Animation of 3D human body model

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Task

Design and create basic animation of 3D human body model in 3D animation tool (3DStudio Max, Blendet, Maya)

Solution

Design and creation of these 3D animation. All animations are created in 3Dstudio max 9.0.
Basic techniques:

1. design basic poses of animation (just for imagine how the resulting animation should loook like) – its created basically not in 3D tool but only on paper
2. Creation of keyframes
    - The basic pose is designed in each keyframe

- Poses are modified in bone selection. We are using biped model. We just modify transforms of bones, using inverse kinematics (move, rotation, scale). Just be careful to not over-rotate bones (we want to look real, so we have to modify bones to positions which is real in our world).
- Setup transforms between keyframes

3. Editing whole animation in Track view – Dope Sheet or Curve Editor
4. Add bodies and clothes. Modification of details, mostly overlaps objects with clothes (because creation of animation is designed in bones levels)
5. Animation rendering

I created these basic animations:
steps, smooth walk,
pointing left hand,
pointing right hand,
greetings (waving),
idle state
sit on chair,

The 3D animation of walk and steps - explanation

Walking requires much balance and coordination and also conveys a great deal about one's personality. Our model is young woman.

Computer animators have a number of tools available for animating walks. It seems as though software vendors have focused a considerable amount of effort on technology for animation walks, and quite a few new and innovative tools are available for automating all or part of the walking process. These sophisticated tools can be both a help and a hinderance. As the animator, we should still understand exactly how characters walk and how we want our characters to do it.

Mechanics of walking

Walking has been described as "controlled falling." Every time you take a step, you lean forward and fall slightly, and are caught by your outstretched foot. If you failed to put your foot forward, you would fall flat on your face. After your foot touches the ground, your body's weight is transferred to it and your knee bends to absorb the shock. The front leg then lifts the body and propels it forward as the rear leg swings up to catch you again, and the cycle repeats.

Walking is complex. Not only do the feet have to move across the ground, but the hips, spine, arms, shoulders, and head all move in sync to keep the system in balance. Although these movements are complex, if you break them down joint by joint, the mechanics of walking becomes clear.

Timing

A normal walking gait will take anywhere from one-third to two-thirds of a second per step, (8-16 frames at 24fps, or 10 to 20 frames at 30fps) with a half second per step being about average. A full cycle (both right and left steps) about a second per cycle. Larger characters tend to walk slower and smaller characters walk faster. In general, men have slightly slower gaits than women, and sad people walk slower than happy people.

Keeping your feet on the ground

- **Inverse Kinematics (IK) with Locks**

3DS max IK allow you to "pin" or "lock" an object, such as a foot, to a point in space or to another object—such as the floor. IK is one of the preferred walk-animation methods because it ensures that a character's grounded foot stays in the same spot for the duration of the step.

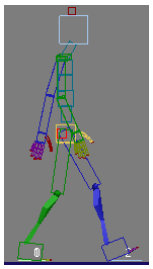
- **Footstep Generators**.

These plug-ins enable you to toss down footprints on the ground, up hills, down ladders, wherever you want. The program then automatically moves the character's legs and feet to match.

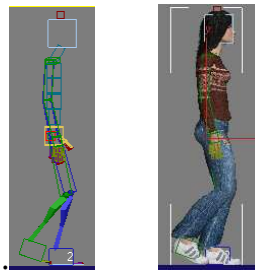
Walk cycle

The walk usually starts with the feet at the "extended position," where the feet are farthest apart and the character's weight shifts to the forward foot.

When the feet are fully extended, the hips rotate along the axis of the spine. To keep balance, the shoulders swing in the opposite direction. From the front, the spine looks relatively straight. But from the top, you can see the hips and shoulders twist in opposite directions.

