Team 1912 Combustion
Ignition Team Manual
Autodesk 3ds Max
Animation

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Introduction

Animation is possibly the most difficult art form anyone can attempt. It takes years to get good at it and you are never done learning. It is also impossible to be “taught” animation. You can be shown how to make a model or do an effect but unless you practice and just go off on your own, you’ll never truly know how to do animation. Much like programming and other computer related tasks, animation is self-taught. The Autodesk products that we use in the FIRST Robotics animation challenges are given to teams for free and can be downloaded from www.autodesk.com/edcommunity. In this manual, you will be given tips and a basic overview of creating an animation during the season.

Season Overview

Anywhere from the day or two a week after the season kickoff in January, the animation challenge will be released. The task is to take the challenge and create an animation explaining a solution to the challenge. In the past the challenges have been:

- **Bio-mimicry (2009)** - Take something from nature, such as a spider’s ability to make a web, a fly-trap’s ability to catch its prey, or an archer fish’s ability to shoot water at its target, and use it to create technology beneficial to mankind.
- **Change Your World (2010)** - Find a problem in your environment (can be your school, community, state, country, or the entire world) and create a solution to it. For example, acid rain in the atmosphere can be fixed with neutralizing agents released through tubes attached to tall buildings in major cities.
- **Change Their World (2011)** – The likos have had their civilization destroyed due to major environmental disasters. Devise a solution that will help the likos to overcome these disasters and rebuild their planet. Some teams had ideas along the lines of reinventing the wheel, medicine, and clearing out space junk from the atmosphere.
- **Get Involved with the likos (2012)** – It is one year later and the likos have completely rebuilt their civilization. They want to repay Earth by fixing our education system. Students must find a
There are specific instructions for the length of the animation which basically follow this order:

- A title slide with no specific length (recommended 5 seconds)
- A one second black slide
- A 30 second animation
- Another one second of black
- And credits (this is optional and there is no specified time limit for it. It is recommended that you include credits but keep it relatively simple depending on how much time you have to work on it. If you don’t have much time before submission, a single 5-10 still slide will suffice. However, if you have a week or so left and you would like to make some fancy credits, you can animate some using 3ds max)

Along with the animation, a digital storyboard and a 50 word maximum description are required to be submitted. For full details on the animation criteria, the instructions can be found at [www.autodesk.com/first](http://www.autodesk.com/first).

Making a 30 animation may not seem like a hard challenge and that is the first mistake to make when starting. It is a very time consuming task that requires a lot of patience (and trust me, if you aren’t patient now, you will learn to be). Creating a good animation that effectively conveys the story can take thousands of hours. The best way to accomplish this in the amount of time given is to divide the animation into segments and assign a different person to each. A segment can mean an entire scene, or materials, or characters and rigging, or lights and cameras, or any one of hundreds of other aspects that go into animation creation.

When assigning people to segments, it is best to assign maybe two or three to each person so that they are gainfully employed throughout the creation period. It is also better to have no fewer than three and no more than six people working on the animation at one time. Too few people will cause the task to become overwhelming while too many people will be counterproductive.

Time management is of the utmost importance when it comes to animating. It is a good idea to spend a few days on concept and storyboard but once you have your idea in place and planned out, lock it in. Don’t go back and change major things once you have started because then you are just asking for a headache. After storyboarding, all time and energy should be directed toward getting the animation done as quickly as possible. A week of left over time should be allowed at the end so that rendering and turning the scenes into a movie can be done. It is suggested that submission be done two to three days beforehand because on the day of, the site will be slow due to an overwhelming number of submissions, and also, should a problem arise, you have time to get it resolved.

Program Overview
The program that will be covered in this manual is Autodesk 3ds Max 2012. At first, 3ds Max may seem a bit overwhelming with its four screens and multiple command bars and menus, but in time all those characteristics will become almost natural and many of them will become your best friend. When 3ds opens, the default screen is:

The four mini screens are known as the viewports and are useful for placement of and modeling objects. The cube in the upper right corner of every viewport is called the viewcube. It allows you to rotate the entire scene. In the upper left corner of every viewport are three little menus. The plus sign allows you to maximize a viewport, which basically means to make it the sole viewport (not recommended unless the four viewports just really annoy you), activate or disable a viewport, show or hide the viewcube (definitely not recommended in any situation. It may be evil sometimes but it makes things so much harder without it), and so on. The menu next to the plus sign allows you to change the orientation of the viewport to perspective, left, right, front, back, top, bottom, or orthographic. It also allows you to enter into the view from a camera, select lights, etc. The final menu allows you to change how the objects are viewed in the viewports. The options include shaded, realistic, wireframe, and many others. Changing this will not affect how the objects come out when they are rendered.

