H-Anim Motion Data Definition Updates

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Myeong Won Lee
The University of Suwon

web 3D korea

Agenda

- H-Anim motion definition
  - Topics
  - Scope
  - Concept
- The design method of H-Anim models

Topics (ISO/IEC 19774:2005)

- Foreword
- Introduction
- 1 Scope
- 2 Normative references
- 3 Definitions
- 4 Concepts
- 5 Abstract data types
- 6 Object interfaces
- 7 Conformance
- Annexes
- A Nominal body dimensions and levels of articulation
- B Feature points for the human body
- C VRML binding
- D X3D binding
- E Guidelines for H-Anim in VRML and X3D worlds
- Bibliography

Topics (New version)

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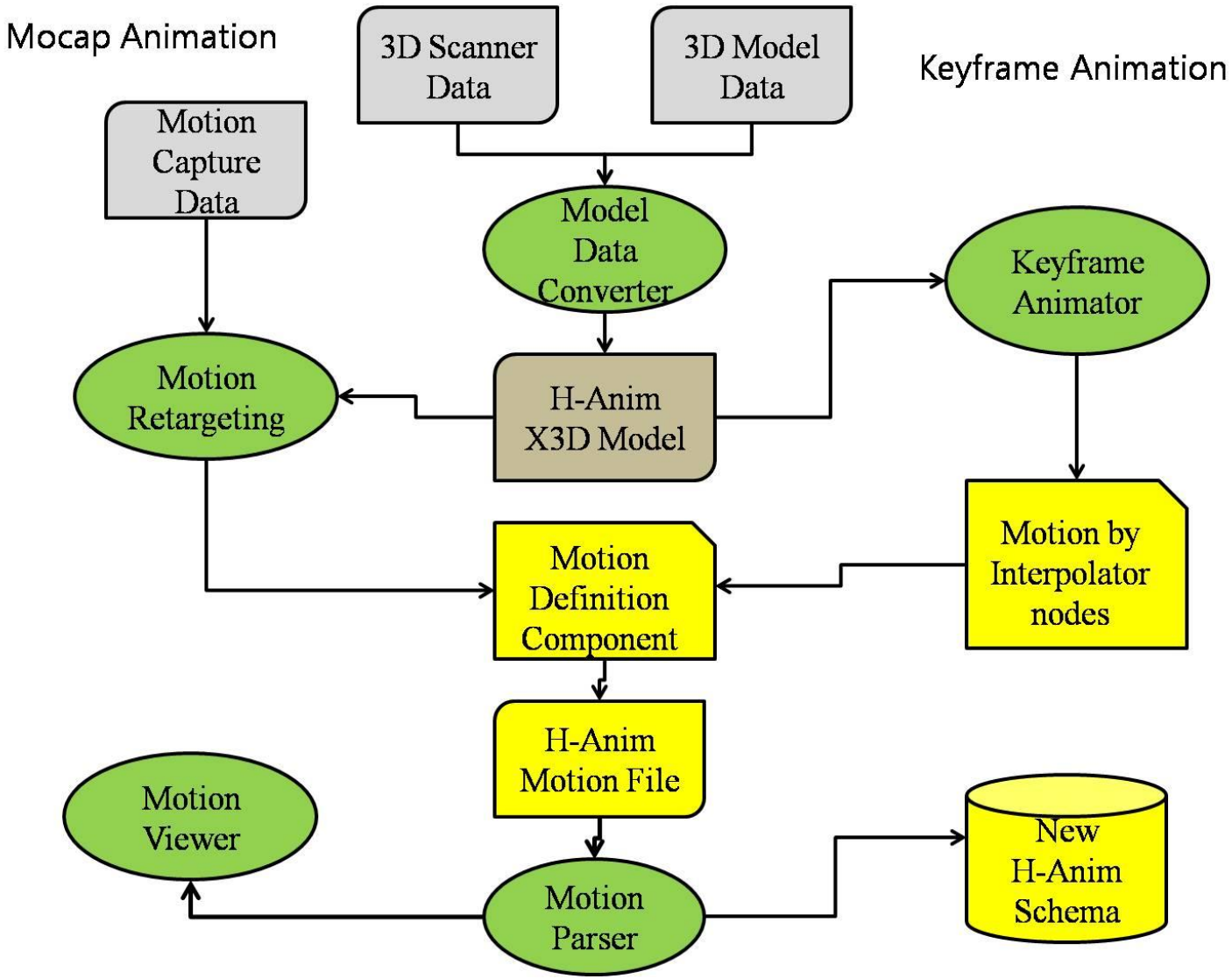
- E Guidelines for H-Anim in VRML and X3D worlds
- F H-Anim Character Modeling Method
- G H-Anim Character Animation Examples
- Bibliography

