

---

---

**Information technology — Media context  
and control —**

**Part 4:  
Virtual world object characteristics**

*Technologies de l'information — Contrôle et contexte de supports —  
Partie 4: Caractéristiques d'objet du monde virtuel*



Reference number  
ISO/IEC 23005-4:2013(E)

**AVA Documents**  
Document Sharing Hub  
© ISO/IEC 2013



**COPYRIGHT PROTECTED DOCUMENT**

© ISO/IEC 2013

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

Page

|                                                                         |     |
|-------------------------------------------------------------------------|-----|
| Foreword .....                                                          | iv  |
| Introduction.....                                                       | v   |
| 1 Scope .....                                                           | 1   |
| 2 Normative references .....                                            | 2   |
| 3 Terms, definitions and abbreviated terms .....                        | 2   |
| 3.1 Terms and definitions .....                                         | 2   |
| 3.2 Abbreviated terms .....                                             | 3   |
| 4 Virtual world object metadata .....                                   | 3   |
| 4.1 Introduction.....                                                   | 3   |
| 4.2 Schema wrapper conventions .....                                    | 4   |
| 4.3 Root element and top-level tools.....                               | 5   |
| 4.4 Virtual world object base type .....                                | 8   |
| 4.5 Virtual world object common data types .....                        | 34  |
| 5 Avatar metadata.....                                                  | 58  |
| 5.1 Introduction.....                                                   | 58  |
| 5.2 AvatarType .....                                                    | 59  |
| 6 Virtual object metadata .....                                         | 193 |
| 6.1 Introduction.....                                                   | 193 |
| 6.2 VirtualObjectType.....                                              | 193 |
| Annex A (normative) Classification Schemes .....                        | 200 |
| Annex B (informative) Virtual World Object Characteristics Schema ..... | 249 |
| Annex C (informative) Possible usage of ISO/IEC 23005-4.....            | 250 |
| Annex D (informative) The information on ISO 639 .....                  | 251 |
| Annex E (informative) Patent statements .....                           | 252 |
| Bibliography.....                                                       | 253 |

## Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 23005-4 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

This second edition cancels and replaces the first edition (ISO/IEC 23005-4:2011), which has been technically revised.

ISO/IEC 23005 consists of the following parts, under the general title *Information technology — Media context and control*:

- *Part 1: Architecture*
- *Part 2: Control information*
- *Part 3: Sensory information*
- *Part 4: Virtual world object characteristics*
- *Part 5: Data formats for interaction devices*
- *Part 6: Common types and tools*
- *Part 7: Conformance and reference software*

## Introduction

ISO/IEC 23005 (MPEG-V) provides an architecture and specifies associated information representations to enable interoperability between virtual worlds, e.g. digital content provider of a virtual world, gaming (serious), simulation, DVD, and the real world, e.g. sensors, actuators, vision and rendering, robotics (e.g. for revalidation), (support for) independent living social and welfare systems, banking, insurance, travel, real estate, rights management and many others.

Virtual worlds (often referred to as 3D3C for 3D visualization and navigation and the 3Cs of Community, Creation and Commerce) integrate existing and emerging media technologies (e.g. instant messaging, video, 3D, VR, AI, chat, voice, etc.) that allow for the support of existing and the development of new kinds of social networks. The emergence of virtual worlds as platforms for social networking is recognized by businesses as an important issue for at least two reasons:

- 1) it offers the power to reshape the way companies interact with their environments (markets, customers, suppliers, creators, stakeholders, etc.) in a fashion comparable to the Internet;
- 2) it allows for the development of new (breakthrough) business models, services, applications and devices.

Each virtual world, however, has a different culture and audience making use of these specific worlds for a variety of reasons. These differences permit users to have unique experiences.

Although realistic experiences have been achieved via devices such as 3D audio/visual devices, it is hard to realize sensory effects only with presentation of audiovisual contents. The addition of sensory effects leads to even more realistic experiences in the consumption of audiovisual contents. This will lead to the application of new media for enhanced experiences of users in a more realistic sense.

Such new media will benefit from the standardization of control and sensory information which includes sensory effect metadata, sensory device capabilities/commands, user sensory preferences, and various delivery formats. The MPEG-V architecture can be applicable for various business models for which audiovisual contents can be associated with sensory effects that need to be rendered on appropriate sensory devices.

The International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) draw attention to the fact that it is claimed that compliance with this document may involve the use of patents.

ISO and the IEC take no position concerning the evidence, validity and scope of these patent rights.

The holders of these patent rights have assured ISO and the IEC that they are willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statements of the holders of these patent rights are registered with ISO and the IEC. Information may be obtained from the companies listed in Annex E.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those identified in Annex E. ISO and the IEC shall not be held responsible for identifying any or all such patent rights.



# Information technology — Media context and control —

## Part 2: Virtual world object characteristics

### 1 Scope

This part of ISO/IEC 23005 specifies syntax and semantics of description schemes and descriptors used to characterize a virtual world object related metadata, making it possible to migrate a virtual world object (or only its characteristics) from one virtual world to another and to control a virtual world object in a virtual world by real world devices.

The system architecture of ISO/IEC 23005 is depicted in Figure 1 — System Architecture and the scope of this part of ISO/IEC 23005 is highlighted. That is, only the information representation that acts as an input to the possible R→V/V→R Adaptation and as an exchangeable information format to support interoperability between the virtual worlds, as defined in ISO/IEC 23005-1, is specified in this part of ISO/IEC 23005.

NOTE The actual R→V/V→R Adaptation is deliberately informative and left open for industry competition.

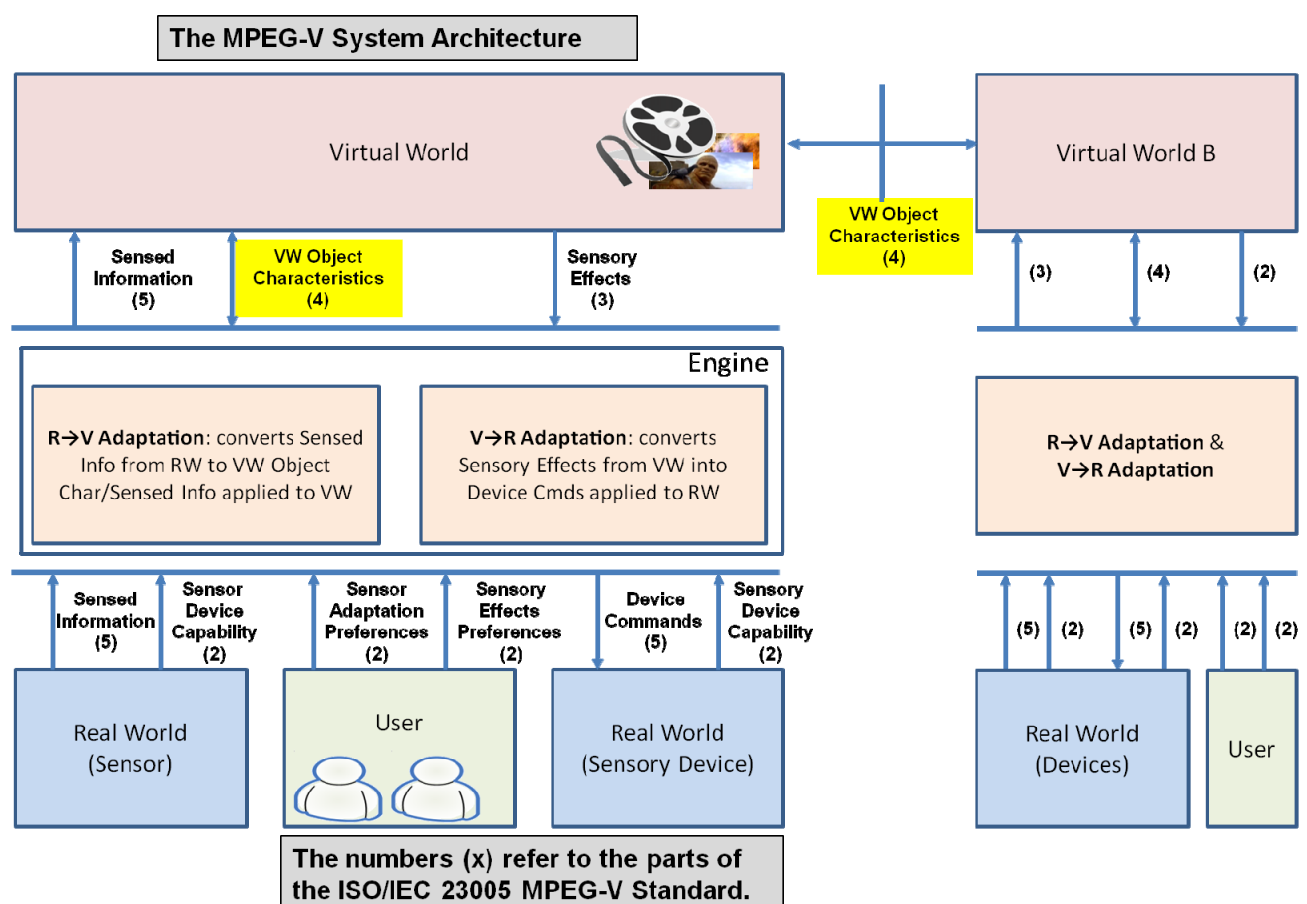


Figure 1 — System Architecture

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 15938-5, *Information technology — Multimedia content description interface — Part 5: Multimedia description schemes*

ISO/IEC 21000-5, *Information technology — Multimedia framework (MPEG-21) — Part 5: Rights Expression Language*

ISO/IEC 23005-6, *Information technology — Media context and control — Part 6: Common types and tools*

## 3 Terms, definitions and abbreviated terms

### 3.1 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO/IEC 23005-6 and the following apply.

#### 3.1.1

##### **avatar**

entity that can be used as a (visual) representation of the user inside the virtual environments

**EXAMPLE** A player's representation in the video game and human or fantastic representations of a person's self in non-gaming online worlds.

#### 3.1.2

##### **avatar metadata**

defines the description schemes and descriptors to represent **avatars** (3.1.1)

#### 3.1.3

##### **Extensible Markup Language**

set of rules for encoding documents in machine-readable form

#### 3.1.4

##### **Rights expression language**

machine-readable language that declares rights and permissions

#### 3.1.5

##### **Uniform Resource Identifier**

compact string of characters for identifying an abstract or physical resource

#### 3.1.6

##### **Uniform Resource Locator**

compact string representation for a resource available via the Internet

#### 3.1.7

##### **virtual object**

entity that is any (visual) object except for avatars in the virtual environment

#### 3.1.8

##### **virtual object metadata**

defines the description schemes and descriptors to represent **virtual objects** (3.1.7)

**3.1.9****virtual world object**

entity that includes avatars and virtual objects in the virtual world

**3.1.10****virtual world object metadata**

defines the description schemes and descriptors to represent **virtual world objects** (3.1.9)

**3.2 Abbreviated terms**

For the purposes of this document, the following abbreviated terms apply.

|          |                                                            |
|----------|------------------------------------------------------------|
| MPEG-21: | multimedia framework (ISO/IEC 21000-5)                     |
| MPEG-7:  | multimedia content description interface (ISO/IEC 15938-5) |
| REL:     | rights expression language                                 |
| URI:     | Uniform Resource Identifier                                |
| URL:     | Uniform Resource Locator                                   |
| XML:     | Extensible Markup Language                                 |

**4 Virtual world object metadata****4.1 Introduction**

A specificity of Virtual Environments (VEs) with respect to other multimedia applications consists in the representation of virtual world objects inside the environment. The "virtual world object" can be classified into two types: avatars and virtual objects. An avatar can be used as a (visual) representation of the user inside the environment. These virtual world objects serve different purposes:

- characterize various kinds of objects within the VE,
- provide an interaction with the VE.

In general, creating an object is a time consuming task. Even though some components of the object may be related to the virtual environment (e.g. the avatar wearing a medieval suite in a contemporary style VE may be inappropriate), there is a real need of being able to create the object once and import/use it in different VEs. To serve the latter purpose, it should be possible to control the object from external applications (e.g. the emotions one avatar exposes in the VE can be obtained by processing the associated user's physiological sensors). The current standard proposes an XML Schema, called Virtual World Object Characteristics XSD, for describing an object by considering three main requirements:

- it should be possible to easily create importers/exporters from various VEs implementations,
- it should be easy to control an object within an VE,
- it should be possible to modify a proprietary template (specific to the virtual world) of the object by using data contained in Virtual World Object Characteristics file.

In detail, once the object is created possibly by an authoring tool specific to a VW, it can be used in any other VWs. In case of avatars, a user can have one's own unique presentation inside all VWs, like in real life. He can change and upgrade his avatar, i.e. "virtual himself" in one VW and then all the updated properties will be reflected in all the other VWs. The avatar itself contains representation and animation features but also higher level semantic information. However, each VW may have its own internal structure for handling avatars. ISO/IEC 23005 (MPEG-V) is not imposing any specific constraints on the internal structure of representing

data by the VW, but proposes a descriptive format able to drive the transformation of a template or a creation from scratch of an avatar compliant with the VW. All the associated characteristics of the avatar (including the associated motion) can be exported from a VW and then imported to another VW. Similarly, any virtual object created by a user can also be exchangeable between VWs by exporting and importing the associated characteristics of the object. In case of interfacing between virtual worlds and the real world, the sensed real world information will be processed to obtain the meaningful data which can be used as a control parameters on the associated characteristics of the object in the VW. As for avatar, the captured gesture of a user can be used to control the gesture of the avatar in the VW by updating the associated characteristics of the avatar. Similarly, the avatar motions created in the virtual world can be mapped onto a real robot for the use in dangerous areas, the maintenance tasks, the support for disabled and/or elderly people, and the like.

