this book it'll be apparent how much work we have to do to get a really interesting result. No matter how talented – the best guys are always the ones that work the hardest. But hang the work, it's the unique *result* that we're after. Every time we do a scene, we're doing something unique – something nobody else has ever done. It's a proper craft.

HOW MUCH DO WE LEAVE TO The ASSISTANT?

Milt Kahl's answer: 'I do enough to have iron clad control over the scene.'

Ken Harris's answer: 'I draw anything which is not a simple inbetween.'

Milt again: 'I don't leave assistants very much. How much can I get away with leaving and still control the scene? If it's fast action, I do every drawing.'

The purpose of the assistant is to free the animator to get through more work by handling the less important bits – but as we have seen, he/she can't be just a brainless drawing machine. The computer produces *perfect* inbetweens, but obviously has to be programmed to put in the eccentric bits that give it the life.

Here's my tip on saving work – my rule of thumb:

TAKE The LONG SHORT CUT.

The long way turns out to be shorter.

Because: something usually goes wrong with some clever rabbit's idea for a short cut and it turns out to take even longer trying to fix everything when it goes wrong.

I've found it's quicker to just do the work, and certainly more enjoyable because we're on solid ground and not depending on some smart guy's probably half-baked scheme.

And again, if you don't want to do lots of work, what are you doing in animation?

One of the things I *love* about animation is that you have to be specific. If a drawing is out of place it's just *wrong* – clearly wrong – as opposed to 'Art' or 'Fine Art' where everything these days is amorphous and subjective.

For us, it's obvious whether our animation works or not, whether things have weight, or just jerk about or float around wobbling amorphously.

We can't hide in all that 'unconscious mind' stuff. Of course, we can dress up and *act* like temperamental prima donnas – but we can't kid anybody with the work. It's obvious whether it's good or bad.

And there's nothing more satisfying than getting it right!