Illusion of Life in 3D Character Animation. Part 1

February 25, 2010

What are the most common mistakes new animators make and why? Could it be that the mistakes come from ignoring the classic rules of animation?

Back in 2003 I did a study wishing to confirm just that. Idea was to find what makes good animation and then, via a case study, see if new animators can hit the target – and if not see where they fail and why. Study was in Finnish, title translates to "The Illusion of life in 3D Character Animation" – my final thesis in Multimedia studies. I shall examine this in 2 articles though without the 'scientific' style and constant referencing. References are listed at the end.

What is good character animation?

Unquestionably we want to see characters come to life. To seem alive a character has to move like a living creature and show self-motivation in its actions. Illusion is based on how it reminds us of life and how at the same time it is a caricature – and imitation of life rather than a copy. A copy of life would be difficult and boring to do, and could not be applied to all imaginary characters. Imitation is enough. What is there to imitate, then? Two things: Lifelike motion and acting.

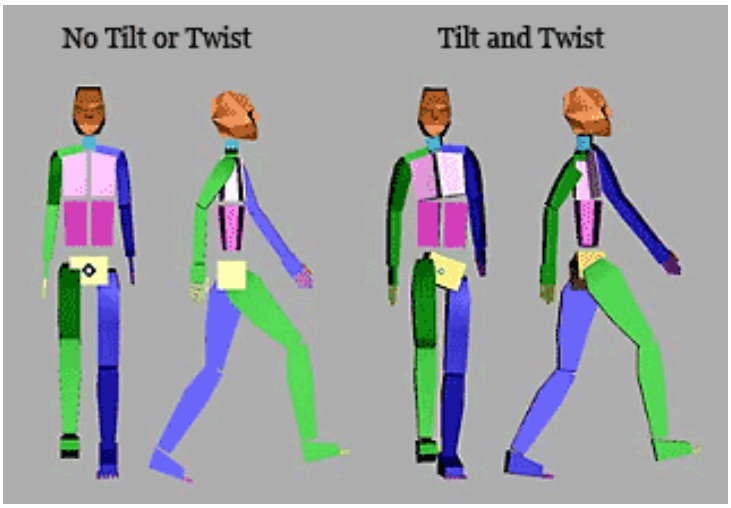
Since acting is, in my opinion, more advanced than making things move 'right', and since it would have expanded study scope greatly, I chose to ignore it. But I did expect lifelike motion. To achieve that one needs to study motion.

Discoveries made from studying motion

Origin of motion. Each movement is caused by gravity, or other such major force, or is a reaction to it. A move starts by going off balance and ends by again achieving balance. Character has a center of balance and to move about a character has use energy to get that center moving, actually often falling. For example walk is a combination of controlled falls. Fall, catch, fall, catch and so on.

Balance. A bipedal character is in balance when you can draw straight line from base of the neck to A) the leg that has weight or B) to a direct line crossing the two ankles.

Tilt & Twist. Gravity gave the need for a rigid supporting skeleton and we move it with muscles. But muscles are expensive to both build and use, so creatures with rigid spine(vertebrate) have evolved a way to move by tilting and twisting. In fact all vertebrate moves are rotation of some sort and every body part involved in creating a motion rotates on three(3) axis.



Look at bipedal walk. Tilt and twist of the hips gets a leg up and going and gives reach to the motion. So also moves the point of balance. Rotations of upper body help to compensate for this. Other vertebrate creatures like lizards have short legs but compensate this with a very flexible spine. Understanding movement and then by training further bare skeletons can tell you how a creature would move in life.

Principles of the Illusion of Life

Animation professionals, back in the first golden age of animation, studied things like the above and developed principles to achieve Illusion of Life. They still apply. For purposes of my study I've chosen 9 about lifelike motion and ignored others that concern storytelling(framing and more) or acting. The explanations are my variations of what you can find elsewhere on the net or in books.