Scope

- Definition of a humanoid character model capable of generating motion from captured motion data
- Definition of a humanoid character model capable of generating motion using 3D scanner data
- Definition of a humanoid character model capable of generating motion using a general motion definition such as keyframe, interpolation, kinematics, and dynamics for human figures
- Definition of motion parameters for transferring or exchanging motion between different human character models
- Definition of a motion data interface for including motion data
- Definition of a motion viewer's functionality

H-Anim Character Animation Generation



Motion Data Definition

- Definition of a Motion Data Component
  - Joint node (update)
    - Define additional fields for motion parameters
  - Motion node
    - Define motion captured data for an H-Anim character model
    - Define the motion node after adjusting the center of each joint to the H-Anim character model

Joint Node Update

```
Interface Joint {
// the same as the existing joint node
float[3] bboxCenter 0 0 0
float[3] bboxSize -1 -1 -1
float[3] center 0 0 0
sequence<Object> children []
sequence<Object> displacers []
sequence<float[3]> llimit []
float[4] limitOrientation 0 0 1 0
string name ""
float[4] rotation 0 0 1 0
float[3] scale 1 1 1
float[4] scaleOrientation 0 0 1 0
float[3] translation 0 0 0
sequence<float[3]> ulimit []

// define additional fields
int[2] ChannelsNumber
sequence<string> Channels
float[3] Offset
}
```

```
HIERARCHY
ROOT Hips
{
 OFFSET 0.000000 0.000000 0.000000
 CHANNELS 6 Xposition Yposition Zposition Zrotation
 JOINT Chest
 {
  OFFSET 0.000000 5.613096 0.000000
  CHANNELS 3 Zrotation Xrotation Yrotation
  JOINT LeftCollar
  {
   OFFSET 0.003804 10.354579 1.025227
   CHANNELS 3 Zrotation Xrotation Yrotation
   JOINT LeftShoulder
   {
    OFFSET 3.922637 0.000000 0.000000
    CHANNELS 3 Zrotation Xrotation Yrotation
```

- Fields for receiving motion capture data
  - ChannelsNumber
  - Channels
  - Offset

Joint Node Update

- Define additional fields: Offset, Channels, ChannelsNumber (new fields)

```
Interface Joint {
   …
   float[3]              Offset
   int[2]                ChannelsNumber
   sequence<string>      Channels
}
```

  - ChannelsNumber: Number of channels at a joint
  - Channels: Identifiers for channels
  - Offset: the center of a joint

- Example

```
Joint {
…
Offset                [ 1, 3 ]
ChannelsNumber        [ 1, 3 ]
Channels              " Xrotate   Yrotate   Zrotate"
}
```

Motion Node

- Definition of Motion Node (a new node)
  - Define fields of Frames, FrameTime, transformation Channels

```
Interface Motion {
   int                  Frames
   float                FrameTime
   sequence<float>   Transformation
}
```

  - Frames: Number of frames for an animation sequence
  - FrameTime: Specifies a sampling rate
  - Transformation: Transformation values of a joint for each frame

- Example

```
Motion {
Frames              601
Frametime           0.033333
transformation      [ 11.623, 31.312, 64.121, -0.700, -4.023, ……
                    11.616, 31.313, 64.107, -0.696, -3.954, ……
                    …… ]
}
```

NewHanim.hanim – Modeling Part (1)

```
<Scene>
<NavigationInfo speed="1.5" type='"EXAMINE" "ANY"'/>
<HAnimHumanoid DEF="girl1" name="girl1" version="1.1"/>

<HAnimJoint DEF="hanim_HumanoidRoot" center="0.0 0.0 0.0"
containerField="skeleton" name="HumanoidRoot"/>

<HAnimJoint DEF="hanim_sacroiliac" center="0.0 0.0 0.0" name="sacroiliac"
containerField="children"
Offset="0.000000 0.000000 0.000000“
Channels="6, Xposition, Yposition, Zposition, Zrotation, Xrotation, Yrotation" />

<HAnimSegment DEF="hanim_pelvis" name="pelvis" containerField="children"/>
<Transform translation="0.0 0.0 0.0"  rotation="0 0 0 0"  scale="0.0 0.0 0.0"
scaleOrientation="0 0 0 0">

<Appearance>
<Material diffuseColor="0.537300 0.196100 0.196100"/>
<ImageTexture url="girl1.bmp"/>
</Appearance>
```