The proposed schema deals only with metadata and does not include representation of the geometry, sound, scent, animation or texture. To represent the latter, references to media resources are used. To provide a full interoperable solution, it may be combined with ISO/IEC 14496-16 (MPEG-4 Part 16) which includes a framework for defining and animating avatars) and/or ISO/IEC 14496-11 (MPEG-4 Part 11) which includes a framework for defining graphical assets.

There is a base type of attributes and characteristics of the virtual world objects which is shared by both avatars and virtual objects.

The base type of the virtual world object characteristics is composed of following type of data:

- **Identity**: contains an identification descriptors.
- **Sound**: contains sound resources and the related properties.
- **Scent**: contains scent resources and the related properties.
- **Control**: contains a set of descriptors for controlling motion features of an object such as translation, orientation and scaling.
- **Event**: contains a set of descriptors providing input events from a mouse, keyboard and etc.
- **Behaviour Model**: contains a set of descriptors defining the behavior information of the object according to input events.
- **id**: contains a unique identifier for identifying individual virtual world object information.

The virtual world object base type is inherited to both avatar metadata and virtual object metadata to extend the specific aspects of each of metadata.

## 4.2 Schema wrapper conventions

The Syntax defined in this Clause assumes the following Schema Wrapper to form a valid XML schema document.

```
<schema xmlns="http://www.w3.org/2001/XMLSchema"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004" xmlns:r="urn:mpeg:mpeg21:2003:01-REL-R-
NS" xmlns:mpegvct="urn:mpeg:mpeg-v:2012:01-CT-NS" xmlns:vwoc="urn:mpeg:mpeg-
v:2012:01-VWOC-NS" targetNamespace="urn:mpeg:mpeg-v:2012:01-VWOC-NS"
elementFormDefault="qualified" attributeFormDefault="unqualified"
version="ISO/IEC 23005-4" id="VWOCSchema.xsd">
  <!-- ##### -->
  <!-- Import of reference schema -->
  <!-- ##### -->
  <import namespace="urn:mpeg:mpeg7:schema:2004"
schemaLocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/MPEG-
7_schema_files/mpeg7-v2.xsd"/>
```

```
<import namespace="urn:mpeg:mpeg21:2003:01-REL-R-NS"
schemaLocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/MPEG-
21_schema_files/rel-r/rel-r.xsd"/>
<import namespace="urn:mpeg:mpeg-v:2012:01-CT-NS" schemaLocation="MPEG-V-
CT.xsd"/>
```

Additionally, the following line should be appended to the resulting schema document in order to obtain a well-formed XML document.

```
</schema>
```

## 4.3 Root element and top-level tools

### 4.3.1 Introduction

This Subclause specifies the root element and the top-level tools which can follow root element in virtual world object characteristics information. The root element is the only element which can appear as the topmost element when the world object characteristics information specified in this Part of ISO/IEC 23005 is instantiated. The top-level tools are defined as the elements which are allowed to appear as the topmost element within the root element.

### 4.3.2 XML representation syntax

```
<!-- ##### -->
<!-- Declaration of Root Element -->
<!-- ##### -->
<element name="VWOCInfo" type="vwoc:VWOCInfoType"/>

<complexType name="VWOCInfoType">
  <sequence>
    <element name="AvatarList" type="vwoc:AvatarListType" minOccurs="0"/>
    <element name="VirtualObjectList" type="vwoc:VirtualObjectListType"
minOccurs="0"/>
  </sequence>
</complexType>

<complexType name="AvatarListType">
  <sequence>
    <element name="Avatar" type="vwoc:AvatarBaseType" maxOccurs="unbounded"/>
  </sequence>
</complexType>

<complexType name="VirtualObjectListType">
  <sequence>
    <element name="VirtualObject" type="vwoc:VirtualObjectBaseType"
maxOccurs="unbounded"/>
  </sequence>
</complexType>
```

## 4.3.3 Binary representation syntax

|                                       | <i>Number of bits</i> | <i>Mnemonic</i>       |
|---------------------------------------|-----------------------|-----------------------|
| VWOCInfo                              |                       | VWOCInfoType          |
| VWOCInfoType{                         |                       |                       |
| AvatarListFlag                        | 1                     | bslbf                 |
| VritualObjectListFlag                 | 1                     | bslbf                 |
| if(AvatarListFlag){                   |                       |                       |
| AvatarList                            |                       | AvatarListType        |
| }                                     |                       |                       |
| if(VirtualObjectListFlag){            |                       |                       |
| VirtualObjectList                     |                       |                       |
| }                                     |                       |                       |
|                                       |                       |                       |
| AvatarListType{                       |                       |                       |
| NumAvatarType                         |                       | vluimsbf5             |
| for(k=0;k< NumAvatarType;k++){        |                       |                       |
| IndividualAvatarType                  | 8                     | bslbf                 |
| Avatar                                |                       | AvatarBaseType        |
| }                                     |                       |                       |
| }                                     |                       |                       |
| VirtualObjectListType{                |                       |                       |
| NumVirtualObjectType                  |                       | vluimsbf5             |
| for(k=0;k< NumVirtualObjectType;k++){ |                       |                       |
| IndividualVirtualObjectType           | 16                    | bslbf                 |
| VirtualObject                         |                       | VirtualObjectBaseType |
| }                                     |                       |                       |
| }                                     |                       |                       |

#### 4.3.4 Semantics

| Name                           | Description                                                                                                                                                                                                                                                                                                                                              |                                |                                                 |                   |          |          |                   |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------------------------|-------------------|----------|----------|-------------------|
| VWOCInfo                       | The root element that serves as the topmost element in the virtual world object characteristics description.                                                                                                                                                                                                                                             |                                |                                                 |                   |          |          |                   |
| VWOCInfoType                   | The root type provides basic structure that the virtual world object characteristics information description should follow through the root element.                                                                                                                                                                                                     |                                |                                                 |                   |          |          |                   |
| AvatarListFlag                 | This field, which is only present in the binary representation, signals the presence of the AvatarList element. "1" means that the element shall be used. "0" means that the element shall not be used.                                                                                                                                                  |                                |                                                 |                   |          |          |                   |
| VirtualObjectListFlag          | This field, which is only present in the binary representation, signals the presence of the VirtualObjectList element. "1" means that the element shall be used. "0" means that the element shall not be used.                                                                                                                                           |                                |                                                 |                   |          |          |                   |
| AvatarList                     | Optional wrapper element that serves as the placeholder for the list of avatar characteristics information.                                                                                                                                                                                                                                              |                                |                                                 |                   |          |          |                   |
| VirtualObjectList              | Optional wrapper element that serves as the placeholder for the list of virtual object characteristics information.                                                                                                                                                                                                                                      |                                |                                                 |                   |          |          |                   |
| AvatarListType                 | Wrapper element type which allows multiple occurrences of avatar characteristics information.                                                                                                                                                                                                                                                            |                                |                                                 |                   |          |          |                   |
| NumAvatarType                  | This field, which is only present in the binary representation, specifies the number of Avatar information contained in the AvatarListType.                                                                                                                                                                                                              |                                |                                                 |                   |          |          |                   |
| Avatar                         | Specifies the description of avatar characteristics information.                                                                                                                                                                                                                                                                                         |                                |                                                 |                   |          |          |                   |
| AvatarBaseType                 | AvatarBaseType is a type providing a characteristic description of an individual avatar.                                                                                                                                                                                                                                                                 |                                |                                                 |                   |          |          |                   |
| IndividualAvatarType           | <p>This field, which is only presented in the binary representation, specifies the types of each avatar.</p> <table> <tr> <th>Individual Avatar Type</th><th>Binary representation for sensor type (8 bits)</th></tr> <tr> <td>AvatarType</td><td>00000000</td></tr> <tr> <td>Reserved</td><td>00000001-11111111</td></tr> </table>                      | Individual Avatar Type         | Binary representation for sensor type (8 bits)  | AvatarType        | 00000000 | Reserved | 00000001-11111111 |
| Individual Avatar Type         | Binary representation for sensor type (8 bits)                                                                                                                                                                                                                                                                                                           |                                |                                                 |                   |          |          |                   |
| AvatarType                     | 00000000                                                                                                                                                                                                                                                                                                                                                 |                                |                                                 |                   |          |          |                   |
| Reserved                       | 00000001-11111111                                                                                                                                                                                                                                                                                                                                        |                                |                                                 |                   |          |          |                   |
| VirtualObjectListType          | Wrapper element type which allows multiple occurrences of virtual object characteristics information.                                                                                                                                                                                                                                                    |                                |                                                 |                   |          |          |                   |
| NumVirtualObjectType           | This field, which is only present in the binary representation, specifies the number of virtual object information contained in the virtual object list type.                                                                                                                                                                                            |                                |                                                 |                   |          |          |                   |
| VirtualObject                  | Specifies the description of virtual object characteristics information.                                                                                                                                                                                                                                                                                 |                                |                                                 |                   |          |          |                   |
| VirtualObjectBaseType          | VirtualObjectBaseType is a type providing a characteristic description of an individual virtual object.                                                                                                                                                                                                                                                  |                                |                                                 |                   |          |          |                   |
| IndividualVirtualObjectType    | <p>This field, which is only presented in the binary representation, specifies the types of each virtual object.</p> <table> <tr> <th>Individual Virtual Object Type</th><th>Binary representation for sensor type (16 bits)</th></tr> <tr> <td>VirtualObjectType</td><td>0000hex</td></tr> <tr> <td>Reserved</td><td>0001hex-FFFFhex</td></tr> </table> | Individual Virtual Object Type | Binary representation for sensor type (16 bits) | VirtualObjectType | 0000hex  | Reserved | 0001hex-FFFFhex   |
| Individual Virtual Object Type | Binary representation for sensor type (16 bits)                                                                                                                                                                                                                                                                                                          |                                |                                                 |                   |          |          |                   |
| VirtualObjectType              | 0000hex                                                                                                                                                                                                                                                                                                                                                  |                                |                                                 |                   |          |          |                   |
| Reserved                       | 0001hex-FFFFhex                                                                                                                                                                                                                                                                                                                                          |                                |                                                 |                   |          |          |                   |

#### 4.3.5 Examples

The following shows two use cases of VWOCInfo element, which are for listing avatar characteristics information and for listing virtual object characteristics information.

The first example shows the case when the `VWOCInfo` is used for `AvatarList`.

```
<vwoc:VWOCInfo xsi:schemaLocation="urn:mpeg:mpeg-v:2012:01-VWOC-NS
VWOCSchema.xsd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:mpegvct="urn:mpeg:mpeg-v:2012:01-CT-NS" xmlns:vwoc="urn:mpeg:mpeg-
v:2012:01-VWOC-NS" xmlns:r="urn:mpeg:mpeg21:2003:01-REL-R-NS"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004">
  <vwoc:AvatarList>
    <vwoc:Avatar xsi:type="vwoc:AvatarType" id="ID_1" gender="male">
      . . .
    </vwoc:Avatar>
  </vwoc:AvatarList>
</vwoc:VWOCInfo>
```

The second example shows the case when the `VWOCInfo` is used for `VirtualObjectList`.

```
<vwoc:VWOCInfo xsi:schemaLocation="urn:mpeg:mpeg-v:2012:01-VWOC-NS
VWOCSchema.xsd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:mpegvct="urn:mpeg:mpeg-v:2012:01-CT-NS" xmlns:vwoc="urn:mpeg:mpeg-
v:2012:01-VWOC-NS" xmlns:r="urn:mpeg:mpeg21:2003:01-REL-R-NS"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004">
  <vwoc:VirtualObjectList>
    <vwoc:VirtualObject xsi:type="vwoc:VirtualObjectType" id="ID_80">
      . . .
    </vwoc:VirtualObject>
  </vwoc:VirtualObjectList>
</vwoc:VWOCInfo>
```

Note that these examples are only showing a part of the complete XML description to show the use of the root element, `VWOCInfo`, with the `AvatarList` and the `VirtualObjectList`.

## 4.4 Virtual world object base type

### 4.4.1 Introduction

This Subclause defines a complex type of `VWOBaseType`, which the avatar characteristics information and virtual object characteristics information should inherit.