The main menu for 3ds Max as well as the save, open, new, etc., buttons are located here:
The object manipulation tools are here:

In red is the move tool which allows you to move the selected object along the X, Y, or Z axis. In green is the rotate tool which allows you to rotate the selected object around one of the axis. In orange is the scale tool. This allows you to change the dimensions of the object relative to its other dimensions.

The rendering tools are located here:
The green arrow points to the Render Setup Menu. This allows you to choose whether to render one frame, all frames, or only certain frames in the animation. It also allows you to choose the animation quality such as Standard or HD, save the render file as a .jpeg, .png, .avi, etc., or change the renderer. The default renderer is Scanline which is fast and has decent quality. Mental Ray Renderer is suggested, however, because it has more material options and looks better. It is slower than Scanline though.
The red circle indicates which button to press when changing the renderer.

The orange arrow points to the Rendered Frame Window. This brings up a window showing the last rendered frame for you to view. You will not be able to view animations in this window so animations must have an assigned save file BEFORE rendering.
The window in the top right corner with the green status bar automatically comes up when a render is in progress. This window is very useful because it tells you which frame out of how many is currently being rendered, how much time each frame is taking to render, how much total time has passed, and it gives an estimated time of completion. I have seen renders take anywhere from 5 seconds to 12 hours. The reason for the time differences is the number of polygons and the types of materials in the scene which will be covered later. If you ever wish to pause or stop a render while it is in progress, you can do so in the upper right window.

The Rendered Frame Window, shown above on the left in the middle of a mental ray render, allows you to change the precision of the render, shadows, reflections, refractions, and so on. What rendering basically does is take the un-pretty object or scene in the viewport and refines it, adds the materials, and makes it pretty. A completed render of the teapot is shown below. And before you ask, no one knows why there is a pre-made teapot available for use or why it is the symbol for the render buttons. It is a mystery that may never be solved.
The blue arrow points to the Render Production button. This button will automatically start a render.

The menus to the right side of the screen, shown circled in green above, are your basic create and modification tools. These menus can also be found along the menu bar at the top of the screen but this one is easier to use and access. The top line of buttons opens the main menus, the second line opens the sub tabs, and within the sub tabs are more sub menus. In the image above, the main create menu is shown open with the geometry sub tab and standard primitives sub menu.

The main menus, in order from left to right and with sub tabs and sub menus, are:
Create

- Geometry
  - Standard Primitives
  - Extended Primitives
  - Compound Objects
  - Particle Systems
  - Patch Grids
  - Body Objects
  - Doors
  - NURBS Surfaces
  - Windows
  - mental ray
  - AEC Extended
  - Dynamics Objects
  - Stairs

- Shapes
  - Splines
  - NURBS Curves
  - Extended Splines

- Lights
  - Photometric
  - Standard

- Cameras***
  - Standard

- Helpers
  - Standard
  - Atmospheric Apparatus
  - Camera Match
  - Assembly Heads
  - Manipulators
  - Particle Flow
  - MassFX
  - CAT Objects
  - VRML 97

- Space Warps
  - Forces
  - Deflectors
  - Geometric/Deformable
  - Modifier-Based
  - Particles & Dynamics

- Systems
  - Standard
The menus that you will mostly need to use are the create, modify, and motion (if you have rigged, moving characters mainly).

***Go to the drop down create menu at the top of the screen then go down to cameras, from there you have the option of creating a camera from your current view which will definitely come in handy.