NewHanim.hanim – Modeling Part (2)

```
<Shape>
<IndexedFaceSet coordIndex="0, 1, 2, -1, 0, 2, 3, -1, 0, 3, 4, -1, 0, 4, 5, -1, 0, 5, 6, -1,
0, 6, 7, -1, 0, 7, 8, -1, 0, 8, 9, -1, 0, 9, 10, -1, 0, 10, 11, -1, 0, 11, 12, -1, 0, 12, 1, -1,
…"
texCoordIndex="0, 1, 2, -1, 0, 2, 3, -1, 0, 3, 4, -1, 0, 4, 5, -1, 0, 5, 6, -1, 0, 6, 7, -1, 0,
7, 8, -1, 0, 8, 9, -1, 0, 9, 10, -1, 0, 10, 11, -1, 0, 11, 12, -1, 0, 12, 1, -1, 1, 13, 14, -1,  -
1 …">
<Coordinate point="0.0000 105.4000 0.0000, 0.0000 91.2700 -56.9400, -35.2900
91.2700 -49.3200, -61.1200 91.2700 -40.1100, -70.5700 91.2700 0.0000, -61.1200
…"/>
<TextureCoordinate point="0.6211 0.5754,0.7851 0.5720,0.7614 0.5720,0.6907
0.5698,0.6200 0.5698,0.6158 0.5702,0.5451 0.5702,0.4167 0.5698,0.5451
…"/>
</IndexedFaceSet>
</Shape>
</Transform>
</HAnimSegment>
</HAnimJoint>
```

NewHanim.hanim – Motion Part

```
…
…
<HAnimMotion>
<FrameInformation frames ="392" frametime = "0.033333">
<SegmentTransform transform = "
196.1625 71.7332 -58.9121 25.9900 9.3900 -76.6700 29.9100 -61.7800 39.3900
0.1500 30.8300 -
…
…
0.3300 -14.2200 -0.2300 2.1900 -4.9100 -21.1400 -5.5400 8.5100 13.4900 -
10.7700 ">
</HAnimMotion>
</Scene>
</X3D>
```

Schema Extension for H-Anim Character Animation (1)

1. Schema definition for Motion data

```
<xs:group name="ChildContentModelHumanoidAnimation">
  <xs:annotation>
    <xs:appinfo>Child-node content model corresponding to X3DChildNode for HumanoidAnimation component.</xs:appinfo>
            <xs:documentation source="http://www.web3d.org/x3d/specifications/ISO-IEC-FDIS-19775-1.2-X3D-AbstractSpecification/Part01/components/hanim.html"/>
  </xs:annotation>
  <xs:choice>
            <xs:element ref="HAnimHumanoid"/>
            <xs:element ref="HAnimJoint"/>
            <xs:element ref="HAnimSegment"/>
            <xs:element ref="HAnimSite"/>
<!-- added -->
            <xs:element ref="HAnimMotion"/>
<!-- added -->
  </xs:choice>
</xs:group>
```

Schema Extension for H-Anim Character Animation (2)

2. Schema definition for the updated Joint node

```
<xs:element name="HAnimJoint">
  <xs:annotation>
     <xs:appinfo/>
        <xs:documentation     source="http://www.web3d.org/x3d/specifications/ISO-IEC-FDIS-19775-1.2-X3D-AbstractSpecification/Part01/components/hanim.html#HAnimJoint"/>
     </xs:annotation>
     <xs:complexType mixed="false">
     <xs:complexContent mixed="false">
     <xs:extension base="X3DGroupingNode">
              <xs:attribute name="name" type="jointName"/>
             <xs:attribute name="center" type="SFVec3f" default="0 0 0"/>
             <xs:attribute name="rotation" type="SFRotation" default="0 0 1 0"/>
             <xs:attribute name="scale" type="SFVec3f" default="1 1 1"/>
             <xs:attribute name="scaleOrientation" type="SFRotation" default="0 0 1 0"/>
             <xs:attribute name="translation" type="SFVec3f" default="0 0 0"/>
             <xs:attribute name="skinCoordIndex" type="MFInt32"/>
```

Schema Extension for H-Anim Character Animation (3)

```
            <xs:attribute name="skinCoordWeight" type="MFFloat"/>
            <xs:attribute name="llimit" type="MFFloat"/>
            <xs:attribute name="ulimit" type="MFFloat"/>
            <xs:attribute name="limitOrientation" type="SFRotation" default="0 0 1 0"/>
            <xs:attribute name="stiffness" type="MFFloat" default="0 0 0"/>
<!- added -->
            <xs:attribute name="Offset" type="SFVec3f"/>
            <xs:attribute name="ChannelsNumber" type="MFInt32"/>
            <xs:attribute name="Channels" type="MFString"/>
<!- added -->
        </xs:extension>
      </xs:complexContent>
   </xs:complexType>
</xs:element>
```