## 4.4.2 XML representation syntax

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagram | <p>The diagram shows a UML class for <b>VWOBaseType</b> with a dashed border, indicating it is a restriction of the <b>anyType</b> base type. It features an <b>attributes</b> compartment containing an <b>any</b> attribute and an <b>id</b> attribute. The main body of the class is a sequence of elements: <b>vwoc:Identification</b> (0+..1), <b>vwoc:VWOC</b> (0+..1), and <b>vwoc:BehaviorModelList</b> (0+..1). The <b>vwoc:VWOC</b> element is further detailed with a sequence of four sub-elements: <b>vwoc:SoundList</b>, <b>vwoc:ScentList</b>, <b>vwoc:ControlList</b>, and <b>vwoc:EventList</b>.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Source  | <pre> &lt;!-- ##### --&gt; &lt;!-- VWO Base Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="VWOBaseType" abstract="true"&gt;   &lt;complexContent&gt;     &lt;restriction base="anyType"&gt;       &lt;sequence&gt;         &lt;element name="Identification" type="vwoc:IdentificationType" minOccurs="0"/&gt;         &lt;element name="Description" type="string" minOccurs="0"/&gt;         &lt;element name="VWOC" minOccurs="0"&gt;           &lt;complexType&gt;             &lt;sequence&gt;               &lt;element name="SoundList" type="vwoc:VWOSoundListType" minOccurs="0"/&gt;               &lt;element name="ScentList" type="vwoc:VWOScentListType" minOccurs="0"/&gt;               &lt;element name="ControlList" type="vwoc:VWOCControlListType" minOccurs="0"/&gt;               &lt;element name="EventList" type="vwoc:VWOEventListType" minOccurs="0"/&gt;             &lt;/sequence&gt;           &lt;/complexType&gt;         &lt;/element&gt;         &lt;element name="BehaviorModelList" type="vwoc:VWOBehaviorModelListType" minOccurs="0"/&gt;       &lt;/sequence&gt;       &lt;attribute name="id" type="ID" use="optional"/&gt;     &lt;/restriction&gt;   &lt;/complexContent&gt; &lt;/complexType&gt;  &lt;!-- ##### --&gt; &lt;!-- Avatar BaseType --&gt; &lt;!-- ##### --&gt; &lt;complexType name="AvatarBaseType" abstract="true"&gt;   &lt;complexContent&gt;     &lt;extension base="vwoc:VWOBaseType"/&gt;   &lt;/complexContent&gt; </pre> |

```

</complexType>

<!-- ##### -->
<!-- Virtual Object BaseType -->
<!-- ##### -->
<complexType name="VirtualObjectBaseType" abstract="true">
  <complexContent>
    <extension base="vwoc:VWOBaseType"/>
  </complexContent>
</complexType>

```

#### 4.4.3 Binary representation syntax

| VWOBaseType{             | Number of bits | Mnemonic           |
|--------------------------|----------------|--------------------|
| IdentificationFlag       | 1              | Bslbf              |
| DescriptionFlag          | 1              | Bslbf              |
| VWOCFlag                 | 1              | Bslbf              |
| BehaviorModelListFlag    | 1              | bslbf              |
| IdFlag                   | 1              | bslbf              |
|                          |                |                    |
| if(IdentificationFlag) { |                |                    |
| Identification           |                | IdentificationType |
| }                        |                |                    |
| if>DescriptionFlag) {    |                |                    |
| Description              | See ISO 10646  | UTF-8              |
| }                        |                |                    |
| if(VWOCFlag) {           |                |                    |
| SoundListFlag            | 1              | bslbf              |
| ScentListFlag            | 1              | bslbf              |
| ControlListFlag          | 1              | bslbf              |
| EventListFlag            | 1              | bslbf              |
| if(SoundListFlag) {      |                |                    |
| SoundList                |                | VWOSoundListType   |
| }                        |                |                    |
| if(ScentListFlag) {      |                |                    |

|                             |               |                          |
|-----------------------------|---------------|--------------------------|
| ScentList                   |               | VWOScentListType         |
| }                           |               |                          |
| if(ControlListFlag) {       |               |                          |
| ControlList                 |               | VWOControlListType       |
| }                           |               |                          |
| if(EventListFlag) {         |               |                          |
| EventList                   |               | VWOEventListType         |
| }                           |               |                          |
| }                           |               |                          |
| if(BehaviorModelListFlag) { |               |                          |
| BehaviorModelList           |               | VWOBehaviorModelListType |
| }                           |               |                          |
| if(IdFlag) {                |               |                          |
| id                          | See ISO 10646 | UTF-8                    |
| }                           |               |                          |
| }                           |               |                          |
|                             |               |                          |
| AvatarBaseType {            |               |                          |
| VWOBase                     |               | VWOBaseType              |
| }                           |               |                          |
|                             |               |                          |
| VirtualObjectBaseType {     |               |                          |
| VWOBase                     |               | VWOBaseType              |
| }                           |               |                          |

## 4.4.4 Semantics

| Name                  | Description                                                                                                                                                                                                                                                           |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VWOBaseType           | The base type that describes common attributes and elements in both avatars and virtual objects.                                                                                                                                                                      |
| DescriptionFlag       | This field, which is only presented in the binary representation, signals the presence of the description element. "1" means that the element shall be used. "0" means that the element shall not be used.                                                            |
| VWOCFlag              | This field, which is only presented in the binary representation, signals the presence of the <code>VWOC</code> element which contains sound, scent, control and event lists. "1" means that the element shall be used. "0" means that the element shall not be used. |
| IdFlag                | This field, which is only presented in the binary representation, signals the presence of the <code>id</code> attribute. "1" means that the element shall be used. "0" means that the element shall not be used.                                                      |
| IdentificationFlag    | This field, which is only present in the binary representation, signals the presence of the <code>Identification</code> element. "1" means that the element shall be used. "0" means that the element shall not be used.                                              |
| SoundListFlag         | This field, which is only present in the binary representation, signals the presence of the <code>Sound</code> element list. "1" means that the element shall be used. "0" means that the element shall not be used.                                                  |
| ScentListFlag         | This field, which is only present in the binary representation, signals the presence of the <code>Scent</code> element list. "1" means that the element shall be used. "0" means that the element shall not be used.                                                  |
| ControlListFlag       | This field, which is only present in the binary representation, signals the presence of the <code>Control</code> element list. "1" means that the element shall be used. "0" means that the element shall not be used.                                                |
| EventListFlag         | This field, which is only present in the binary representation, signals the presence of the <code>Event</code> element list. "1" means that the element shall be used. "0" means that the element shall not be used.                                                  |
| BehaviorModelListFlag | This field, which is only present in the binary representation, signals the presence of the <code>BehaviorModel</code> element list. "1" means that the element shall be used. "0" means that the element shall not be used.                                          |
| Identification        | Describes the identification of the virtual world object.                                                                                                                                                                                                             |
| Description           | Contains the description of the virtual world object.                                                                                                                                                                                                                 |
| VWOC                  | Describes a set of characteristics of the virtual world objects.                                                                                                                                                                                                      |
| SoundList             | Describes a list of the sound effects associated to the virtual world object.                                                                                                                                                                                         |
| ScentList             | Describes a list of the scent effects associated to the virtual world object.                                                                                                                                                                                         |
| ControlList           | Describes a list of the controls associated to the virtual world object.                                                                                                                                                                                              |
| EventList             | Describes a list of the input events associated to the virtual world object.                                                                                                                                                                                          |
| BehaviorModelList     | Describes a list of the behaviour models associated to the virtual world object.                                                                                                                                                                                      |
| id                    | Unique identifier for identifying individual virtual world object information.                                                                                                                                                                                        |
| AvatarBaseType        | A type providing a characteristic description of an individual avatar.                                                                                                                                                                                                |
| VirtualObjectBaseType | A type providing a characteristic description of an individual virtual object.                                                                                                                                                                                        |

#### 4.4.5 Examples

```

<vwoc:VWOCInfo xsi:schemaLocation="urn:mpeg:mpeg-v:2012:01-VWOC-NS
VWOCSchema.xsd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:mpegvct="urn:mpeg:mpeg-v:2012:01-CT-NS" xmlns:vwoc="urn:mpeg:mpeg-
v:2012:01-VWOC-NS" xmlns:r="urn:mpeg:mpeg21:2003:01-REL-R-NS"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004">
  <vwoc:AvatarList>
    <vwoc:Avatar xsi:type="vwoc:AvatarType" id="AVATARID_1" gender="male">
      <vwoc:VWOC>
        <vwoc:SoundList>
          <vwoc:Sound loop="1" soundID="SOUNDID_10" duration="10"
intensity="3" name="BurpSound">
            <vwoc:ResourcesURL>http://www.BurpSound.info</vwoc:ResourcesURL>
          </vwoc:Sound>
        </vwoc:SoundList>
        <vwoc:ScentList>
          <vwoc:Scent loop="2" duration="1" intensity="3"
name="BurpingScent" scentID="SCENTID_11">
            <vwoc:ResourcesURL>http://www.Burp.info</vwoc:ResourcesURL>
          </vwoc:Scent>
        </vwoc:ScentList>
        <vwoc:ControlList>
          <vwoc:Control controlID="CTRLID_12">
            <vwoc:MotionFeatureControl>
              <vwoc:Position>
                <mpegvct:X>1</mpegvct:X>
                <mpegvct:Y>1</mpegvct:Y>
                <mpegvct:Z>10</mpegvct:Z>
              </vwoc:Position>
              <vwoc:Orientation>
                <mpegvct:X>0</mpegvct:X>
                <mpegvct:Y>0</mpegvct:Y>
                <mpegvct:Z>0</mpegvct:Z>
              </vwoc:Orientation>
              <vwoc:ScaleFactor>
                <mpegvct:X>1</mpegvct:X>
                <mpegvct:Y>1</mpegvct:Y>
                <mpegvct:Z>3</mpegvct:Z>
              </vwoc:ScaleFactor>
            </vwoc:MotionFeatureControl>
          </vwoc:Control>
        </vwoc:ControlList>
        <vwoc:EventList>
          <vwoc:Event eventID="ID_13">
            <vwoc:Mouse>urn:mpeg:mpeg-v:01-VWOC-MouseEventCS-NS:click
</vwoc:Mouse>
          </vwoc:Event>
        </vwoc:EventList>
      </vwoc:VWOC>
    <vwoc:BehaviorModelList>
      <vwoc:BehaviorModel>
        <vwoc:BehaviorInput eventIDRef="ID_13"/>
        <vwoc:BehaviorOutput controlIDRefs="CTRLID_12"
scentIDRefs="SCENTID_11" soundIDRefs="SOUNDID_10"/>
      </vwoc:BehaviorModel>
    </vwoc:BehaviorModelList>
  </vwoc:Avatar>
</vwoc:AvatarList>
</vwoc:VWOCInfo>

```

## 4.4.6 IdentificationType

## 4.4.6.1 XML representation syntax

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagram |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Source  | <pre> &lt;!-- ##### --&gt; &lt;!-- Identification Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="IdentificationType"&gt;   &lt;sequence&gt;     &lt;element name="UserID" type="anyURI" minOccurs="0"/&gt;     &lt;element name="Ownership" type="mpeg7:AgentType" minOccurs="0"/&gt;     &lt;element name="Rights" type="r:License" minOccurs="0" maxOccurs="unbounded"/&gt;     &lt;element name="Credits" type="mpeg7:AgentType" minOccurs="0" maxOccurs="unbounded"/&gt;   &lt;/sequence&gt;   &lt;attribute name="name" type="string" use="optional"/&gt;   &lt;attribute name="family" type="string" use="optional"/&gt; &lt;/complexType&gt; </pre> |

## 4.4.6.2 Binary representation syntax

| IdentificationType{ | Number of bits | Mnemonic |
|---------------------|----------------|----------|
| UserIDFlag          | 1              | bslbf    |
| OwnershipFlag       | 1              | bslbf    |
| RightsFlag          | 1              | bslbf    |
| CreditsFlag         | 1              | bslbf    |
| nameFlag            | 1              | bslbf    |
| familyFlag          | 1              | bslbf    |
| if(UserIDFlag) {    |                |          |
| UserID              | See ISO 10646  | UTF-8    |
| }                   |                |          |

|                               |                              |                 |
|-------------------------------|------------------------------|-----------------|
| if(OwnershipFlag) {           |                              |                 |
| Ownership                     |                              | AgentType       |
| }                             |                              |                 |
| if(RightsFlag) {              |                              |                 |
| NumRights                     |                              | vluimsbf5       |
| for(k=0; k< NumRights; k++){  |                              |                 |
| Rights                        | See ISO/IEC<br>21000-16:2005 | LicenseType     |
| }                             |                              |                 |
| }                             |                              |                 |
| if(CreditsFlag) {             |                              |                 |
| NumCredits                    |                              | vluimsbf5       |
| for(k=0; k< NumCredits; k++){ |                              |                 |
| Credits                       |                              | AgentType       |
| }                             |                              |                 |
| }                             |                              |                 |
| if(nameFlag) {                |                              |                 |
| name                          | See ISO 10646                | UTF-8           |
| }                             |                              |                 |
| if(familyFlag) {              |                              |                 |
| family                        | See ISO 10646                | UTF-8           |
| }                             |                              |                 |
| }                             |                              |                 |
|                               |                              |                 |
| AgentType{                    | <b>Number of bits</b>        | <b>Mnemonic</b> |
| mpeg7:AgentType               |                              | UTF-8           |
| }                             |                              |                 |
|                               |                              |                 |

| LicenseType{  | Number of bits | Mnemonic |
|---------------|----------------|----------|
| r:LicenseType |                | UTF-8    |
| }             |                |          |

