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US6538654 Claim Chart

Autodesk 3ds Max

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Contents

Bibliographic Data

US6538654: System And Method For Optimizing 3D Animation And Textures

Issue Date: March 25, 2003

Filing Date: December 23, 1999

Priority Date: December 24, 1998

Inventors: Anthony Rose, Andrew D. Davie, Alexis Vuillemin.

Original Assignee: B3D Inc.

Current Assignee: B3D Inc.

Independent Claims: 9 (Claim #1, #6, #7, #8, #10, #11, #12, #14 and #15)

Total Claims: 15

Applications: The invention can be used in following application areas :

- 3D animation object development and rendering software
- Animation film making studios.

Summary: The subject patent relates to 3D animation software. It discloses a method for determining and removing the animation data of 3D objects which are outside the view frame.

U.S. Family Members: 5

Non-U.S. Family Members: 0

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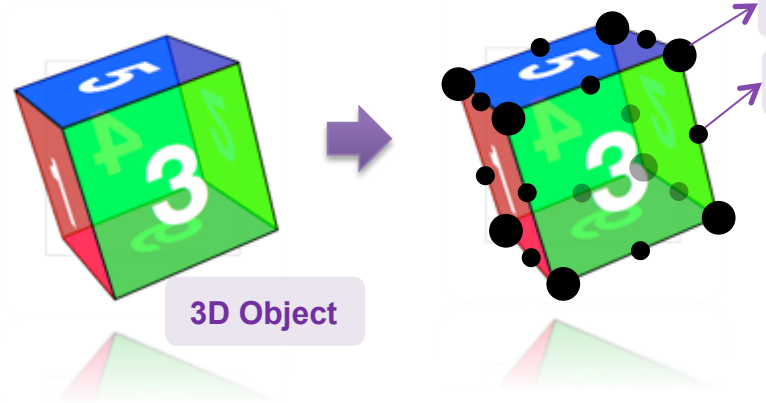
Invention Overview

Subject patent describes the process of creating the animation data for 3D objects (Actors, Props, Cube etc.) in an optimized manner. Below diagrams illustrate the method proposed in the claimed invention.

Step 1: Modeling: Creation of nodes in 3D-Object



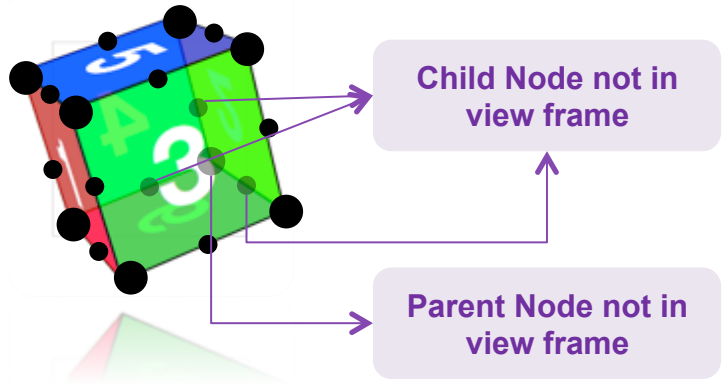
There are two types of nodes –

- Parent Node –All 8 vertices of cube (shown as big black dots).
- Child Node – 12 edges of the cube (represented by small black dots)

Animation data is applied to 3D object (e.g. Cube) which is divided into sub-parts (e.g. Six faces of the cube). Each sub-part is made up of nodes. The nodes govern the geometry of the object.

Animation data applied to the parent node of the 3D object and is inherited by the respective child node.

Step 2: Determination and Analysis of View Frame



The view frame is analyzed to determine the nodes that are not visible on the screen of the viewer.

As evident from the image, face 6 of cube and the nodes associated with it are not visible to the viewer. All such nodes are determined to be outside the view frame.