Schema Extension for H-Anim Character Animation (4)

3. Schema definition for the Motion node

```
<!- added -->
<xs:element name="HAnimMotion">
   <xs:annotation>
       <xs:appinfo/>
            <xs:documentation source="..."/>
   </xs:annotation>
   <xs:complexType>
            <xs:attribute name="DEF" type="xs:ID" use="required"/>
            <xs:attribute name="Frames" type="SFInt32" use="required"/>
            <xs:attribute name="Frametime" type="SFFloat" use="required"/>
            <xs:attribute name="Transformation" type="MFVec3f" use="required"/>
<!--        <xs:attribute name="Transformation" type="MFRotation" use="required"/>-->
    </xs:complexType>
 </xs:element>
```

H-Anim Characters

1.Jin

2.Chul

3.Hyun

4.Young

5.Ju

6.Ga

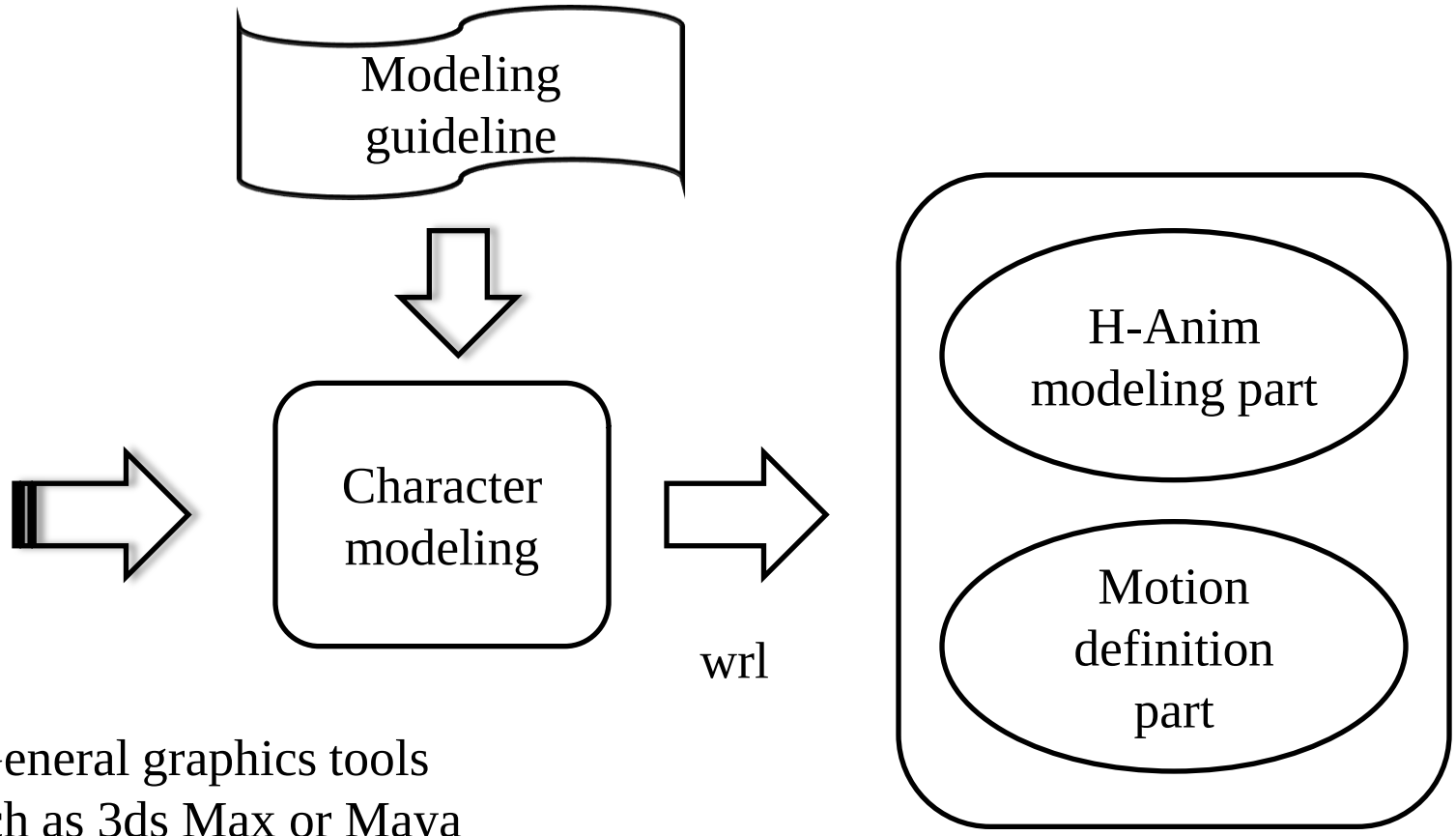
7.No

8.Da

9.Ru

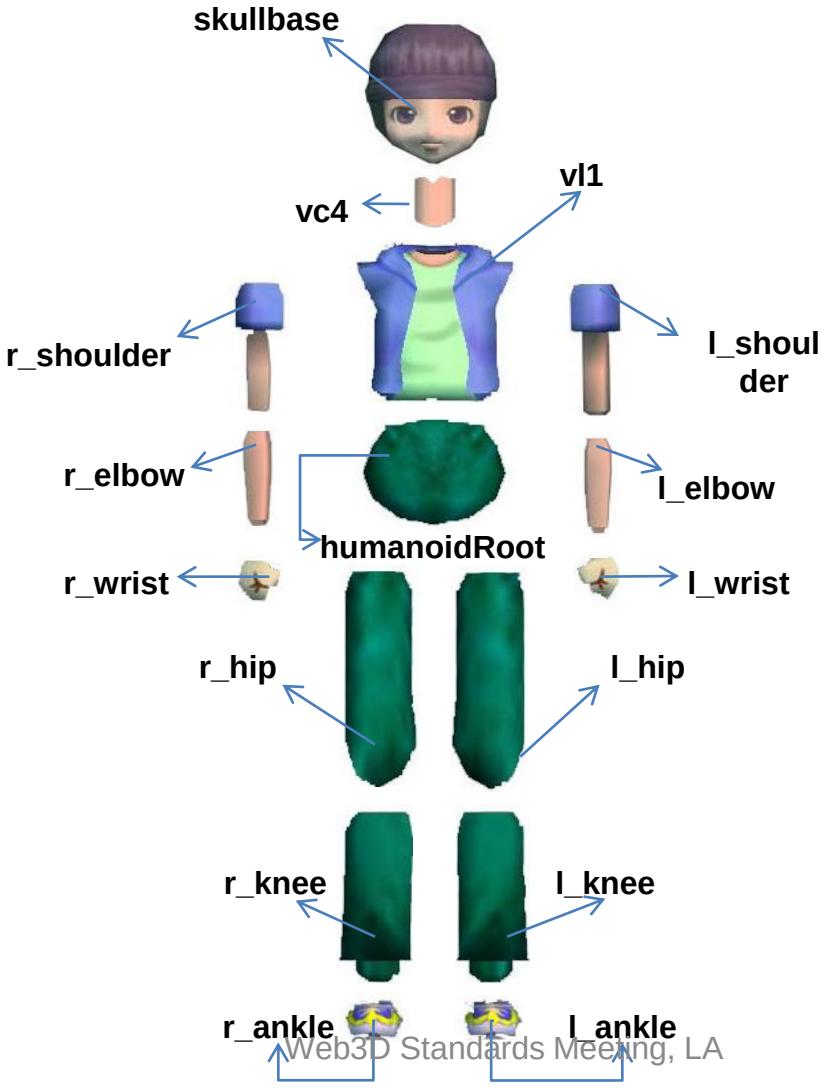
10.Mi

A Procedure for Modeling an H-Anim Character Using General Graphics Tools



H-Anim Character Modeling (1)