#### 4.4.6.3 Semantics

| Name                | Definition                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identification Type | Describes the identification of a virtual world object.                                                                                                                                                                                                                                                                                                                                                                                                         |
| UserIDFlag          | This field, which is only present in the binary representation, signals the presence of the <code>UserID</code> element. "1" means that the element shall be used. "0" means that the element shall not be used.                                                                                                                                                                                                                                                |
| OwnershipFlag       | This field, which is only present in the binary representation, signals the presence of the <code>Ownership</code> element. "1" means that the element shall be used. "0" means that the element shall not be used.                                                                                                                                                                                                                                             |
| RightsFlag          | This field, which is only presented in the binary representation, signals the presence of the <code>rights</code> element. "1" means that the element shall be used. "0" means that the element shall not be used.                                                                                                                                                                                                                                              |
| CreditsFlag         | This field, which is only presented in the binary representation, signals the presence of the <code>credits</code> element. "1" means that the element shall be used. "0" means that the element shall not be used.                                                                                                                                                                                                                                             |
| nameFlag            | This field, which is only present in the binary representation, signals the presence of the <code>name</code> attribute. "1" means that the element shall be used. "0" means that the element shall not be used.                                                                                                                                                                                                                                                |
| familyFlag          | This field, which is only present in the binary representation, signals the presence of the <code>family</code> attribute. "1" means that the attribute shall be used. "0" means that the attribute shall not be used.                                                                                                                                                                                                                                          |
| UserID              | Contains the user identification associated to the virtual world object                                                                                                                                                                                                                                                                                                                                                                                         |
| Ownership           | Describes the ownership of the virtual world object which shall be based on the type "AgentType" defined in subclause 7.4.2 of ISO/IEC 15938-5:2003. In the binary representation, the "AgentType" shall be encoded by UTF-8.                                                                                                                                                                                                                                   |
| NumRights           | This field, which is only present in the binary representation, specifies the number of <code>rights</code> information.                                                                                                                                                                                                                                                                                                                                        |
| Rights              | Describes the rights of the virtual world object which shall be based on the type "LicenseType" defined in ISO/IEC 21000-5:2004. In the binary representation, the "LicenseType" shall be encoded by UTF-8.                                                                                                                                                                                                                                                     |
| NumCredits          | This field, which is only present in the binary representation, specifies the number of <code>credits</code> information.                                                                                                                                                                                                                                                                                                                                       |
| Credits             | Describes the contributors of the virtual object in chronological order which shall be based on the type "AgentType" defined in subclause 7.4.2 of ISO/IEC 15938-5:2003. In the binary representation, the "AgentType" shall be encoded by UTF-8.<br>Note: The 1 <sup>st</sup> listed credit describes an original author of a virtual world object. The subsequent credits represent the list of the contributors of the virtual world object chronologically. |
| name                | Describes the name of the virtual world object.                                                                                                                                                                                                                                                                                                                                                                                                                 |
| family              | Describes the relationship with other virtual world objects.                                                                                                                                                                                                                                                                                                                                                                                                    |

#### 4.4.7 VWO SoundListType

##### 4.4.7.1 XML representation syntax

|         |                                                                                                                                                                                                                                                                                      |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagram |                                                                                                                                                                                                                                                                                      |
| Source  | <pre> &lt;!-- ##### --&gt; &lt;!-- VWO Sound List Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="VWO SoundListType"&gt;   &lt;sequence&gt;     &lt;element name="Sound" type="vwoc:VWO SoundType" maxOccurs="unbounded"/&gt;   &lt;/sequence&gt; &lt;/complexType&gt; </pre> |

##### 4.4.7.2 Binary representation syntax

| VWO SoundListType {                 | Number of bits | Mnemonic      |
|-------------------------------------|----------------|---------------|
| NumVWO SoundType                    |                | vluimsbf5     |
| for(k=0; k< NumVWO SoundType; k++){ |                |               |
| Sound                               |                | VWO SoundType |
| }                                   |                |               |
| }                                   |                |               |

##### 4.4.7.3 Semantics

| Name              | Definition                                                                                                                                  |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| VWO SoundListType | Wrapper element type which allows multiple occurrences of sound effects associated to the virtual world object.                             |
| NumVWO SoundType  | This field, which is only present in the binary representation, specifies the number of Sound information contained in the sound list type. |
| Sound             | Describes a sound effect associated to the virtual world object.                                                                            |

#### 4.4.8 VWO ScentListType

##### 4.4.8.1 XML representation syntax

|         |                                                                                                                                                                                                                                                                                      |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagram |                                                                                                                                                                                                                                                                                      |
| Source  | <pre> &lt;!-- ##### --&gt; &lt;!-- VWO Scent List Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="VWO ScentListType"&gt;   &lt;sequence&gt;     &lt;element name="Scent" type="vwoc:VWO ScentType" maxOccurs="unbounded"/&gt;   &lt;/sequence&gt; &lt;/complexType&gt; </pre> |

## 4.4.8.2 Binary representation syntax

| VWOScentListType {                 | Number of bits | Mnemonic     |
|------------------------------------|----------------|--------------|
| NumVWOScentType                    |                | vluimsbf5    |
| for(k=0; k< NumVWOScentType; k++){ |                |              |
| Scent                              |                | VWOScentType |
| }                                  |                |              |
| }                                  |                |              |

## 4.4.8.3 Semantics

| Name             | Definition                                                                                                                                  |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| VWOScentListType | Wrapper element type which allows multiple occurrences of Scent effects associated to the virtual world object.                             |
| NumVWOScentType  | This field, which is only present in the binary representation, specifies the number of Scent information contained in the scent list type. |
| Scent            | Describes a scent effect associated to the virtual world object.                                                                            |

## 4.4.9 VWOControlListType

## 4.4.9.1 XML representation syntax

|         |                                                                                                                                                                                                                                                                                            |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagram |                                                                                                                                                                                                                                                                                            |
| Source  | <pre> &lt;!-- ##### --&gt; &lt;!-- VWO Control List Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="VWOControlListType"&gt;   &lt;sequence&gt;     &lt;element name="Control" type="vwoc:VWOControlType" maxOccurs="unbounded"/&gt;   &lt;/sequence&gt; &lt;/complexType&gt; </pre> |

## 4.4.9.2 Binary representation syntax

| VWOControlListType {                 | Number of bits | Mnemonic       |
|--------------------------------------|----------------|----------------|
| NumVWOControlType                    |                | vluimsbf5      |
| for(k=0; k< NumVWOControlType; k++){ |                |                |
| Control                              |                | VWOControlType |
| }                                    |                |                |
| }                                    |                |                |

#### 4.4.9.3 Semantics

| Name               | Definition                                                                                                                                                   |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VWOControlListType | Wrapper element type which allows multiple occurrences of the controls associated to the virtual world object.                                               |
| NumVWOControlType  | This field, which is only present in the binary representation, specifies the number of <code>control</code> information contained in the Control list type. |
| Control            | Describes a control associated to the virtual world object.                                                                                                  |

#### 4.4.10 VWOEventListType

##### 4.4.10.1 XML representation syntax

|         |                                                                                                                                                                                                                                                                                    |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagram |                                                                                                                                                                                                                                                                                    |
| Source  | <pre> &lt;!-- ##### --&gt; &lt;!-- VWO Event List Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="VWOEventListType"&gt;   &lt;sequence&gt;     &lt;element name="Event" type="vwoc:VWOEventType" maxOccurs="unbounded"/&gt;   &lt;/sequence&gt; &lt;/complexType&gt; </pre> |

##### 4.4.10.2 Binary representation syntax

|                                    |                       |                 |
|------------------------------------|-----------------------|-----------------|
| VWOEventListType {                 | <b>Number of bits</b> | <b>Mnemonic</b> |
| NumVWOEventType                    |                       | vluimsbf5       |
| for(k=0; k< NumVWOEventType; k++){ |                       |                 |
| Event                              |                       | VWOEventType    |
| }                                  |                       |                 |
| }                                  |                       |                 |

##### 4.4.10.3 Semantics

| Name             | Definition                                                                                                                                               |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| VWOEventListType | Wrapper element type which allows multiple occurrences of the input events associated to the virtual world object.                                       |
| NumVWOEventType  | This field, which is only present in the binary representation, specifies the number of <code>Event</code> information contained in the Event list type. |
| Event            | Describes an input event associated to the virtual world object.                                                                                         |

## 4.4.11 VWOBehaviorModelListType

## 4.4.11.1 XML representation syntax

|         |                                                                                                                                                                                                                                                                                                                     |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagram |                                                                                                                                                                                                                                                                                                                     |
| Source  | <pre> &lt;!-- ##### --&gt; &lt;!-- VWO Behavior Model List Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="VWOBehaviorModelListType"&gt;   &lt;sequence&gt;     &lt;element name="BehaviorModel" type="vwoc:VWOBehaviorModelType" maxOccurs="unbounded"/&gt;   &lt;/sequence&gt; &lt;/complexType&gt; </pre> |

## 4.4.11.2 Binary representation syntax

| VWOBehaviorModelListType {                    | Number of bits | Mnemonic             |
|-----------------------------------------------|----------------|----------------------|
| NumVWOBehaviorModelType                       |                | vluimsbf5            |
| for(k=0; k< NumVWOBehaviorModelType;<br>k++){ |                |                      |
| BehaviorModel                                 |                | VWOBehaviorModelType |
| }                                             |                |                      |
| }                                             |                |                      |

## 4.4.11.3 Semantics

| Name                     | Definition                                                                                                                                                   |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VWOBehaviorModelListType | Wrapper element type which allows multiple occurrences of the behavior models associated to the virtual world object.                                        |
| NumVWOBehaviorModelType  | This field, which is only present in the binary representation, specifies the number of BehaviorModel information contained in the behavior model list type. |
| BehaviorModel            | Describes a behavior model associated to the virtual world object.                                                                                           |

#### 4.4.12 VWOSoundType

##### 4.4.12.1 XML representation syntax

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagram | <pre> classDiagram     class VWOSoundType {         soundID         intensity         duration         loop         name         ResourcesURL vwoc:ResourcesURL     } </pre>                                                                                                                                                                                                                                                                                                                                                                                                           |
| Source  | <pre> &lt;!-- ##### --&gt; &lt;!-- VWO Sound Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="VWOSoundType"&gt;   &lt;sequence&gt;     &lt;element name="ResourcesURL" type="anyURI"/&gt;   &lt;/sequence&gt;   &lt;attribute name="soundID" type="ID" use="optional"/&gt;   &lt;attribute name="intensity" type="float" use="optional"/&gt;   &lt;attribute name="duration" type="unsignedInt" use="optional"/&gt;   &lt;attribute name="loop" type="unsignedInt" use="optional"/&gt;   &lt;attribute name="name" type="string" use="optional"/&gt; &lt;/complexType&gt; </pre> |

##### 4.4.12.2 Binary representation syntax

| VWOSoundType{       | Number of bits | Mnemonic |
|---------------------|----------------|----------|
| SoundIDFlag         | 1              | bslbf    |
| IntensityFlag       | 1              | bslbf    |
| DurationFlag        | 1              | bslbf    |
| LoopFlag            | 1              | bslbf    |
| NameFlag            | 1              | bslbf    |
| ResourcesURL        | See ISO 10646  | UTF-8    |
| if(SoundIDFlag) {   |                |          |
| SoundID             | See ISO 10646  | UTF-8    |
| }                   |                |          |
| if(IntensityFlag) { |                |          |
| Intensity           | 32             | fsbf     |

|                    |               |        |
|--------------------|---------------|--------|
| }                  |               |        |
| if(DurationFlag) { |               |        |
| Duration           | 32            | uimsbf |
| }                  |               |        |
| if(LoopFlag) {     |               |        |
| Loop               | 8             | uimsbf |
| }                  |               |        |
| if(NameFlag) {     |               |        |
| Name               | See ISO 10646 | UTF-8  |
| }                  |               |        |
| }                  |               |        |

#### 4.4.12.3 Semantics

| Name               | Definition                                                                                                                                                                                                               |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VWOSoundType       | A type that contains the descriptions of a sound effect associated to the virtual world object.                                                                                                                          |
| SoundIDFlag        | This field, which is only present in the binary representation, signals the presence of the <code>ID</code> attribute of the sound. "1" means the attribute shall be used and "0" means the attribute shall not be used. |
| IntensityFlag      | This field, which is only present in the binary representation, signals the presence of the <code>intensity</code> attribute. "1" means the attribute shall be used and "0" means the attribute shall not be used.       |
| DurationFlag       | This field, which is only present in the binary representation, signals the presence of the <code>duration</code> attribute. "1" means the attribute shall be used and "0" means the attribute shall not be used.        |
| LoopFlag           | This field, which is only present in the binary representation, signals the presence of the <code>loop</code> attribute. "1" means the attribute shall be used and "0" means the attribute shall not be used.            |
| NameFlag           | This field, which is only present in the binary representation, signals the presence of the <code>name</code> attribute. "1" means the attribute shall be used and "0" means the attribute shall not be used.            |
| SoundResources URL | Element that contains a link to sound file, usually MP4 file..                                                                                                                                                           |
| soundID            | A unique identifier of the object sound.                                                                                                                                                                                 |
| intensity          | The strength(volume) of the sound                                                                                                                                                                                        |
| duration           | The length of time that the sound lasts. The default unit is ms.                                                                                                                                                         |
| loop               | A playing option to describe the number of repetition (default value: 1, 0: indefinite repetition, 1:once, 2: twice, ..., n: n times)                                                                                    |
| name               | The name of the sound.                                                                                                                                                                                                   |