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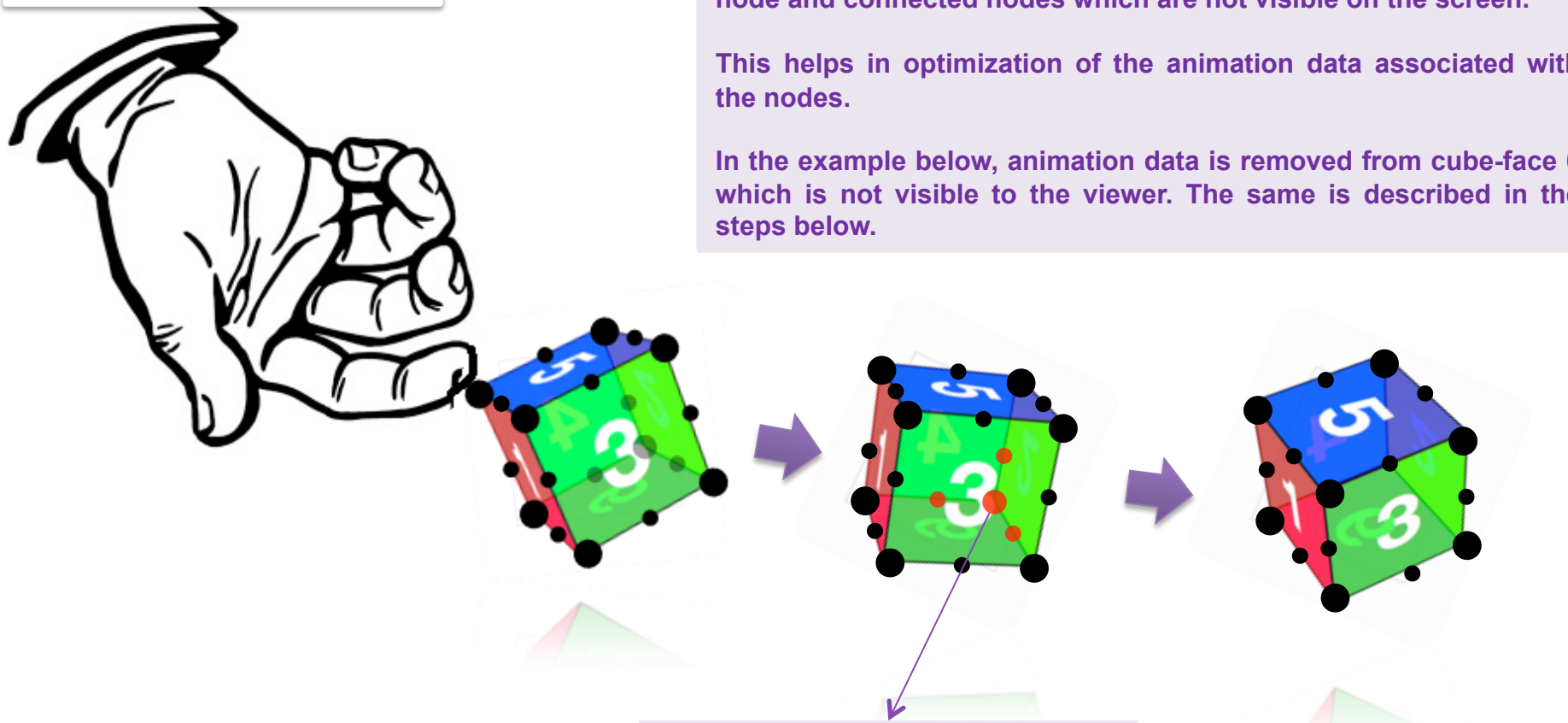
Invention Overview

Step 3: Optimizing Animation

The method claimed removes the animation data of the parent node and connected nodes which are not visible on the screen.

This helps in optimization of the animation data associated with the nodes.

In the example below, animation data is removed from cube-face 6 which is not visible to the viewer. The same is described in the steps below.



Step 1.
3D object is characterized by nodes (both parent & child node) and animation data is applied therein.

Step 2:
View frame is analyzed to determine nodes that are outside the view frame such as face 6 on the bottom of the cube.

Step 3:
Animation data for determined nodes (e.g. face 6 in the image) are removed.

Information on Previous Slide

CLAIM ELEMENTS

This section presents the shortlisted claim used for mapping. It also provides an overview on what information has been identified and to what extent. Below is the color-coding used for this purpose –

- **Green** text represents a sub-element, relevant information for which is directly and explicitly available in the product.
- Blue text represents additional important information related to a topic/subtopic added by the analyst team.