The above image shows the key frames. This is essential when animating something. First you must activate one of the Key modes which save movements as keys along the frame bar, thus making an animation. When a key mode is activated, the frame bar and the outlines of the viewports are tinted red. A simple movement, such as up, down, left, right, is marked with a red key; rotations are marked with green keys; scaling is marked with blue keys. You can layer keys, for example, having a move and rotate key on the same frame or having all three on the same frame. However, you cannot have two of the same (such as two movements, two scales, etc.) on the same frame because they will cancel each other out. The slider at the top of the frame bar allows you to move from one frame to another, view animations manually, and it also tells you which frame out of the total amount of frames you are currently on. The default frames are 0-100 but this can be changed. The zero frame is counted as the first frame, meaning that 0-100 is actually 101 frames. An important thing to note is that 30 frames is equal to one second. It is really sad when your beginning and you think that one frame is one second…. It doesn’t end well.

The blue box shows the Set Keys. You can use this to create periods of pauses in movement.
The green box is the Toggle Auto Key Mode button. This is the easiest mode to use when animating. A warning: make sure that you are in auto key when you are moving an object and want that segment to be animated. On a similar note, make sure you are out of auto key when you are making a movement that you do not want animated.

The orange box shows the Toggle Set Key Mode button. This mode is more complicated to use when animating so it is strongly suggested that animators, especially new ones, use Auto Key.

The purple boxes show the play, rewind, and fast forward buttons. These can be used to view movements before rendering.

The yellow bow is a small dialog box that will tell you which frame you are currently working on.

The red arrow points to the Time Configuration menu. This menu will allow you to change the number of frames, the speed of the animation (such as 1x, 1/4x, 2x, etc.) and so on.

**Saving and Backups**

One of the biggest pieces of advice I can give you is to save and save often! 3ds Max can be a little temperamental and crash without warning. The files can also become corrupted so it is best to have them saved on several machines and make sure that every person on the animation team has a copy. That way it isn’t as heart wrenching when the dialog box saying “Error: failed to open file due to corruption” pops up.

**Polygons**

Polygons are a bit difficult to explain because they become something that you just know, they aren’t something you are told exactly. They best way to explain it would be like this: Imagine you have a piece of square paper and you cut four squares of equal size out of it. Each of those squares would be a polygon. The more polygons you have, the easier it is to model and the more detail you can have. However, more polygons also means the file will become much larger. This will cause lag and the rendering will take forever.

**Materials**

Materials are tons of fun to play and experiment with. You can do almost anything with materials and with the right material you can make an object look 10x better. There are materials that look like glass, dirt, ceramic, wallpaper, fabric, and one that will even make you 3d world look 2d. The type of renderer you are using will affect what kind of materials you have access to. Scanline does not have many materials so if you are going for something detailed, don’t use it. However, if you want something simple that will render fast, it will work just fine. Mental ray has countless more materials to use and once you start looking, you will be blown away. These materials take longer to render though so have a definite idea in mind about what you want to do, and keep a schedule allowing a lot of time for rendering at the end.
Plugins

When you look at some of the advanced tutorials out there, you will almost definitely come across the word “Plugin”. A plugin is an extension of the 3ds program that allows you to do extra things and must be purchased separately. You can buy the plugins if you want to but you can still do everything you need to without them. Some of the things may not be as easy as it would be with a plugin but it is possible with a little creativity.

YouTube

YouTube is one of my favorite sources for tutorials when animating. You can find a video for almost anything and everything you want to do if you search Youtube for it. All you have to do is type in “3ds Max …………….” Or “3ds Max …………………. Tutorial” and you will almost certainly get the result your looking for. Not all videos have audio but even if they did, you would still need to pause the video every few frames so that you can do it along with the video.

Other Terms

Here are some terms from the text that were not discussed in as much detail as others:

Iikos- iikos are a race of incredibly cute and adorable little aliens that were supplied to teams by Autodesk for the 2011 and 2012 animation competitions. They come with materials and fully rigged but is suggested that you do your own rig and make your own skin materials.

Rigging- when you create a model for a character, you have basically created that characters skin. If you want the character to move you have to rig it which in layman’s terms means to give it a skeleton. Once the model has a rig you can move its body, face, etc., and animate it.

Storyboard- A storyboard, which you can create in Autodesk Sketchbook, is a full layout of your animation from the first scene to the very end. It should show every significant action or instance in the animation and include movements of both characters and cameras, any lighting or materials and changes that may occur to those, and include either the full or pieces of the script.