INTERNATIONAL STANDARD

ISO/IEC 23005-3

Fourth edition
2019-08

Information technology — Media context and control —

Part 3: Sensory information

Technologies de l'information — Contrôle et contexte de supports —

Partie 3: Information sensorielle

Reference number
ISO/IEC 23005-3:2019(E)

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Published in Switzerland

Contents

Page

Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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

This fourth edition cancels and replaces the third edition (ISO/IEC 23005-3:2016), which has been technically revised. The main changes compared to the previous edition are as follows:

— Addition of the arrayed light effect.

A list of all parts in the ISO/IEC 23005 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The ISO/IEC 23005 series provides an architecture and specifies information representation of data flowing in and out of the real world and virtual worlds.

The data for the real world are communicated through sensors and actuators. The data for virtual worlds consist of properties of virtual objects and multi-sensorial data embedded in audio-visual content. MPEG-V specifies data formats for sensors, actuators, virtual objects, and audio-visual content.

Data captured from the real world could need to be adapted for use in a virtual world and data from virtual worlds could also need to be adapted for use in the real world. This document does not specify how the adaptation is carried out but only specifies the interfaces.

Data for sensors are sensor capabilities, sensed data, and sensor adaptation preferences.

Data for actuators are sensory device capabilities, sensory device commands, and sensory effect preferences.

Data for virtual objects are characteristics of avatars and virtual world objects.

Sensory effect could be needed to enrich audio-visual contents.

The system architecture is depicted in Figure 1 and the scope of this document is highlighted. That is only the information representation that acts as an input to the possible Adaptation VR – as defined in ISO/IEC 23005-1 – is specified in this document.

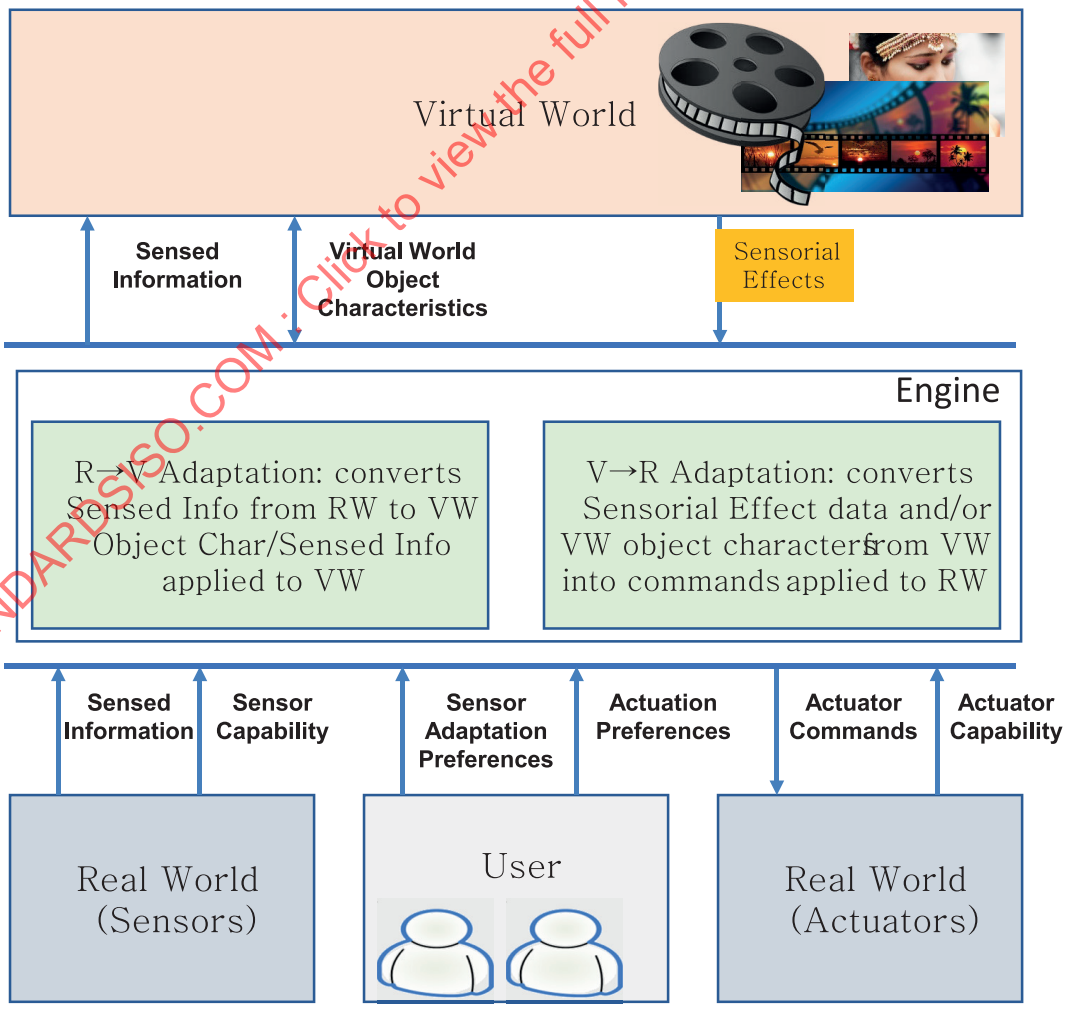

Figure 1 — Scope of ISO/IEC 23005-3 marked with a yellow box

NOTE 1 The actual R→V/V→R Adaptation is deliberately informative and left open for industry competition.