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Elements and Sub Elements of Claim 1

Preamble:

In a computer system for creating animation data for a 3D object appearing in a 3D animated content, the 3D object having a hierarchy of parent nodes and children nodes, each node being associated with animation data, a method for optimizing the animation data associated with each node comprising:

Clause 1:

determining if the node is outside a view frame;

Clause 2:

determining if any child node associated with the node is outside the view frame; and

Clause 3:

removing the animation data associated with the node if the node and any associated child node are outside the view frame.

PRODUCT OVERVIEW

This section provides an overview of the product mapped with the subject patent. This information is provided to aid understanding of the mapping by providing a glance at the product beforehand.

Purple text and boxes represent comments added by the analyst team to improve understanding.

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Company: Autodesk
Product: 3ds Max

Introduction

3ds Max® 3D modeling software provides a comprehensive modeling, animation, simulation, and rendering solution for games, film, and motion graphics artists. 3ds Max delivers efficient new tools, accelerated performance, and streamlined workflows to help increase overall productivity for working with complex, high-resolution assets.

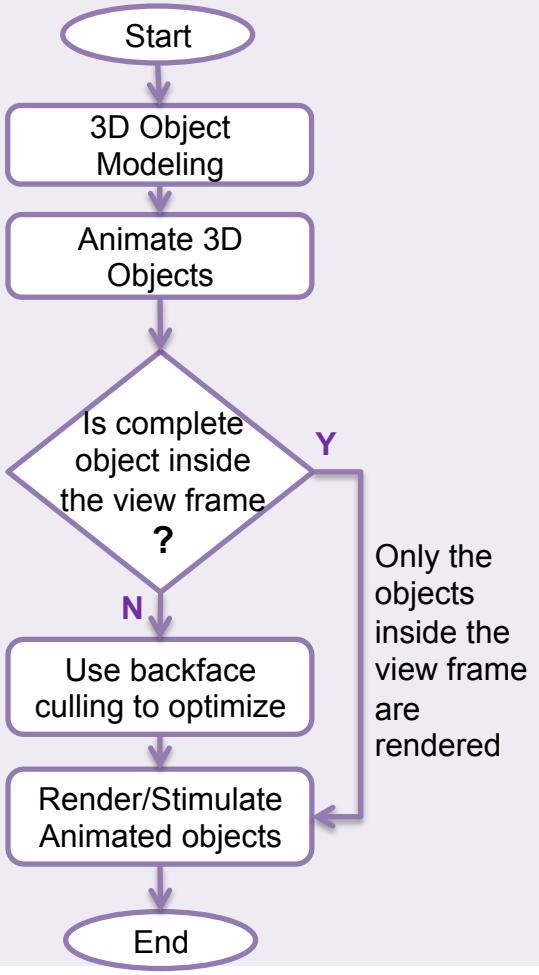
Features

Some of its prominent features are:

- Point cloud support – You can import, visualize, snap to, and render point cloud data.
- Python scripting - You can use python scripting to extend and customize 3ds Max.
- Populate enhancements and crowd animation.
- **Back face culling**
- Mesh and surface modeling.
- Texture assignments and editing.
- Accelerated viewport performance

Analyst Comment: 3ds Max is 3D content modeling software by Autodesk. It is used to create 3D scenes such as games and animation films. It is easy to use and efficient.

Diagram below depicts the workflow of the product. It is provided by analyst for illustrative purpose.



Source: http://www.autodesk.com/products/3ds-max/overview

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Company: Autodesk
Product: 3ds Max

Market information:

Autodesk reported impressive second-quarter fiscal 2015 results. Both revenues of $637 million and earnings of $0.21 per share beat the Zacks Consensus Estimate. The company provided an upbeat guidance for the third quarter.

The company's flagship products (AutoCAD, AutoCAD LT, AutoCAD Civil 3D, AutoCAD Mechanical, AutoCAD Architecture, **Autodesk 3ds Max** and Autodesk Maya) accounted for **approximately 51% of revenues in 2014**. Design and creation suites accounted for approximately 34.0% of revenues, while new products contributed 14.0% of revenues in fiscal 2014.