#### 4.4.12.4 Examples

This example shows the description of the sound information associated to an object with the following semantics. The sound resource whose name is “BigAlarm” is saved at “[http://sounddb.com/alarmsound\\_0001.wav](http://sounddb.com/alarmsound_0001.wav)” and the value of soundID, its identifier is “SoundID3”. The length of the sound is 30 seconds. The sound shall be played with the volume of intensity = “50 %” repeatedly.

```
<vwoc:Sound loop="0" soundID="SoundID3" duration="30" intensity="0.5"
name="BigAlarm">
  <vwoc:ResourcesURL>http://sounddb.com/alarmsound\_0001.wav</vwoc:ResourcesURL>
</vwoc:Sound>
```

#### 4.4.13 VWOScentType

##### 4.4.13.1 XML representation syntax

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagram |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| source  | <pre>&lt;!-- ##### --&gt; &lt;!-- VWO Scent Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="VWOScentType"&gt;   &lt;sequence&gt;     &lt;element name="ResourcesURL" type="anyURI"/&gt;   &lt;/sequence&gt;   &lt;attribute name="scentID" type="ID" use="optional"/&gt;   &lt;attribute name="intensity" type="float" use="optional"/&gt;   &lt;attribute name="duration" type="unsignedInt" use="optional"/&gt;   &lt;attribute name="loop" type="unsignedInt" use="optional"/&gt;   &lt;attribute name="name" type="string" use="optional"/&gt; &lt;/complexType&gt;</pre> |

##### 4.4.13.2 Binary representation syntax

| VWOScentType{ | Number of bits | Mnemonic |
|---------------|----------------|----------|
| ScentIDFlag   | 1              | bslbf    |
| IntensityFlag | 1              | bslbf    |
| DurationFlag  | 1              | bslbf    |
| LoopFlag      | 1              | bslbf    |
| NameFlag      | 1              | bslbf    |

|                     |               |        |
|---------------------|---------------|--------|
| ResourcesURL        | See ISO 10646 | UTF-8  |
| if(ScentIDFlag) {   |               |        |
| ScentID             | See ISO 10646 | UTF-8  |
| }                   |               |        |
| if(IntensityFlag) { |               |        |
| Intensity           | 32            | fsbf   |
| }                   |               |        |
| if(DurationFlag) {  |               |        |
| Duration            | 32            | uimsbf |
| }                   |               |        |
| if(LoopFlag) {      |               |        |
| Loop                | 8             | uimsbf |
| }                   |               |        |
| if(NameFlag) {      |               |        |
| Name                | See ISO 10646 | UTF-8  |
| }                   |               |        |
| }                   |               |        |

#### 4.4.13.3 Semantics

| Name          | Definition                                                                                                                                                                                                               |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VWOScentType  | A type that contains the descriptions of a scent effect associated to the virtual world object.                                                                                                                          |
| ScentIDFlag   | This field, which is only present in the binary representation, signals the presence of the <code>ID</code> attribute of the scent. "1" means the attribute shall be used and "0" means the attribute shall not be used. |
| IntensityFlag | This field, which is only present in the binary representation, signals the presence of the <code>intensity</code> attribute. "1" means the attribute shall be used and "0" means the attribute shall not be used.       |
| DurationFlag  | This field, which is only present in the binary representation, signals the presence of the <code>duration</code> attribute. "1" means the attribute shall be used and "0" means the attribute shall not be used.        |
| LoopFlag      | This field, which is only present in the binary representation, signals the presence of the <code>loop</code> attribute. "1" means the attribute shall be used and "0" means the attribute shall not be used.            |
| NameFlag      | This field, which is only present in the binary representation, signals the presence of the <code>name</code> attribute. "1" means the attribute shall be used and "0" means the attribute shall not be used.            |

| Name               | Definition                                                                                                                            |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| ScentResources URL | Element that contains a link to a scent file.                                                                                         |
| scentID            | A unique identifier of the object scent.                                                                                              |
| intensity          | The strength of the scent                                                                                                             |
| duration           | The length of time that the scent lasts. The default unit is ms.                                                                      |
| loop               | A playing option to describe the number of repetition (default value: 1, 0: indefinite repetition, 1:once, 2: twice, ..., n: n times) |
| name               | The name of the scent.                                                                                                                |

#### 4.4.13.4 Examples

This example shows the description of the scent information associated to the object. The scent resource whose name is “rose” is saved at “http://scentdb.com/flower\_0001.sct” and the value of scentID, its identifier is “ScentID5” The intensity shall be 20 % with duration of 20 seconds.

```
<vwoc:Scent duration="20" intensity="0.2" name="rose" scentID="ScentID5">
  <vwoc:ResourcesURL>http://scentdb.com/flower_0001.sct</vwoc:ResourcesURL>
</vwoc:Scent>
```

#### 4.4.14 VWOControlType

##### 4.4.14.1 XML representation syntax

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagram | <pre> classDiagram     class VWOControlType {         +MotionFeatureControl         +controlID     }     class MotionFeatureControl {         +Position         +Orientation         +ScaleFactor     }     VWOControlType --&gt; MotionFeatureControl     VWOControlType --&gt; controlID     MotionFeatureControl --&gt; Position     MotionFeatureControl --&gt; Orientation     MotionFeatureControl --&gt; ScaleFactor </pre>                                                                                                                                                                                                                                                                                                                                                                                          |
| source  | <pre> &lt;!-- ##### --&gt; &lt;!-- VWO Control Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="VWOControlType"&gt;   &lt;sequence&gt;     &lt;element name="MotionFeatureControl" type="vwoc:MotionFeaturesControlType"/&gt;   &lt;/sequence&gt;   &lt;attribute name="controlID" type="ID" use="optional"/&gt; &lt;/complexType&gt; &lt;!-- ##### --&gt; &lt;!-- Motion Features Control Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="MotionFeaturesControlType"&gt;   &lt;sequence&gt;     &lt;element name="Position" type="mpegvct:Float3DVectorType" minOccurs="0"/&gt;     &lt;element name="Orientation" type="mpegvct:Float3DVectorType" minOccurs="0"/&gt;     &lt;element name="ScaleFactor" type="mpegvct:Float3DVectorType" minOccurs="0"/&gt;   &lt;/sequence&gt; &lt;/complexType&gt; </pre> |

## 4.4.15 Binary representation syntax

| VWOControlType {           | Number of bits | Mnemonic                 |
|----------------------------|----------------|--------------------------|
| ControlIDFlag              | 1              | bslbf                    |
| MotionFeatureControl       |                | MotionFeatureControlType |
| If(ControlIDFlag) {        |                |                          |
| ControlID                  | See ISO 10646  | UTF-8                    |
| }                          |                |                          |
| }                          |                |                          |
| MotionFeaturesControlType{ |                |                          |
| PositionFlag               | 1              | bslbf                    |
| OrientationFlag            | 1              | bslbf                    |
| ScaleFactorFlag            | 1              | bslbf                    |
| if(PositionFlag) {         |                |                          |
| Position                   |                | Float3DVectorType        |
| }                          |                |                          |
| if(OrientationFlag) {      |                |                          |
| Orientation                |                | Float3DVectorType        |
| }                          |                |                          |
| if(ScaleFactorFlag) {      |                |                          |
| ScaleFactor                |                | Float3DVectorType        |
| }                          |                |                          |
| }                          |                |                          |

## 4.4.15.1 Semantics

| Name           | Definition                                                                                                                                                                                          |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VWOControlType | A type that contains the descriptions of a control associated to the virtual world object.                                                                                                          |
| ControlIDFlag  | This field, which is only present in the binary representation, signals the presence of the ControlID element. "1" means the attribute shall be used and "0" means the attribute shall not be used. |

|                      |                                                                                     |                                                                                                                                                                                                       |
|----------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MotionFeatureControl | Set of elements that control position, orientation and scale of the virtual object. |                                                                                                                                                                                                       |
|                      | <b>Element</b>                                                                      | <b>Information</b>                                                                                                                                                                                    |
|                      | MotionFeatureControlType                                                            | A type that provides three types of controls such as position control, orientation control, and scaling control.                                                                                      |
|                      | PositionFlag                                                                        | This field, which is only present in the binary representation, signals the presence of the Position element. "1" means the attribute shall be used and "0" means the attribute shall not be used.    |
|                      | OrientationFlag                                                                     | This field, which is only present in the binary representation, signals the presence of the Orientation element. "1" means the attribute shall be used and "0" means the attribute shall not be used. |
|                      | ScaleFactorFlag                                                                     | This field, which is only present in the binary representation, signals the presence of the ScaleFactor element. "1" means the attribute shall be used and "0" means the attribute shall not be used. |
|                      | Position                                                                            | The position of the object in the scene with 3D floating point vector (x, y, z).                                                                                                                      |
|                      | Orientation                                                                         | The orientation of the object in the scene with 3D floating point vector as an Euler angle (yaw, pitch, roll).                                                                                        |
|                      | ScaleFactor                                                                         | The scale of the object in the scene expressed as 3D floating point vector (Sx, Sy, Sz).                                                                                                              |
| controlID            | A unique identifier of the control.                                                 |                                                                                                                                                                                                       |

NOTE 1 If two controllers are associated to the same object but on different parts of the object and if these parts exist hierarchical structures (parent and children relationship) then the controllers does perform the relative motion of the children. If the controllers are associated with the same part, the controller does the scaling or similar effects for the entire object.

NOTE 2 The reference coordinate system of this part is the right handed coordinate system.

#### 4.4.15.2 Examples

This example shows the description of object control information with the following semantics. The motion feature control of changing a position is given and its value of controlID, its identifier is "CtrlID7" The object shall be positioned at X="122.0", Y="150.0" and Z="40.0".

```
<vwoc:Control controlID="CtrlID7">
  <vwoc:MotionFeatureControl>
    <vwoc:Position>
      <mpegvct:X>122.0</mpegvct:X>
      <mpegvct:Y>150.0</mpegvct:Y>
      <mpegvct:Z>40.0</mpegvct:Z>
    </vwoc:Position>
  </vwoc:MotionFeatureControl>
</vwoc:Control>
```

## 4.4.16 VWOEventType

## 4.4.16.1 XML representation syntax

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagram |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Source  | <pre> &lt;!-- ##### --&gt; &lt;!-- VWO Event Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="VWOEventType"&gt;   &lt;sequence&gt;     &lt;element name="Mouse" type="mpeg7:termReferenceType" minOccurs="0" maxOccurs="unbounded"/&gt;     &lt;element name="Keyboard" minOccurs="0" maxOccurs="unbounded"&gt;       &lt;complexType&gt;         &lt;attribute name="keyCode" type="mpeg7:unsigned8" use="optional"/&gt;         &lt;attribute name="event" use="required"&gt;           &lt;simpleType&gt;             &lt;restriction base="string"&gt;               &lt;enumeration value="pressed"/&gt;               &lt;enumeration value="clicked"/&gt;               &lt;enumeration value="released"/&gt;             &lt;/restriction&gt;           &lt;/simpleType&gt;         &lt;/attribute&gt;       &lt;/complexType&gt;     &lt;/element&gt;     &lt;element name="UserDefinedInput" type="string" minOccurs="0" maxOccurs="unbounded"/&gt;   &lt;/sequence&gt;   &lt;attribute name="eventID" type="ID" use="required"/&gt; &lt;/complexType&gt; </pre> |

## 4.4.16.2 Binary representation syntax

| VWOEventType {       | Number of bits | Mnemonic |
|----------------------|----------------|----------|
| MouseFlag            | 1              | bslbf    |
| KeyboardFlag         | 1              | bslbf    |
| UserDefinedInputFlag | 1              | bslbf    |
| if(MouseFlag) {      |                |          |

|                                              |               |              |
|----------------------------------------------|---------------|--------------|
| NumOfMouse                                   |               | vluimsbf5    |
| for (k=0; k<NumOfMouse; k++) {               |               |              |
| Mouse                                        |               | MouseEventCS |
| }                                            |               |              |
| }                                            |               |              |
| if(KeyboardFlag) {                           |               |              |
| NumOfKeyboard                                |               | vluimsbf5    |
| for(k=0; k< NumOfKeyboard;<br>k++ ) {        |               |              |
| keyCodeFlag                                  | 1             | bslbf        |
| if(keyCodeFlag) {                            |               |              |
| keyCode                                      | 8             | uimsbf       |
| }                                            |               |              |
| Event                                        | 2             | bslbf        |
| }                                            |               |              |
| }                                            |               |              |
| if(UserDefinedInputFlag) {                   |               |              |
| NumOfUserDefinedInput                        |               | vluimsbf5    |
| for(k=0;<br>k<NumOfUserDefinedInput; k++ ) { |               |              |
| UserDefinedInput                             | See ISO 10646 | UTF-8        |
| }                                            |               |              |
| }                                            |               |              |
| EventID                                      | See ISO 10646 | UTF-8        |
| }                                            |               |              |