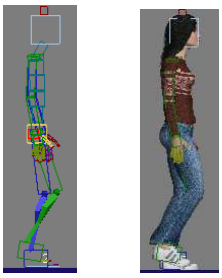


As the weight of the body is transferred to the forward foot, the forward knee bends to absorb the shock. This is called the "recoil position," and is the lowest point in the walk

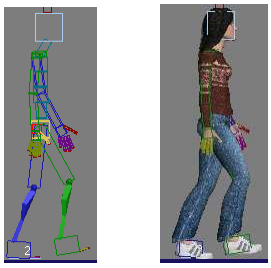


Halfway through the first step, the forward knee straightens out and lifts the body to it’s highest point. In this "passing position," the free foot passes the supporting leg.

At the passing position, the front view shows the weight of the free leg pulling the hip out of center, causing a counter-rotation in the shoulders. From the top, however, the hips and shoulders are nearly parallel.

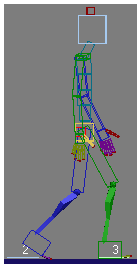


As the character moves forward, the weight-bearing foot lifts off the ground at the heel, transmitting the force to the ball of the foot. The body starts to fall forward. The free foot swings forward like a pendulum to meet the ground and catch the body’s weight.

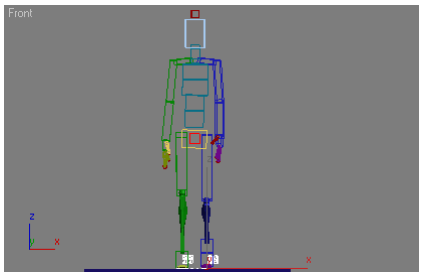


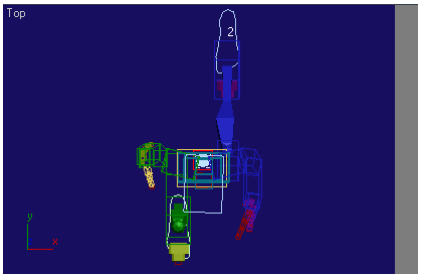
The free leg makes contact with the ground, completing half the cycle. The second half is an exact mirror of the first. If it differs, the character may appear to limp.

At the extension of the second leg, the hips and shoulders again are flat when viewed from the front. From the top, however, you can see the completed rotation of the hips and shoulders.

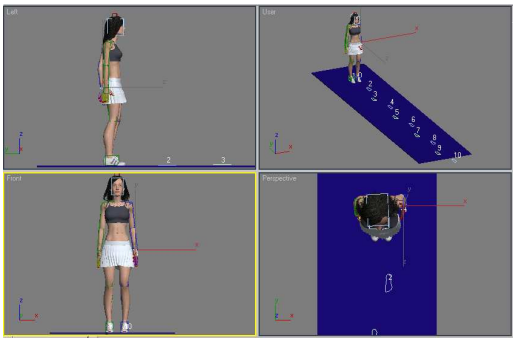


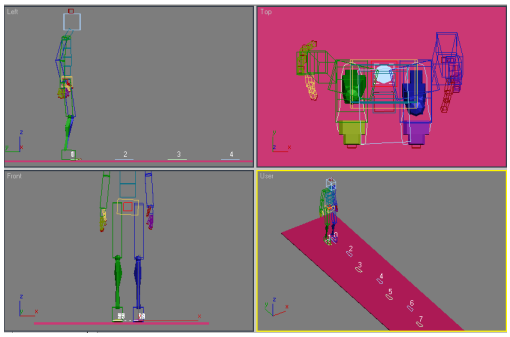
Because walking is kind of like falling forward, the body should be angled forward slightly at the hips for most walks. The spine will arch up slightly to keep the chest and head over the hips. However, this line of action can change with the character's attitude.



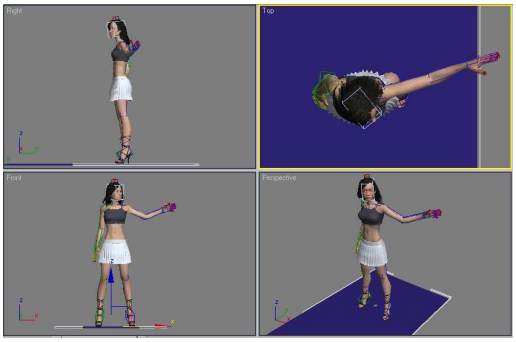


The 3D animation of walk and steps.