Source 1

Analyst Comment: Autodesk is one of the biggest market players in the 3D animation and modeling software industry. Its modeling software 3ds Max contributes significantly to revenues which were reported to be $618 million in Q32015.

Source 2

Source 1: *http://www.nasdaq.com/article/autodesk-inc-adsk-new-analyst-report-from-zacks-equity-research-zacks-equity-research-report-cm341945*

Source 2: *http://investors.autodesk.com/phoenix.zhtml?c=117861&p=irol-irhome*

PRODUCT MAPPING

This section provides element-by-element mapping of the subject claim with the product identified. Below is the color-coding used for this purpose –

- **Green** text represents a sub-element for which relevant information is explicitly available.
- **Purple** text represents comments and notes added by the analyst team to improve understanding.
- **Blue box** represents the claim element that is being mapped with the product.

Note: To explicitly show presence of some claim elements, we have used references/ text which are not from official website of Autodesk.

Claim 1 (Preamble) (I)

In a computer system for creating animation data for a 3D object appearing in a 3D animated content, the 3D object having a hierarchy of parent nodes and children nodes, each node being associated with animation data, a method for optimizing the animation data associated with each node comprising:

3ds Max® 3D modeling software provides a comprehensive **modeling, animation, simulation, and rendering solution for games, film, and motion graphics artists**. 3ds Max delivers efficient new tools, accelerated performance, and streamlined workflows to help increase overall productivity for working with complex, high-resolution assets1.

3D animated content

Computer System

Source 1

Autodesk® 3ds Max® 2015 software is supported on the following 64-bit operating systems

Software	
Operating System	Microsoft® Windows® 7 (SP1), Windows® 8 and Windows® 8.1 Professional operating system

Source 2

Analyst Comment: 3ds Max is 3D animation software used to create 3D animated content for games, films etc. Since it requires an operating system to run, the presence of a computer system is validated.

Source 1: http://www.autodesk.in/products/3ds-max/overview

Source 2: http://knowledge.autodesk.com/support/3ds-max/troubleshooting/caas/sfdcarticles/sfdcarticles/System-requirements-for-Autodesk-3ds-Max-2015.html

Claim 1 (Preamble) (II)

In a computer system for creating animation data for a 3D object appearing in a 3D animated content, **the 3D object having a hierarchy of parent nodes and children nodes**, each node being associated with animation data, a method for optimizing the animation data associated with each node comprising:

*Description of **"the 3D object having a hierarchy of parent nodes and children nodes"** from the subject patent.*

> **Actors and props (collectively referred to as actors) are composed of a hierarchy of nodes**. The hierarchy begins with a root node and proceeds down to other nodes, **each node being associated with a discrete piece of 3D geometry (group of polygons) making up the 3D object. Each node is further identified by a node name. For example, a node representing an object's head might be named a "head" node.**
>
> **Each node has zero or more parent and child nodes, with the restriction that the linkages cannot form a loop. Thus, a trunk node may have a leg node as one of its children, and a head node as one of its parents.**

Analyst Comment: According to the subject patent, a 3D object (e.g. actors and props occurring in 3D content) is made up of various 3D geometries and each 3D geometry is associated with a unique node.
A node (e.g. trunk) may have other nodes connected to it called as parent and child nodes. For example, a parent node (e.g. head) and a child node (e.g. leg) are connected to the trunk node.

Source: http://patentimages.storage.googleapis.com/pdfs/US6538654.pdf (Column 5, Line 58)

Claim 1 (Preamble) (III)

In a computer system for creating animation data for a 3D object appearing in a 3D animated content, **the 3D object having a hierarchy of parent nodes and children nodes**, each node being associated with animation data, a method for optimizing the animation data associated with each node comprising:

Geometry forming parent node and child node

Meshes are complex models created from many polygon faces that are smoothed together when the object is rendered.

Analyst Comment: Similar to what is described in the subject patent (see slide 14), 3D objects in Autodesk 3ds Max are comprised of meshes (geometry) which are synonymous with nodes.
We have shown the presence of 3D geometry which indicates the availability of nodes in the product.