## 4.4.16.3 Semantics

| Name                 | Definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                    |                     |             |       |      |                                                                  |             |      |                                                                               |             |      |                                                                                                                   |           |      |                                                                                                              |              |      |                                                                                                                    |            |      |                                                                                                               |      |      |                                                                                 |  |                |          |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|---------------------|-------------|-------|------|------------------------------------------------------------------|-------------|------|-------------------------------------------------------------------------------|-------------|------|-------------------------------------------------------------------------------------------------------------------|-----------|------|--------------------------------------------------------------------------------------------------------------|--------------|------|--------------------------------------------------------------------------------------------------------------------|------------|------|---------------------------------------------------------------------------------------------------------------|------|------|---------------------------------------------------------------------------------|--|----------------|----------|
| VWOEventType         | A type that contains the descriptions of an input event associated to the virtual world object.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                    |                     |             |       |      |                                                                  |             |      |                                                                               |             |      |                                                                                                                   |           |      |                                                                                                              |              |      |                                                                                                                    |            |      |                                                                                                               |      |      |                                                                                 |  |                |          |
| MouseFlag            | This field, which is only present in the binary representation, signals the presence of the mouse element. “1” means the element shall be used, and “0” means the element shall not be used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                    |                     |             |       |      |                                                                  |             |      |                                                                               |             |      |                                                                                                                   |           |      |                                                                                                              |              |      |                                                                                                                    |            |      |                                                                                                               |      |      |                                                                                 |  |                |          |
| KeyboardFlag         | This field, which is only present in the binary representation, signals the presence of the keyboard element. “1” means the element shall be used, and “0” means the element shall not be used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                    |                     |             |       |      |                                                                  |             |      |                                                                               |             |      |                                                                                                                   |           |      |                                                                                                              |              |      |                                                                                                                    |            |      |                                                                                                               |      |      |                                                                                 |  |                |          |
| UserDefinedInputFlag | This field, which is only present in the binary representation, signals the presence of the UserDefinedInput element. “1” means the element shall be used, and “0” means the element shall not be used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                    |                     |             |       |      |                                                                  |             |      |                                                                               |             |      |                                                                                                                   |           |      |                                                                                                              |              |      |                                                                                                                    |            |      |                                                                                                               |      |      |                                                                                 |  |                |          |
| NumOfMouse           | This field, which is only present in the binary representation, specifies the number of mouse events contained in the VWOEventType.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                    |                     |             |       |      |                                                                  |             |      |                                                                               |             |      |                                                                                                                   |           |      |                                                                                                              |              |      |                                                                                                                    |            |      |                                                                                                               |      |      |                                                                                 |  |                |          |
| Mouse                | <div>Describes a mouse event as a reference to a classification scheme (CS) term. A CS that may be used for this purpose is the MouseEventCS defined in A.2.1.1.</div> <table><tr><th>Name</th><th>Element<br/>(4 bits)</th><th>Description</th></tr><tr><td>click</td><td>0000</td><td>Describes the event of click the left button of a mouse. (click)</td></tr><tr><td>doubleclick</td><td>0001</td><td>Describes the event of double-click the left button of a mouse. (doubleclick)</td></tr><tr><td>leftBtnDown</td><td>0010</td><td>Describes the event which takes place at the moment of holding down the left button of a mouse. ( LeftButtonDown)</td></tr><tr><td>leftBtnUp</td><td>0011</td><td>Describes the event which takes place at the moment of releasing the left button of a mouse. ( LeftButtonUP)</td></tr><tr><td>rightBtnDown</td><td>0100</td><td>Describes the event which takes place at the moment of holding down the left button of a mouse. ( RightButtonDown)</td></tr><tr><td>rightBtnUp</td><td>0101</td><td>Describes the event which takes place at the moment of releasing the left button of a mouse. ( RightButtonUP)</td></tr><tr><td>move</td><td>0110</td><td>Describes the event which takes place while changing the mouse position. (Move)</td></tr><tr><td></td><td>0111 -<br/>1111</td><td>Reserved</td></tr></table> | Name                                                                                                               | Element<br>(4 bits) | Description | click | 0000 | Describes the event of click the left button of a mouse. (click) | doubleclick | 0001 | Describes the event of double-click the left button of a mouse. (doubleclick) | leftBtnDown | 0010 | Describes the event which takes place at the moment of holding down the left button of a mouse. ( LeftButtonDown) | leftBtnUp | 0011 | Describes the event which takes place at the moment of releasing the left button of a mouse. ( LeftButtonUP) | rightBtnDown | 0100 | Describes the event which takes place at the moment of holding down the left button of a mouse. ( RightButtonDown) | rightBtnUp | 0101 | Describes the event which takes place at the moment of releasing the left button of a mouse. ( RightButtonUP) | move | 0110 | Describes the event which takes place while changing the mouse position. (Move) |  | 0111 -<br>1111 | Reserved |
| Name                 | Element<br>(4 bits)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Description                                                                                                        |                     |             |       |      |                                                                  |             |      |                                                                               |             |      |                                                                                                                   |           |      |                                                                                                              |              |      |                                                                                                                    |            |      |                                                                                                               |      |      |                                                                                 |  |                |          |
| click                | 0000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Describes the event of click the left button of a mouse. (click)                                                   |                     |             |       |      |                                                                  |             |      |                                                                               |             |      |                                                                                                                   |           |      |                                                                                                              |              |      |                                                                                                                    |            |      |                                                                                                               |      |      |                                                                                 |  |                |          |
| doubleclick          | 0001                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Describes the event of double-click the left button of a mouse. (doubleclick)                                      |                     |             |       |      |                                                                  |             |      |                                                                               |             |      |                                                                                                                   |           |      |                                                                                                              |              |      |                                                                                                                    |            |      |                                                                                                               |      |      |                                                                                 |  |                |          |
| leftBtnDown          | 0010                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Describes the event which takes place at the moment of holding down the left button of a mouse. ( LeftButtonDown)  |                     |             |       |      |                                                                  |             |      |                                                                               |             |      |                                                                                                                   |           |      |                                                                                                              |              |      |                                                                                                                    |            |      |                                                                                                               |      |      |                                                                                 |  |                |          |
| leftBtnUp            | 0011                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Describes the event which takes place at the moment of releasing the left button of a mouse. ( LeftButtonUP)       |                     |             |       |      |                                                                  |             |      |                                                                               |             |      |                                                                                                                   |           |      |                                                                                                              |              |      |                                                                                                                    |            |      |                                                                                                               |      |      |                                                                                 |  |                |          |
| rightBtnDown         | 0100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Describes the event which takes place at the moment of holding down the left button of a mouse. ( RightButtonDown) |                     |             |       |      |                                                                  |             |      |                                                                               |             |      |                                                                                                                   |           |      |                                                                                                              |              |      |                                                                                                                    |            |      |                                                                                                               |      |      |                                                                                 |  |                |          |
| rightBtnUp           | 0101                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Describes the event which takes place at the moment of releasing the left button of a mouse. ( RightButtonUP)      |                     |             |       |      |                                                                  |             |      |                                                                               |             |      |                                                                                                                   |           |      |                                                                                                              |              |      |                                                                                                                    |            |      |                                                                                                               |      |      |                                                                                 |  |                |          |
| move                 | 0110                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Describes the event which takes place while changing the mouse position. (Move)                                    |                     |             |       |      |                                                                  |             |      |                                                                               |             |      |                                                                                                                   |           |      |                                                                                                              |              |      |                                                                                                                    |            |      |                                                                                                               |      |      |                                                                                 |  |                |          |
|                      | 0111 -<br>1111                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Reserved                                                                                                           |                     |             |       |      |                                                                  |             |      |                                                                               |             |      |                                                                                                                   |           |      |                                                                                                              |              |      |                                                                                                                    |            |      |                                                                                                               |      |      |                                                                                 |  |                |          |
| NumOfKeyboard        | This field, which is only present in the binary representation, specifies the number of keyboard events contained in the VWOEventType.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                    |                     |             |       |      |                                                                  |             |      |                                                                               |             |      |                                                                                                                   |           |      |                                                                                                              |              |      |                                                                                                                    |            |      |                                                                                                               |      |      |                                                                                 |  |                |          |
| keyCodeFlag          | This field, which is only present in the binary representation, signals the presence of the keycode input element. “1” means that the element shall be used, and “0” means that the element shall not be used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                    |                     |             |       |      |                                                                  |             |      |                                                                               |             |      |                                                                                                                   |           |      |                                                                                                              |              |      |                                                                                                                    |            |      |                                                                                                               |      |      |                                                                                 |  |                |          |

|                       |                                                                                                                                                                                                            |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| keyCode               | Describes the corresponding key code (0-255) of each key.                                                                                                                                                  |
| event                 | Describes the keyboard event (pressed, clicked, or released).<br>In the binary representation, the keyboard events are presented as follows.<br>(pressed: 00, clicked: 01, released: 10, and reserved: 11) |
| NumOfUserDefinedInput | This field, which is only present in the binary representation, specifies the number of user-defined input events contained in the <code>VWOEventType</code> .                                             |
| UserDefinedInput      | Describes an input event defined by user.                                                                                                                                                                  |
| eventID               | A unique identifier of the event.                                                                                                                                                                          |

#### 4.4.16.4 Examples

**EXAMPLE 1** This example shows the description of an input event with the following semantics. The mouse as an input device produces new input value, “click.” For identifying this input, the value of eventID is “EventID1.”

```
<vwoc:Event eventID="EventID1">
  <vwoc:Mouse>urn:mpeg:mpeg-v:01-VWOC-MouseEventCS-NS:click</vwoc:Mouse>
</vwoc:Event>
```

**EXAMPLE 2** This example shows the description of an input event with the following semantics. The Keyboard as an input device produces a new input value which is pressing the key code of “65”. For identifying this input, the value of eventID is “EventID2.”

```
<vwoc:Event eventID="EventID2">
  <vwoc:Keyboard keyCode="65" event="pressed"/>
</vwoc:Event>
```

**EXAMPLE 3** This example shows the description of an input event with the following semantics. The Keyboard produces a new input event of pressing the two keys “shift” + “a”. One of the keyboard events is the pressing event, “pressed”, of the “shift” key whose code is “16”, and the other one is the pressing event, “pressed”, of the “a” key whose code is “65”. For identifying this input, the value of eventID is “EventID3.”

```
<vwoc:Event eventID="EventID3">
  <vwoc:Keyboard keyCode="16" event="pressed"/>
  <vwoc:Keyboard keyCode="65" event="pressed"/>
</vwoc:Event>
```

## 4.4.17 VWOBehaviourModelType

## 4.4.17.1 XML representation syntax

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagram |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Source  | <pre> &lt;!-- ##### --&gt; &lt;!-- VWO Behavior Model Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="VWOBehaviourModelType"&gt;   &lt;sequence&gt;     &lt;element name="BehaviorInput" type="vwoc:BehaviorInputType"/&gt;     &lt;element name="BehaviorOutput" type="vwoc:BehaviorOutputType"/&gt;   &lt;/sequence&gt; &lt;/complexType&gt; &lt;!-- ##### --&gt; &lt;!-- Behavior Input Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="BehaviorInputType"&gt;   &lt;attribute name="eventIDRef" type="IDREF"/&gt; &lt;/complexType&gt; &lt;!-- ##### --&gt; &lt;!-- Behavior Output Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="BehaviorOutputType"&gt;   &lt;attribute name="soundIDRefs" type="IDREFS" use="optional"/&gt;   &lt;attribute name="scentIDRefs" type="IDREFS" use="optional"/&gt;   &lt;attribute name="animationIDRefs" type="IDREFS" use="optional"/&gt;   &lt;attribute name="controlIDRefs" type="IDREFS" use="optional"/&gt; &lt;/complexType&gt; </pre> |

## 4.4.17.2 Binary representation syntax

| VWOBehaviourModelType{ | Number of bits | Mnemonic           |
|------------------------|----------------|--------------------|
| BehaviorInput          |                | BehaviorInputType  |
| BehaviorOutput         |                | BehaviorOutputType |
| }                      |                |                    |

|                       |               |       |
|-----------------------|---------------|-------|
| BehaviorInputType{    |               |       |
| EventIDRef            | See ISO 10646 | UTF-8 |
| }                     |               |       |
| BehaviorOutputType{   |               |       |
| SoundIDFlag           | 1             | bslbf |
| ScentIDFlag           | 1             | bslbf |
| AnimationIDFlag       | 1             | bslbf |
| ControlIDFlag         | 1             | bslbf |
| if(SoundIDFlag) {     |               |       |
| SoundIDRefs           | See ISO 10646 | UTF-8 |
| }                     |               |       |
| if(ScentIDFlag) {     |               |       |
| ScentIDRefs           | See ISO 10646 | UTF-8 |
| }                     |               |       |
| if(AnimationIDFlag) { |               |       |
| AnimationIDRefs       | See ISO 10646 | UTF-8 |
| }                     |               |       |
| if(ControlIDFlag) {   |               |       |
| ControlIDRefs         | See ISO 10646 | UTF-8 |
| }                     |               |       |
| }                     |               |       |