1. Uniquely identify each segment according to the naming scheme of H-Anim.

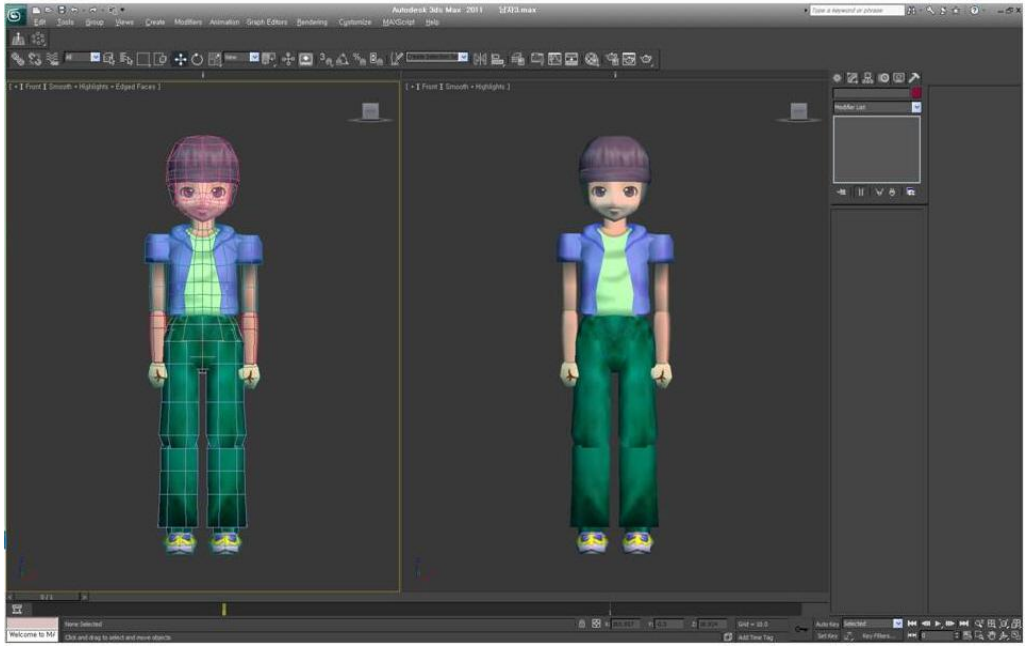


H-Anim Character Modeling (2)

2. Integrate all the segments to form a complete character.

H-Anim Character Modeling (3)

3. Store the designed character as a wrl or x3d file if the general graphics tool has the capability to save the file in either of these formats. Otherwise, use a converter to store the data in the appropriate format.



H-Anim Character Modeling (4)

4. Convert the wrl character file into an H-Anim character file in the H-Anim format (an x3d H-Anim file). This x3d file is different from other general X3D objects because it has the H-Anim structure format. It includes all the segments and joints with their identified H-Anim component names.

H-Anim Character Modeling (5)

- H-Anim modeling file

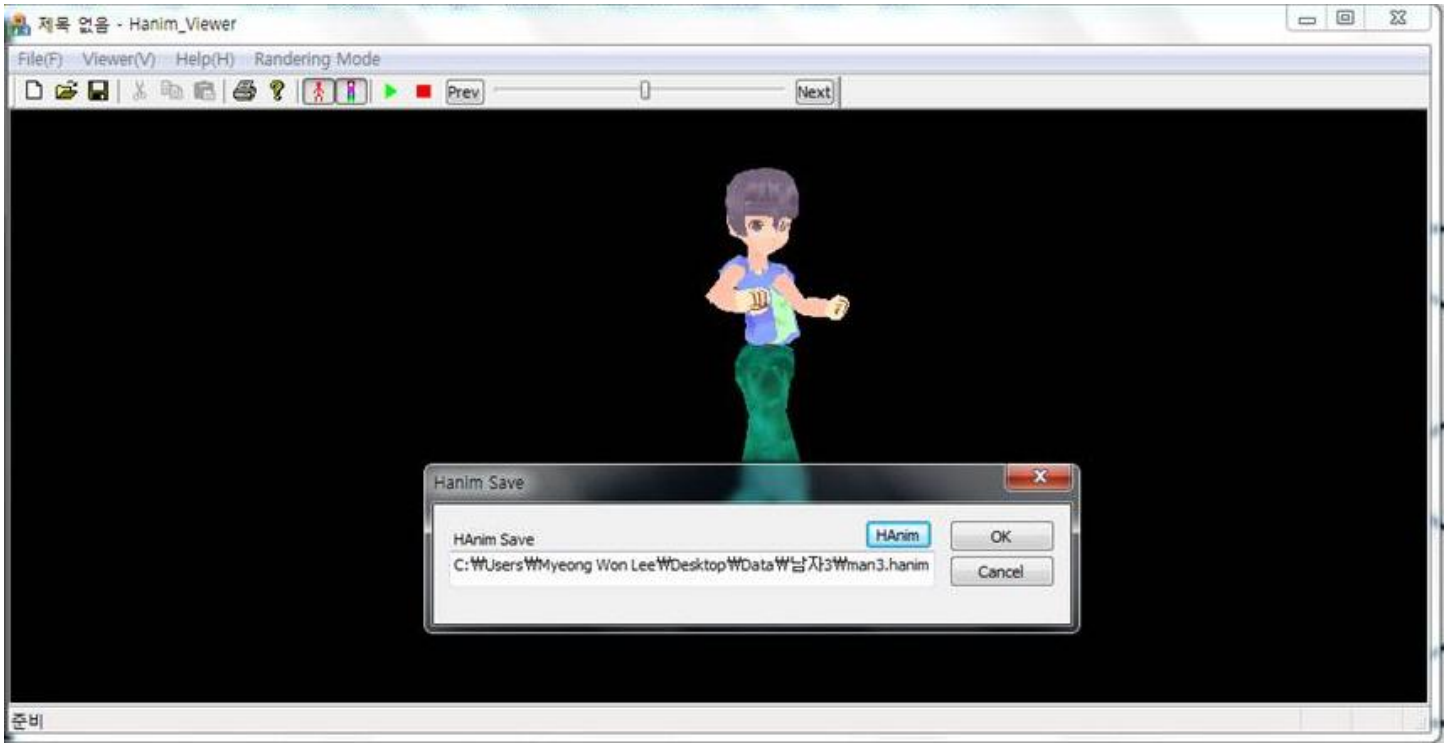
```
<Scene>
<HAnimHumanoid DEF="sample" name="humanoid" version="1.1">
        <HAnimJoint DEF="hanim_HumanoidRoot" center="0 -0.9232 -82.4" containerField="skeleton" name="HumanoidRoot">
                <HAnimJoint DEF="hanim_sacroiliac" center="0 -3.596 -91.49" name="sacroiliac" containerField="children">
                <HAnimSegment DEF="hanim_pelvis" name="pelvis" containerField="children">
                <Transform translation="-7.927 75.275 9.033">
                <Shape>
                <IndexedFaceSet coordIndex="0, 1, 2, -1, 2, 3, 4, -1"  creaseAngle="1.14">
                <Coordinate point="-10.56 -10.15 0.8157, 5.137 -10.15 2.444, -10.07 -10.15 -4.413, 5.137 -10.15 -2.444"/>
                </IndexedFaceSet>
                <Appearance>
                <Material diffuseColor="0.3412 0.8784 0.5608"/>
                </Appearance>
                </Shape>
                </Transform>
                </HAnimSegment>
                        <HAnimJoint DEF="hanim_l_hip" center="9.61 -0.01 -91.24" name="l_hip" containerField="children">
                        <HAnimSegment DEF="hanim_l_thigh" name="l_thigh">
                        <Transform translation="4.586 74.82 20.263">
                        <Shape>
                        <IndexedFaceSet coordIndex="2, 0, 3, -1, 1, 3, 0, -1, 9, 8, 11, -1, 10, 11, 8, -1,
```