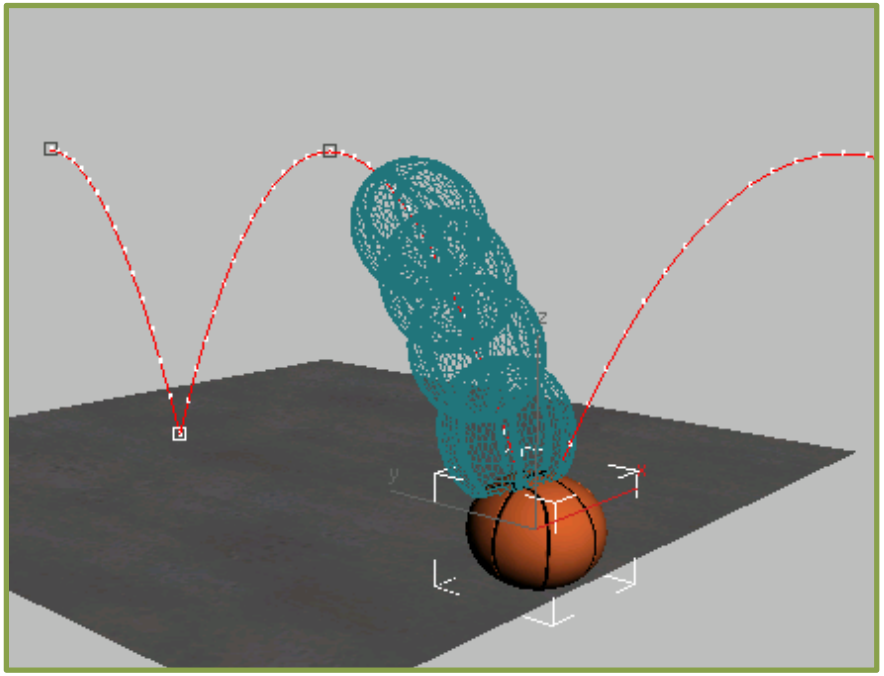
Source : http://www.expertrating.com/courseware/3DCourse/3D-Modeling-1.asp

Claim 1 (Preamble) (IV)

In a computer system for creating animation data for a 3D object appearing in a 3D animated content, the 3D object having a hierarchy of parent nodes and children nodes, **each node being associated with animation data**, a method for optimizing the animation data associated with each node comprising:

To create a bouncing ball, first you use Auto Key to block out the motion, and then use the Curve Editor and other tools to make the motion more realistic. (This is a very typical workflow for animators.)

Animation data



Analyst Comment: The text and image above highlights the method of adding animation to an object. As each object is made up of various nodes, every node will have animation data associated with it.

Source :
http://docs.autodesk.com/3DSMAX/16/ENU/3ds-Max-Tutorials/index.html?url=files/GUID-276E8B76-5EC3-47F5-B8F4-88D67E992619.htm,topicNumber=d30e12258

Claim 1 (Preamble) (V)

In a computer system for creating animation data for a 3D object appearing in a 3D animated content, the 3D object having a hierarchy of parent nodes and children nodes, each node being associated with animation data, **a method for optimizing the animation data associated with each node** comprising:

Description from the subject patent.

In accordance with one aspect of the invention, **the animation and texture data of the 3D animation content is optimized to reduce the size of the animation data to be streamed over the Internet.** The system and method according to this second aspect of the invention gathers statistical information about the nodes and textures being utilized in each frame of the animated content. In doing so, **the system and method determines if a particular node and any of its children nodes are outside the view frame. If they are, then the animation data associated with the node is removed.**

Analyst Comment: According to the subject patent, optimization of animation data includes removing the data associated with a node which is outside the field of view.

Source: https://patentimages.storage.googleapis.com/pdfs/US6538654.pdf (Column 3, Line 17)

Claim 1 (Preamble) (VI)

In a computer system for creating animation data for a 3D object appearing in a 3D animated content, the 3D object having a hierarchy of parent nodes and children nodes, each node being associated with animation data, **a method for optimizing the animation data associated with each node** comprising:

The Culling menu lets you select how you want the weighted polygons of a selected model to be rendered in the Viewer window. You can render only the polygons that compose the outside of your model, only the polygons that compose the inside of your model, or you can render both types of polygons. Choosing to render only set of polygons can reduce rendering times.