#### 4.4.17.3 Semantics

| Name                 | Description                                                                                                                                                 |         |             |            |                |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------|------------|----------------|
| VWOBehaviorModelType | A type that describes a container of an input event and the associated output object behaviors.                                                             |         |             |            |                |
| BehaviorInput        | An input event to make an object behavior.                                                                                                                  |         |             |            |                |
| BehaviorInputType    | Refers to an input event ID <table border="1"> <tr> <th>Element</th><th>Information</th></tr> <tr> <td>eventIDRef</td><td>Input event ID</td></tr> </table> | Element | Information | eventIDRef | Input event ID |
| Element              | Information                                                                                                                                                 |         |             |            |                |
| eventIDRef           | Input event ID                                                                                                                                              |         |             |            |                |
| BehaviorOutput       | Object behavior output according to an input event                                                                                                          |         |             |            |                |

|                    |                                                |                                                                                                                                                                                                                     |
|--------------------|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| BehaviorOutputType | Refers to a list of object behavioral outputs. |                                                                                                                                                                                                                     |
|                    | <i>Element</i>                                 | <i>Information</i>                                                                                                                                                                                                  |
|                    | SoundFlag                                      | This field, which is only present in the binary representation, signals the presence of the <code>sound</code> element. "1" means that the element shall be used. "0" means that the element shall not be used.     |
|                    | ScentFlag                                      | This field, which is only present in the binary representation, signals the presence of the <code>scent</code> element. "1" means that the element shall be used. "0" means that the element shall not be used.     |
|                    | AnimationFlag                                  | This field, which is only present in the binary representation, signals the presence of the <code>animation</code> element. "1" means that the element shall be used. "0" means that the element shall not be used. |
|                    | ControlFlag                                    | This field, which is only present in the binary representation, signals the presence of the <code>control</code> element. "1" means that the element shall be used. "0" means that the element shall not be used.   |
|                    | soundIDRefs                                    | It refers soundIDs to provide sound effects of the object.                                                                                                                                                          |
|                    | scentIDRefs                                    | It refers scentIDs to provide scent effects of the object.                                                                                                                                                          |
|                    | animationIDRefs                                | It refers animationIDs to provide animation clips of the object.                                                                                                                                                    |
|                    | controlIDRefs                                  | It refers controlIDs to provide controls of the object.                                                                                                                                                             |

#### 4.4.17.4 Examples

This example shows the description of a VWO behavior model with the following semantics. If eventID="EventID1" is given as BehaviorInput, then BehaviorOutput shall be executed related to soundID="SoID5" and animationID="AniID4".

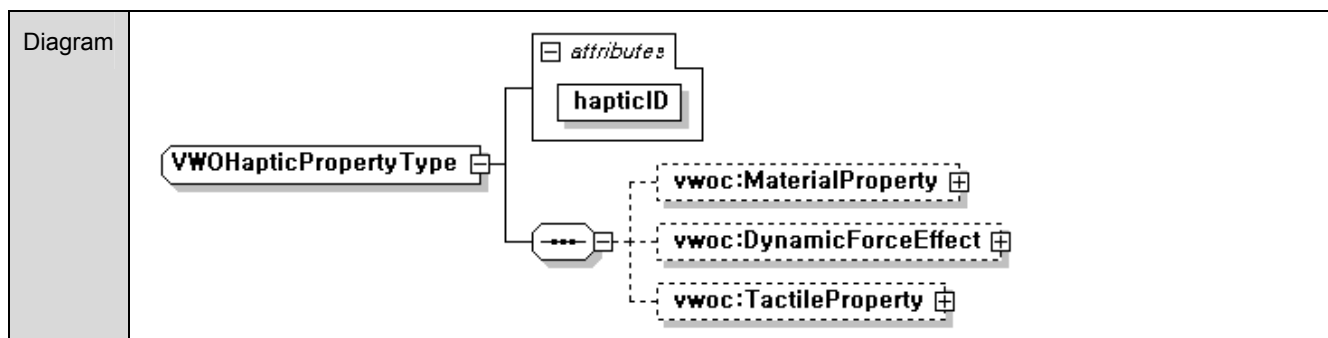
```
<vwoc:BehaviorModel>
  <vwoc:BehaviorInput eventIDRef="EventID1"/>
  <vwoc:BehaviorOutput animationIDRefs="AniID4" soundIDRefs="SoID5"/>
</vwoc:BehaviorModel>
```

## 4.5 Virtual world object common data types

This Subclause specifies syntax and semantics of the common datatypes for avatar and virtual object metadata. To be specific, basic data types which are used as basic building blocks, such as haptic properties, animation description, and other simple data types.

### 4.5.1 VWOHapticPropertyType

#### 4.5.1.1 XML representation syntax



|        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Source | <pre> &lt;!-- ##### --&gt; &lt;!-- VWO Haptic Property Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="VWOHapticPropertyType"&gt;   &lt;sequence&gt;     &lt;element name="MaterialProperty" type="vwoc:MaterialPropertyType" minOccurs="0"/&gt;     &lt;element name="DynamicForceEffect" type="vwoc:DynamicForceEffectType" minOccurs="0"/&gt;     &lt;element name="TactileProperty" type="vwoc:TactileType" minOccurs="0"/&gt;   &lt;/sequence&gt;   &lt;attribute name="hapticID" type="ID" use="required"/&gt; &lt;/complexType&gt; </pre> |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### 4.5.1.2 Binary representation syntax

| VWOHapticPropertyType {      | Number of bits | Mnemonic               |
|------------------------------|----------------|------------------------|
| MaterialPropertyFlag         | 1              | bslbf                  |
| DynamicForceEffectFlag       | 1              | bslbf                  |
| TactilePropertyFlag          | 1              | bslbf                  |
| if(MaterialPropertyFlag) {   |                |                        |
| MaterialProperty             |                | MaterialPropertyType   |
| }                            |                |                        |
| if(DynamicForceEffectFlag) { |                |                        |
| DynamicForceEffect           |                | DynamicForceEffectType |
| }                            |                |                        |
| if(TactilePropertyFlag) {    |                |                        |
| TactileProperty              |                | TactilePropertyType    |
| }                            |                |                        |
| hapticID                     | See ISO 10646  | UTF-8                  |
| }                            |                |                        |

## 4.5.1.3 Semantics

| Name                   | Description                                                                                                                                                                                                               |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VWOHapticPropertyType  | A type that contains the descriptions of a haptic property associated to the virtual world object.                                                                                                                        |
| MaterialPropertyFlag   | This field, which is only present in the binary representation, signals the presence of the <code>MaterialProperty</code> element. "1" means the attribute shall be used and "0" means the attribute shall not be used.   |
| DynamicForceEffectFlag | This field, which is only present in the binary representation, signals the presence of the <code>DynamicForceEffect</code> element. "1" means the attribute shall be used and "0" means the attribute shall not be used. |
| TactilePropertyFlag    | This field, which is only present in the binary representation, signals the presence of the <code>TactileProperty</code> element. "1" means the attribute shall be used and "0" means the attribute shall not be used.    |
| MaterialProperty       | This type contains parameters characterizing material properties.                                                                                                                                                         |
| DynamicForceEffect     | This type contains parameters characterizing force effects.                                                                                                                                                               |
| TactileProperty        | This type contains parameters characterizing tactile properties.                                                                                                                                                          |
| hapticID               | A unique identifier of the haptic property.                                                                                                                                                                               |

## 4.5.1.4 MaterialPropertyType

## 4.5.1.4.1 XML representation syntax

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagram |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Source  | <pre> &lt;!-- ##### --&gt; &lt;!-- Material Property Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="MaterialPropertyType"&gt;   &lt;attribute name="stiffness" type="float" use="optional"/&gt;   &lt;attribute name="staticFriction" type="float" use="optional"/&gt;   &lt;attribute name="dynamicFriction" type="float" use="optional"/&gt;   &lt;attribute name="damping" type="float" use="optional"/&gt;   &lt;attribute name="texture" type="anyURI" use="optional"/&gt;   &lt;attribute name="mass" type="float" use="optional"/&gt; &lt;/complexType&gt; </pre> |

## 4.5.1.4.2 Binary representation syntax

| MaterialPropertyType{     | Number of bits | Mnemonic |
|---------------------------|----------------|----------|
| StiffnessFlag             | 1              | bslbf    |
| StaticFrictionFlag        | 1              | bslbf    |
| DynamicFrictionFlag       | 1              | bslbf    |
| DampingFlag               | 1              | bslbf    |
| TextureFlag               | 1              | bslbf    |
| MassFlag                  | 1              | bslbf    |
| if(StiffnessFlag) {       |                |          |
| Stiffness                 | 32             | fsbf     |
| }                         |                |          |
| if(StaticFrictionFlag) {  |                |          |
| StaticFriction            | 32             | fsbf     |
| }                         |                |          |
| if(DynamicFrictionFlag) { |                |          |
| DynamicFriction           | 32             | fsbf     |
| }                         |                |          |
| if(DampingFlag) {         |                |          |
| Damping                   | 32             | fsbf     |
| }                         |                |          |
| if(TextureFlag) {         |                |          |
| Texture                   | See ISO 10646  | UTF-8    |
| }                         |                |          |
| if(MassFlag) {            |                |          |
| Mass                      | 32             | fsbf     |
| }                         |                |          |
| }                         |                |          |

## 4.5.1.4.3 Semantics

| Name                 | Description                                                                                                                                                                                                            |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MaterialPropertyType | A type that contains the descriptions of a material property associated to the virtual world object.                                                                                                                   |
| StiffnessFlag        | This field, which is only present in the binary representation, signals the presence of the <code>Stiffness</code> element. "1" means the attribute shall be used and "0" means the attribute shall not be used.       |
| StaticFrictionFlag   | This field, which is only present in the binary representation, signals the presence of the <code>StaticFriction</code> element. "1" means the attribute shall be used and "0" means the attribute shall not be used.  |
| DynamicFrictionFlag  | This field, which is only present in the binary representation, signals the presence of the <code>DynamicFriction</code> element. "1" means the attribute shall be used and "0" means the attribute shall not be used. |
| DampingFlag          | This field, which is only present in the binary representation, signals the presence of the <code>Damping</code> element. "1" means the attribute shall be used and "0" means the attribute shall not be used.         |
| TextureFlag          | This field, which is only present in the binary representation, signals the presence of the <code>Texture</code> element. "1" means the attribute shall be used and "0" means the attribute shall not be used.         |
| MassFlag             | This field, which is only present in the binary representation, signals the presence of the <code>Mass</code> element. "1" means the attribute shall be used and "0" means the attribute shall not be used.            |
| stiffness            | The stiffness of the virtual world object (in N/mm).                                                                                                                                                                   |
| staticFriction       | The static friction of the virtual world object.                                                                                                                                                                       |
| dynamicFriction      | The dynamic friction of the virtual world object.                                                                                                                                                                      |
| damping              | The damping of the virtual world object.                                                                                                                                                                               |
| texture              | Contains a link to haptic texture file (e.g. bump image)                                                                                                                                                               |
| mass                 | The mass of the virtual world object.                                                                                                                                                                                  |

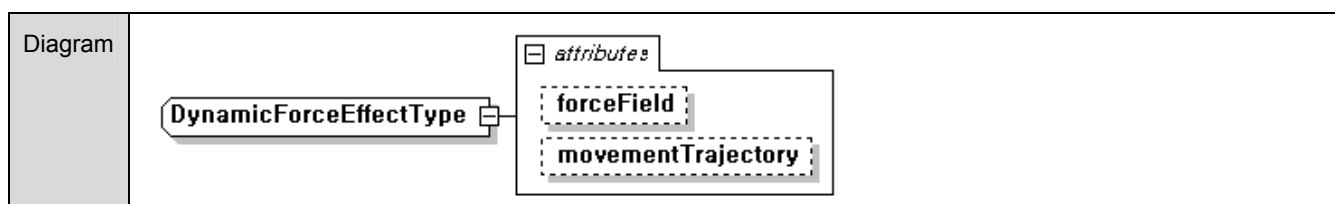
## 4.5.1.4.4 Examples

This example shows the material properties of a virtual world object which has 0.5 N/mm of stiffness, 0.3 of static coefficient of friction, 0.02 of kinetic coefficient of friction, 0,001 damping coefficient, 0.7 of mass and it's surface haptic texture is loaded from the given URL with the id of MID30.

```
<vwoc:HapticProperty hapticID="MID30">
  <vwoc:MaterialProperty stiffness="0.5" staticFriction="0.3"
dynamicFriction="0.02"
damping="0.001" texture="http://haptic.kr/tactile/texture1.bmp" mass="0.7"/>
</vwoc:HapticProperty>
```