1. Tilt & Twist As explained before vertebrate movement is all about rotations.
2. Dynamic balance is having characters mass, inertia and energy in balance. Body parts work together for balance.

3. Dynamics is making note of the laws concerning mass and energy and applying them to animation so it looks like things have weight. Often dynamics is called acceleration and deceleration.
4. Follow Through and Overlapping Action means that in nature not all parts of a character get to speed or stop at the same time.
5. Squash and stretch concern shape changes – all living creatures shapes change in movement in many parts of the body and even as a whole, too, in extreme motions.
6. Arcs: natural movement goes in arcs. It has to do with rotational joints and gravity. See no 1.
7. Natural faults and variance, even chaos. This is the spice of life – imperfections in all things.
8. Anticipation is simply anticipating and action with a counter-action. All natural motions have anticipation.
9. Subconscious action is what everybody does without noticing, like shifting weight when standing. It is part personality, part chaos that is life and part the fact that living things just get stiff without motion.

All the above principles incorporate timing. **Timing** (what moves when in relation to what else) creates illusion of weight and more. Think of it as the tool to do the principles with.

As you can see, the principles above come from the real world. Yet **using principles with our often unreal worlds and characters gives them the Illusion of Life. It's the illusion, the touch of familiar we are after, not The Real**. Heck, you can have Lifelike Adventures of Mr. Garden Hose by applying these right. And they don't have to applied exactly like in real life, rather used for good effect. Animation can (and should) go beyond the 'real'.

I claim using the principles does create lifelike motion and that they are one requirement for good animation. Rest is created with visual storytelling choices and acting.

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Illusion of Life in 3D Character Animation. Part 2.

February 26, 2010

What are the most common mistakes new animators make and why? Could it be that the mistakes come from ignoring the classic rules of animation?

In part 1 we examined what makes good animation. Now let's check what animation helping tools are available that novices may use. Then let's see, via a case study, if novice animators make mistakes and if so where (with some insight into why as well).

Animation helpers in software

Most major animation softwares have some helpers included. New animators are likely to use these to get their productions up and going. Note that I refer back to my research in 2003 here, so things may have changed. Probably there are overall a lot more helpers which can be good or bad – depends how you use them.

- Autorigging. The software autorigger lets you sketch out the driving skeleton with few drags and klicks, and one may think that should be it. In truth every character has problem areas, usually at joints, where you will need to either add bones or corrective morphs, or adjust bone weighting.
- Walk/Run with routes and steps. You draw a route of footsteps to tell character where to go and can adjust the walk with variables like speed or step lenght. Problem is the generated motion is just a sketch and should be treated as such.
- Character dynamics. Character rig can automaticly maintain balance. Hips twist and tilt in the walk and top part of the character balances this out. But again this gives only a sketch, lacks personality and doesn't know things like how heavy or asymmetrical your character may be.

Analyzing animation – a case study

Lets look at how a novice level animation meets the criteria of lifelike animation. Considering I had no group to test with nor the resources for several test subjects, I chose just one animation and only the main character to analyse. My selection was Moriar Ubi Sum, a short movie made by a team of 3 people in 2002 using 3DS Max 4. Luckily it is still on-line. It would be bad manners to leech their stream here, so please go to the site and see animation there. The image is from Moriar Ubi Sum.
http://moriarubisum.free.fr/

It is a curious short because pretty much everything else is of good or even better quality except the main character and his animation. That contrast is the reason I chose just this animation.
The most obvious problems and their connections are as follows.

IMPRESSION	PROBLEM AREA DEFINED
Movements are too precise and the guy moves like on tracks	Variance or chaos. May have used footstep routes to direct the character and did not edit the resulting animation sketch.
Poses and moves too stiff and mechanical and not all parts of the body move	Arcs, Squash & Stretch, Tilt & Twist
Main character looks off balance and doesn't shift his weight when doing something	Balance, Tilt & Twist, Anticipation
Movements don't seem to require an effort and stop or start too abruptly. The character often acts like a marionette doll rather than doing the action himself.	Dynamics, Squash and Stretch, Anticipation
Character's limbs deform badly at knees, elbows and shoulders. Clothes or hair don't react to movement.	No Overlapping action. And may have either used an autorigger and left it at that and/or didn't bother/have time/know how to fix joints.