Optimizing the animation data

Analyst Comment: According to the product description, only the data viewed by the user may be rendered optimizing the animation. As a result, rendering time is reduced.

Source:
http://knowledge.autodesk.com/support/motionbuilder/learn-explore/caas/mne-help/global/docs/motionbuilder2014/en-us/files/Shader-manager-Culling-Mode-menu-htm.html?v=2014

Claim 1 (Clause 1) (l)

determining if the node is outside a **view frame**;

*Description of "**view frame**" from the subject patent.*

> The animation inaccuracy of the child node does not affect the quality of the 3D movie if the child node is **not visible (i.e. outside the view frame).**

Analyst Comment: According to the subject patent, view frame refers to the field of view in which the node is visible and is not obscured by the other nodes.

Source: http://patentimages.storage.googleapis.com/pdfs/US6538654.pdf (Column 65, Line 52)

determining if the node is outside a view frame;

In the 3ds Max Viewport, the display option for Backface Culling is by default disabled for objects. **Backface Culling means that the Backfaces of Polygons are culled and not displayed in View.** By enabling the Backface Culling option for object the display in the 3ds Max Viewport will match the default display when rendering.

Analyst Comment: The software culls the parts (nodes) of the objects outside the view frame. To do this, determination of nodes outside the view frame is necessary.

Source:
http://knowledge.autodesk.com/support/3ds-max/troubleshooting/caas/sfdcarticles/sfdcarticles/Backface-Cull-Object-renders-transparent-when-facing-away-from-view.html

determining if any child node associated with the node is outside the view frame; and

Description from the subject patent.

Thus, removal of a parent node's animation data negatively affects the accuracy of the animation of a child node. **The animation inaccuracy of the child node does not affect the quality of the 3D movie if the child node is not visible (i.e. outside the view frame). However, if the child node is within the view frame, the inaccurate animation of the child node deteriorates the overall quality of the 3D movie.**

Analyst Comment: According to the subject patent, the animation of a child node affects the quality of the complete 3D movie. Hence it becomes important to determine if the child node lies outside the view frame.

Source: https://patentimages.storage.googleapis.com/pdfs/US6538654.pdf (Column 15, Line 60)

determining if any child node associated with the node is outside the view frame; and

The Culling menu lets you select how you want the weighted polygons of a selected model to be rendered in the Viewer window. You can render only the polygons that compose the outside of your model, only the polygons that compose the inside of your model, or you can render both types of polygons. Choosing to render only set of polygons can reduce rendering times.

Source 1

In the 3ds Max Viewport, the display option for Backface Culling is by default disabled for objects. **Backface Culling means that the Backfaces of Polygons are culled and not displayed in View**. By enabling the Backface Culling option for object the display in the 3ds Max Viewport will match the default display when rendering.

Source 2

Analyst Comment: In 3ds Max, backface culling takes place for the nodes present outside the view frame. Determining if child nodes exist outside the view frame is a necessary part of this process.

Source 1:
http://knowledge.autodesk.com/support/motionbuilder/learn-explore/caas/mne-help/global/docs/motionbuilder2014/en-us/files/Shader-manager-Culling-Mode-menu-htm.html?v=2014

Source 2:
http://knowledge.autodesk.com/support/3ds-max/troubleshooting/caas/sfdcarticles/sfdcarticles/Backface-Cull-Object-renders-transparent-when-facing-away-from-view.html

removing the animation data associated with the node if the node and any associated child node are outside the view frame.

In the 3ds Max Viewport, the display option for Backface Culling is by default disabled for objects. **Backface Culling means that the Backfaces of Polygons are culled and not displayed in View.** By enabling the Backface Culling option for object the display in the 3ds Max Viewport will match the default display when rendering.

Removing the animation data

Analyst Comment: Parts (nodes or child nodes) of the 3D objects are dropped if these are determined to be outside the view frame. Removing the nodes means the animation data is removed and therefore never rendered.

Source:
http://knowledge.autodesk.com/support/3ds-max/troubleshooting/caas/sfdcarticles/sfdcarticles/Backface-Cull-Object-renders-transparent-when-facing-away-from-view.html

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