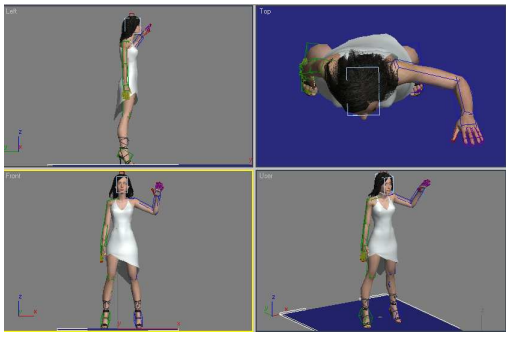


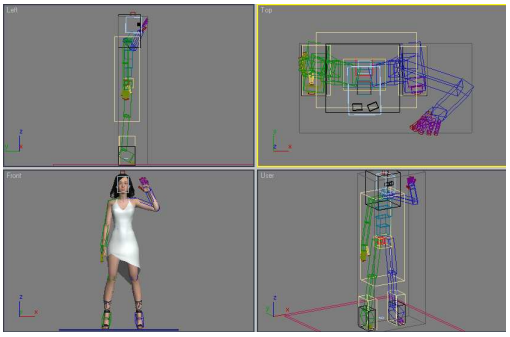


The 3D animation of pointing with left hand and right hand.

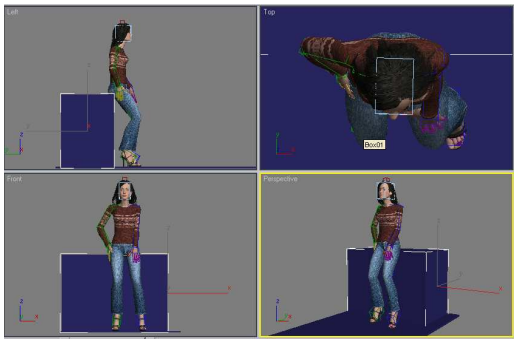


The 3D animation of greetings (waving).

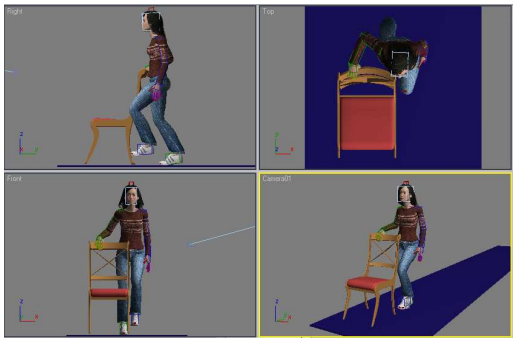


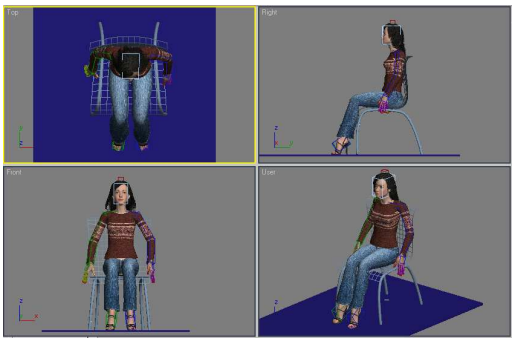


The 3D animation of idle state.



The 3D animation of sitting on chair.





Conclusion

All rendered animations (avi files) are in project folder /Animations
All 3Dstudio max source files (*.max) are in project folder /Sources

Resources

http://www.3dscena.cz/art/3dscena/3d-tutorial-3d-studio-max-michadlo.html
http://www.maxfanatic.com/?p=6
P. Ratner: 3D Human Modeling