H-Anim Character Animation (1)

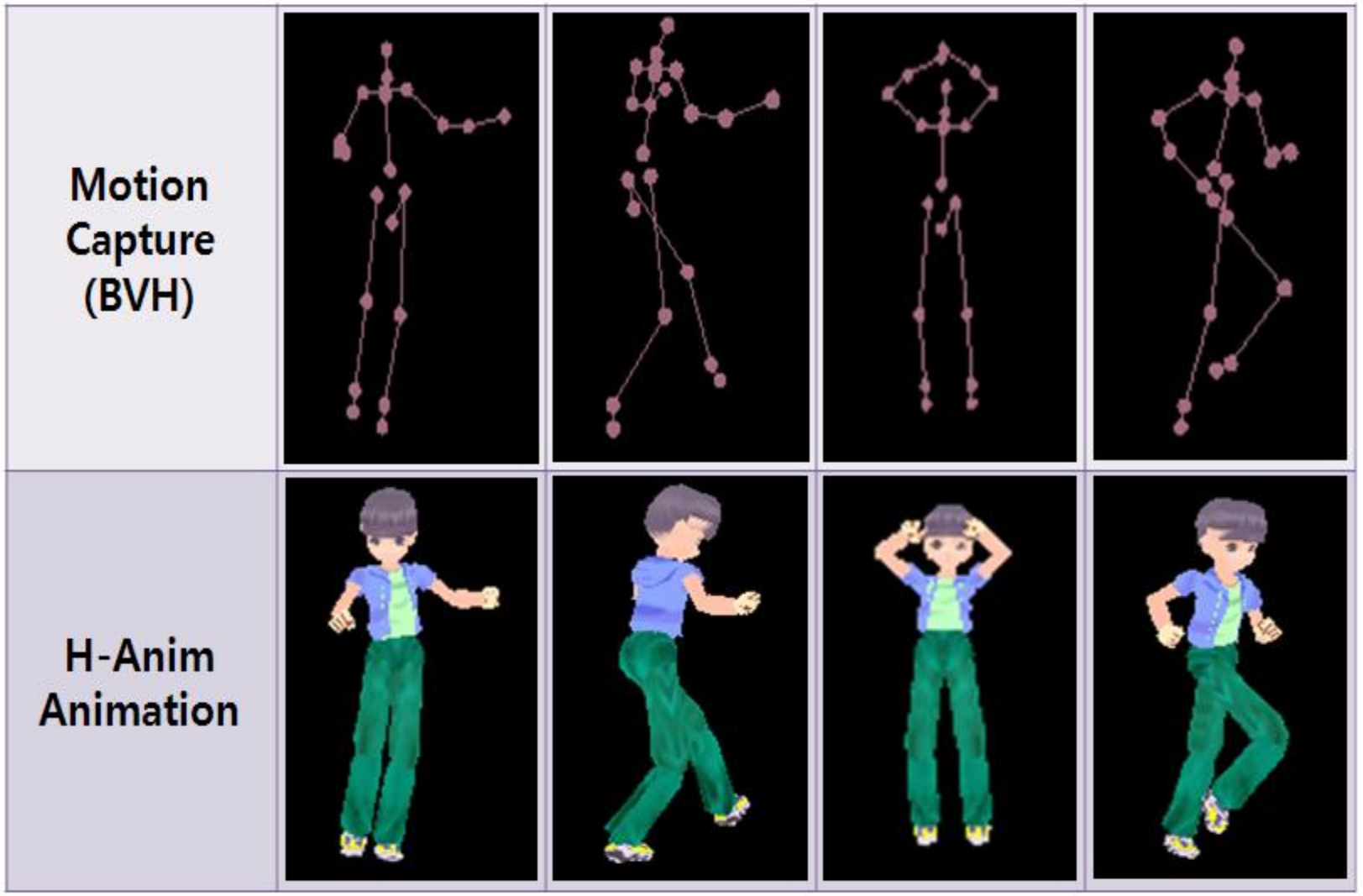
5. Read a motion capture file and apply it to the H-Anim character model. Our H-Anim motion viewer includes the function of motion retargeting which can applies the motion of each joint of the motion captured model to the motion of a corresponding joint of the designed H-Anim character model. The motion viewer displays an animation sequence from the H-Anim character model and a motion capture file.