IMPRESSION	PROBLEM AREA DEFINED
His eyes are not alive and hands and fingers have this 'frozen in death' look to them – they are in a rigid pose and rarely move.	Overlapping + Subconscious action
Movement in general is too lazy or lacks 'punch'.	Overall Timing, Dynamics

For Moriar Ubi Sum creators reading this I wish to say: I don't mean to offend. Rather I wish to make a point. Would you agree with my critique now, 8 years after your animation release? Rest assured I will be equally harsh when examining my own work. That's coming later.

Results

The example animation did lack 'life' and showed the symptoms of tool reliance. We should conclude novice animators often don't pay enough attention to animation principles and may use the software helpers as a crutch. You can find more examples of this in large animation archives. Look for *other than the most popular animations* as popular clips usually have little to fault in this regard. And forget 'first' works by Animation/CG school graduates put out – there is nothing novice or about work being supervised by professionals. Really this study applies to beginner animator's (often self-taught) first productions the most.

Does this mean any animation with these issues sucks? Definitely not. If the animation is entertaining (story, acting etc.), people usually like it. What you can take from this is just that applying the principles and remembering software helpers don't do all the work for you makes for better animation.

Does this seem pointless or useful? Does knowing the principles help you see the problems and how to fix or avoid them? What is your experience?

Postscript
So what happened with the study of these articles are based on? It was rated 2.5/3. The critique is what I really like.

"Has practical approach, like learning material, which is positive but also negative as it takes away from the merit as a research paper."

Personal Animation Production Critique

December 24, 2010

I feel it is only right I rip into my own work just as I did earlier with work of others. So here is a personal animated short movie of mine from 2009 and critique for it.

Animation

I made the animated short Flight or Fight in spring 2009. It was a technical exercise that got out of hand, big time. It goes against what I recommend for production, to begin with I had no story to tell.

I'm a bit ashamed to show this short for it is anything but my best work, but having said many times that I've learned by doing I think I am obliged to show this, too, as I learned so much from it.

View at HD at Vimeo.

Critique

I will judge the animation on how it achieves the illusion of life, or not – following the animation principles.

Story takes place underwater. One of the top animators in game industry told me, kindly, that it was an extremely silly choice – very hard animate.
Underwater setting provides water resistance which acts like a brake and a force, both at once. It will have effect on Dynamics, Balance, Follow Through and in small ways pretty much everything else. In short it will make the animation look floaty, artificial, which is a problem already with normal 3D animation and underwater setting only adds to it.

IMPRESSION	PROBLEM AREA DEFINED
All animation seems to forget water resistance except when convenient. Underwater, especially with any type of current, holding balance and staying still would take far more of an effort than shown here. Moves are also too effortless and he Fishman stays on the bottom like glue when he wants to and he sinks too fast.	Dynamics, Dynamic Balance, Anticipation
Fishman movements lack fluidity, the round flowing feel and and up'n down and side to side movement you'd expect from underwater motion.	Arcs, Variance, Anticipation
Fish movements in particular lack weight and strength – the speed and acceleration and deceleration is not quite right.	Dynamic, Anticipation, Arcs, Timing
Neither character changes their volume in motion. Lack thereof is best seen where the fish is caught under the big root and fights free.	Squash and Stretch

In addition to the above, my animation has acting problems. The Fishman doesn't convey his thoughts well enough. Stronger poses and better timing would help – and really better acting, too.

Post scriptum

Regardkess of the short not meeting my standards in animation, I'm quite happy with it as a technical achievement – that I got it done despite the problems. The colours are nice too and the mood works sometimes. **Of course the most important thing is I learned a lot**.