## 4.5.1.5 DynamicForceEffectType

## 4.5.1.5.1 XML representation syntax



|        |                                                                                                                                                                                                                                                                                                                        |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Source | <pre> &lt;!-- ##### --&gt; &lt;!-- Dynamic Force Effect Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="DynamicForceEffectType"&gt;   &lt;attribute name="forceField" type="anyURI" use="optional"/&gt;   &lt;attribute name="movementTrajectory" type="anyURI" use="optional"/&gt; &lt;/complexType&gt; </pre> |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### 4.5.1.5.2 Binary representation syntax

| DynamicForceEffectType{      | Number of bits | Mnemonic |
|------------------------------|----------------|----------|
| ForceFieldFlag               | 1              | bslbf    |
| MovementTrajectoryFlag       | 1              | bslbf    |
| if(ForceFieldFlag) {         |                |          |
| ForceField                   | See ISO 10646  | UTF-8    |
| }                            |                |          |
| if(MovementTrajectoryFlag) { |                |          |
| MovementTrajectory           | See ISO 10646  | UTF-8    |
| }                            |                |          |
| }                            |                |          |

#### 4.5.1.5.3 Semantics

| Name                   | Description                                                                                                                                                                                                  |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DynamicForceEffectType | A type that contains the descriptions of a dynamic force effect associated to the virtual world object.                                                                                                      |
| ForceFieldFlag         | This field, which is only present in the binary representation, signals the presence of the ForceField element. "1" means the attribute shall be used and "0" means the attribute shall not be used.         |
| MovementTrajectoryFlag | This field, which is only present in the binary representation, signals the presence of the MovementTrajectory element. "1" means the attribute shall be used and "0" means the attribute shall not be used. |
| forceField             | Contains link to force field vector file (sum of force field vectors).                                                                                                                                       |
| movementTrajectory     | Contains link to force trajectory file (e.g. .dat file including a sequence of motion data).                                                                                                                 |

#### 4.5.1.5.4 Examples

This example shows the dynamic force effect of an avatar. The force field characteristic of the avatar with its id of FFID30 is determined by the designed force field file from the URL.

```
<vwoc:HapticProperty hapticID="FFID30">
  <vwoc:DynamicForceEffect forceField="http://haptic.kr/avatar/forcefield.dat"/>
</vwoc:HapticProperty>
```

#### 4.5.1.6 TactileType

##### 4.5.1.6.1 XML representation syntax

|         |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagram |                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Source  | <pre>&lt;!-- ##### --&gt; &lt;!-- Tactile Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="TactileType"&gt;   &lt;attribute name="temperature" type="float" use="optional"/&gt;   &lt;attribute name="vibration" type="float" use="optional"/&gt;   &lt;attribute name="current" type="float" use="optional"/&gt;   &lt;attribute name="tactilePatterns" type="anyURI" use="optional"/&gt; &lt;/complexType&gt;</pre> |

##### 4.5.1.6.2 Binary representation syntax

| TactileType{          | Number of bits | Mnemonic |
|-----------------------|----------------|----------|
| TemperatureFlag       | 1              | bslbf    |
| VibrationFlag         | 1              | bslbf    |
| CurrentFlag           | 1              | bslbf    |
| TactilePatternsFlag   | 1              | bslbf    |
| if(TemperatureFlag) { |                |          |
| temperature           | 32             | fsbf     |
| }                     |                |          |
| if(VibrationFlag) {   |                |          |
| vibration             | 32             | fsbf     |
| }                     |                |          |
| if(CurrentFlag) {     |                |          |
| current               | 32             | fsbf     |

|                           |               |       |
|---------------------------|---------------|-------|
| }                         |               |       |
| if(TactilePatternsFlag) { |               |       |
| tactilePatterns           | See ISO 10646 | UTF-8 |
| }                         |               |       |
| }                         |               |       |

#### 4.5.1.6.3 Semantics

| Name                         | Description                                                                                                                                                                                                               |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TactileType                  | A type that contains the descriptions of a tactile property associated to the virtual world object.                                                                                                                       |
| TemperatureFlag              | This field, which is only present in the binary representation, signals the presence of the <code>temperature</code> attribute. "1" means the attribute shall be used and "0" means the attribute shall not be used.      |
| VibrationFlag                | This field, which is only present in the binary representation, signals the presence of the <code>vibration</code> attribute. "1" means the attribute shall be used and "0" means the attribute shall not be used.        |
| CurrentFlag                  | This field, which is only present in the binary representation, signals the presence of the <code>electric current</code> attribute. "1" means the attribute shall be used and "0" means the attribute shall not be used. |
| TactilePatternsFlag          | This field, which is only present in the binary representation, signals the presence of the <code>tactilePatterns</code> attribute. "1" means the attribute shall be used and "0" means the attribute shall not be used.  |
| <code>temperature</code>     | The temperature of the virtual world object (in degree celcius).                                                                                                                                                          |
| <code>vibration</code>       | The vibration of the virtual world object.                                                                                                                                                                                |
| <code>current</code>         | The electric current of the virtual world object (in mA).                                                                                                                                                                 |
| <code>tactilePatterns</code> | Contains link to tactile pattern file (e.g. grayscale video (.avi, h.264, or .dat file.)                                                                                                                                  |

#### 4.5.1.6.4 Examples

This example shows the tactile properties, with its id of DFEID30, which has 15 degree of temperature and a tactile effect based on the tactile information from the following URL (<http://www.haptic.kr/avatar/tactile1.avi>).

```
<vwoc:HapticProperty hapticID="DFEID30">
  <vwoc:TactileProperty temperature="15"
  tactilePatterns="http://www.haptic.kr/avatar/tactile1.avi"/>
</vwoc:HapticProperty>
```

## 4.5.2 AnimationDescriptionType

## 4.5.2.1 XML representation syntax

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagram |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Source  | <pre> &lt;!-- ##### --&gt; &lt;!-- Animation Description Type --&gt; &lt;!-- ##### --&gt; &lt;complexType name="AnimationDescriptionType"&gt;   &lt;choice&gt;     &lt;sequence&gt;       &lt;element name="Name" type="mpeg7:termReferenceType" minOccurs="0"/&gt;       &lt;element name="Uri" type="anyURI" minOccurs="0"/&gt;     &lt;/sequence&gt;     &lt;element name="Extra" type="vwoc:ExtraType"/&gt;   &lt;/choice&gt;   &lt;attribute name="animationID" type="ID" use="optional"/&gt;   &lt;attribute name="duration" type="unsignedInt" use="optional"/&gt;   &lt;attribute name="loop" type="unsignedInt" use="optional"/&gt; &lt;/complexType&gt; </pre> |

## 4.5.2.2 Binary representation syntax

| AnimationDescriptionType{ | Number of bits | Mnemonic |
|---------------------------|----------------|----------|
| animationIDFlag           | 1              | bslbf    |
| durationFlag              | 1              | bslbf    |
| loopFlag                  | 1              | bslbf    |
| AnimationSourceType       | 1              | bslbf    |
| if(animationIDFlag){      |                |          |
| animationID               | See ISO 10646  | UTF-8    |
| }                         |                |          |
| if(durationFlag){         |                |          |
| duration                  | 32             | uimbsf   |
| }                         |                |          |

|                                     |               |                                                       |
|-------------------------------------|---------------|-------------------------------------------------------|
| if(loopFlag){                       |               |                                                       |
| Loop                                | 8             | uimsbf                                                |
| }                                   |               |                                                       |
| if(SelectAnimationDescriptionType){ |               |                                                       |
| Extra                               |               | ExtraType                                             |
| }                                   |               |                                                       |
| else {                              |               |                                                       |
| NameFlag                            | 1             | bslbf                                                 |
| UriFlag                             | 1             | bslbf                                                 |
| if(NameFlag){                       |               |                                                       |
| TypeOfAnimationCS                   | 8             | bslbf                                                 |
| Name                                | 10            | Number of bits are defined by the type of AnimationCS |
| }                                   |               |                                                       |
| if(UriFlag){                        |               |                                                       |
| Uri                                 | See ISO 10646 | UTF-8                                                 |
| }                                   |               |                                                       |
| }                                   |               |                                                       |
| }                                   |               |                                                       |

#### 4.5.2.3 Semantics

| Name                     | description                                                                                                                                                                                                                    |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AnimationDescriptionType | A type that contains descriptions and a link to the animation file.                                                                                                                                                            |
| animationIDFlag          | This field, which is only present in the binary representation, signals whether <code>animationID</code> attribute is used or not. "1" means that the attribute shall be used, and "0" means that attribute shall not be used. |
| durationFlag             | This field, which is only present in the binary representation, signals whether <code>duration</code> attribute is used or not. "1" means that the attribute shall be used, and "0" means that attribute shall not be used.    |
| loopFlag                 | This field, which is only present in the binary representation, signals whether <code>loop</code> attribute is used or not. "1" means that the attribute shall be used, and "0" means that attribute shall not be used.        |

| SelectAnimationDescriptionType | This field, which is only present in the binary representation, signals which type of animation description shall be used. "0" means that the proprietary description shall be used, and "1" means that the specified name in the classification schemes and the URI shall be used to describe the animation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|------------------------------------------------|-----------------|----------|---------------------|----------|------------------|----------|-----------------|----------|------------------|----------|---------------------|----------|--------------------|----------|------------------|----------|----------------------------|----------|--------------------------|----------|----------------------------|----------|-----------------------------|----------|---------------------------|----------|-----------------|----------|------------|----------|----------|-------------------|
| animationID                    | A unique identifier of the animation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| duration                       | The length of time that the animation lasts. The default unit is ms.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| loop                           | A playing option to describe the number of repetition. (default value: 1, 0:indefinite repetition, 1:once, 2: twice, ..., n: n times)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| Extra                          | Describes an animation in the form of any proprietary but well-formed XML metadata.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| NameFlag                       | This field, which is only present in the binary representation, signals whether the <code>name</code> element is used or not. "1" means that the element shall be used, and "0" means that element shall not be used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| UriFlag                        | This field, which is only present in the binary representation, signals whether the <code>Uri</code> element is used or not. "1" means that the element shall be used, and "0" means that element shall not be used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| TypeOfAnimationCS              | <p>This field, which is only present in the binary representation, describes a class of the animation as one of the classification schemes (CSs). The CSs that may be used for this purpose is defined in A.2.3 and A.2.4.</p> <table> <tr> <th>Type of AnimationCS</th><th>Binary representation for sensor type (8 bits)</th></tr> <tr> <td>IdleAnimationCS</td><td>00000000</td></tr> <tr> <td>GreetingAnimationCS</td><td>00000001</td></tr> <tr> <td>DanceAnimationCS</td><td>00000010</td></tr> <tr> <td>WalkAnimationCS</td><td>00000011</td></tr> <tr> <td>MovesAnimationCS</td><td>00000100</td></tr> <tr> <td>FightingAnimationCS</td><td>00000101</td></tr> <tr> <td>HearingAnimationCS</td><td>00000110</td></tr> <tr> <td>SmokeAnimationCS</td><td>00000111</td></tr> <tr> <td>CongratulationsAnimationCS</td><td>00001000</td></tr> <tr> <td>CommonActionsAnimationCS</td><td>00001001</td></tr> <tr> <td>SpecificActionsAnimationCS</td><td>00001010</td></tr> <tr> <td>FacialExpressionAnimationCS</td><td>00001011</td></tr> <tr> <td>BodyExpressionAnimationCS</td><td>00001100</td></tr> <tr> <td>VODeformationCS</td><td>00001101</td></tr> <tr> <td>VOMotionCS</td><td>00001110</td></tr> <tr> <td>Reserved</td><td>00001111-11111111</td></tr> </table> | Type of AnimationCS | Binary representation for sensor type (8 bits) | IdleAnimationCS | 00000000 | GreetingAnimationCS | 00000001 | DanceAnimationCS | 00000010 | WalkAnimationCS | 00000011 | MovesAnimationCS | 00000100 | FightingAnimationCS | 00000101 | HearingAnimationCS | 00000110 | SmokeAnimationCS | 00000111 | CongratulationsAnimationCS | 00001000 | CommonActionsAnimationCS | 00001001 | SpecificActionsAnimationCS | 00001010 | FacialExpressionAnimationCS | 00001011 | BodyExpressionAnimationCS | 00001100 | VODeformationCS | 00001101 | VOMotionCS | 00001110 | Reserved | 00001111-11111111 |
| Type of AnimationCS            | Binary representation for sensor type (8 bits)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| IdleAnimationCS                | 00000000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| GreetingAnimationCS            | 00000001                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| DanceAnimationCS               | 00000010                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| WalkAnimationCS                | 00000011                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| MovesAnimationCS               | 00000100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| FightingAnimationCS            | 00000101                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| HearingAnimationCS             | 00000110                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| SmokeAnimationCS               | 00000111                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| CongratulationsAnimationCS     | 00001000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| CommonActionsAnimationCS       | 00001001                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| SpecificActionsAnimationCS     | 00001010                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| FacialExpressionAnimationCS    | 00001011                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| BodyExpressionAnimationCS      | 00001100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| VODeformationCS                | 00001101                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| VOMotionCS                     | 00001110                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |
| Reserved                       | 00001111-11111111                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                     |                                                |                 |          |                     |          |                  |          |                 |          |                  |          |                     |          |                    |          |                  |          |                            |          |                          |          |                            |          |                             |          |                           |          |                 |          |            |          |          |                   |