H-Anim Character Modeling (2)

6. The motion viewer can save the animation sequence as an animation file (hanim extension) which has the format of the H-Anim motion data definition. The following figure shows the interface to save an H-Anim animation file after generating an animation sequence.

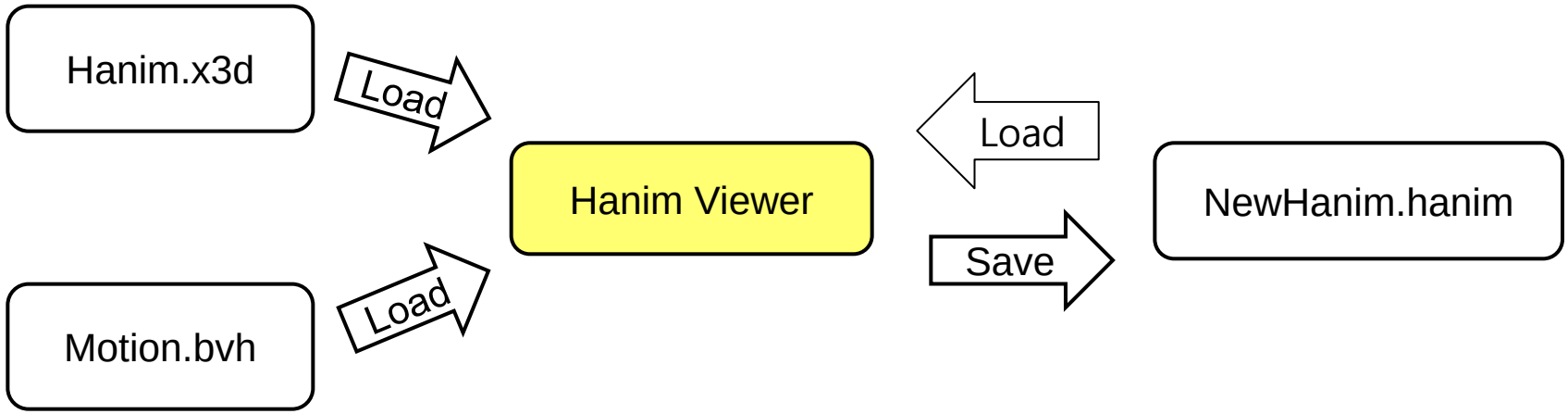


H-Anim Chracter Animation Example



H-Anim Animation File Generation

- H-Anim Motion Viewer
  - Read an H-Anim character model and motion captured data
  - Adjust segment lengths of the mocap character to the H-Anim character
  - Generate and display the motion captured animation for the H-Anim character
  - Generate an H-Anim animation file including the H-Anim character model with the motion captured data



H-Anim Motion Viewer