NOTE 2 Additional informative information can be found in Annex A.

This document contains the tools of the sensory information which can stimulate other senses than vision or audition, e.g. olfaction, mechanoreception, equilibrioception, or thermoception. That is, in addition to the audio-visual content of, for example, a movie, other senses are also stimulated giving the user the sensation of being part of the particular media and resulting in a worthwhile, informative user experience. This document also illustrates some non-normative examples.

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Myongji University	116 Myongji-ro, Cheoin-gu, Yongin, 449-728, Republic of Korea

Information technology — Media context and control —

Part 3:
Sensory information

1 Scope

The technologies specified in this document are description languages and vocabularies which describe sensorial effects.

The adaptation engine is not within the scope of this document (or the ISO/IEC 23005 series).

This document specifies syntax and semantics of the tools describing sensory information to enrich audio-visual contents:

— Sensory Effect Description Language (SEDL) as an XML schema-based language which enables one to describe a basic structure of sensory information;

— Sensory Effect Vocabulary (SEV), an XML representation for describing sensorial effects such as light, wind, fog, vibration, etc. that trigger human senses.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 21000-7:2007, *Information technology — Multimedia framework (MPEG-21) — Part 7: Digital Item Adaptation*

ISO/IEC 23005-6:2019, *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 purposes of this document, the terms and definitions given in ISO/IEC 23005-6 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1.1
digital content provider
entity that acts as the source of digital information of various nature

Note 1 to entry: The digital content may be provided in real-time or non real-time.

EXAMPLE Digital content from an online virtual world, simulation environment, multi-user game, a broadcasted multimedia production, a peer-to-peer multimedia production, or packaged content like a DVD or game.

3.1.2
sensory information
standardized representation format of data flowing in and out of the real world and virtual worlds

Note 1 to entry: This representation format is applicable to ISO/IEC 23005-1:2016, Clause 5, area B.

EXAMPLE Sensory effect metadata, haptic (kinesthetic/tactile) information, emotion information, avatar information.

3.1.3
sensory effect metadata
definition of the description schemes and descriptors to represent *sensory effects* (3.1.4)

3.1.4
sensory effect
effect to augment perception by stimulating human senses in a particular scene of a multimedia application

Note 1 to entry: Combinations of tactile display may provide also directional, shape information.

EXAMPLE Scent, wind, light, haptic (kinesthetic-force, stiffness, weight, friction, texture, widget, button, slider, joystick), tactile: air-jet, suction pressure, thermal, current, vibration.

3.1.5
adaptation VR
entity that can process the *sensory information* (3.1.2) in order to be consumed within the real world's context

Note 1 to entry: This may include the adaptation or transformation of the sensory information according to the capabilities of real-world devices or the preferences of the user. A specification of these capabilities and preferences can be found in ISO/IEC 23005-2.

3.2 Abbreviated terms

CT	common types
DIA	digital item adaptation (ISO/IEC 21000-7)
SEDL	sensory effects description language
SEM	sensory effect metadata
SEV	sensory effects vocabulary
UMA	universal multimedia access
UME	universal multimedia experience
XML	extensible mark-up language
XSI	XML streaming instructions

3.3 Schema documents

In the main text of this document, the syntax of description schemes and descriptors is provided whenever possible as a single schema document.

In some cases though, and in particular for Clause 5, the syntax of description schemes and descriptors is provided as a collection of schema snippets imbricated with other text. In order to form a valid schema document, these schema components should be gathered in a single document with the schema wrapper provided at the head of the clause. For better readability, the relevant schema documents are provided in Annex B.

In all cases, each schema document has a `version` attribute, the value of which is "ISO/IEC 23005-3". Furthermore, an informative identifier is given as the value of the `id` attribute of the `schema` component. This identifier is non-normative and used as a convention in this document to reference another schema document. In particular, it is used for the `schemaLocation` attribute of the `include` and `import` schema components.

3.4 Use of prefixes

For clarity, throughout this document, consistent namespace prefixes are used.

"`xsi`:" prefix is not normative. It is a naming convention in this document to refer to an element of the `http://www.w3.org/2001/XMLSchema-instance` namespace.

"`xml`:" and "`xmlns`:" are normative prefixes defined in Reference [1]. The prefix "`xml`:" is by definition bound to "`http://www.w3.org/XML/1998/namespace`". The prefix "`xmlns`:" is used only for namespace bindings and is not itself bound to any namespace name.

All other prefixes used in either the text or examples of this document are not normative, e.g., "`sedl`:", "`sev`:", "`dia`:", "`si`:", "`mpeg7`:".

In particular, most of the informative examples in this document are provided as XML fragments without the normally required XML document declaration and, thus, miss a correct namespace binding context declaration. In these descriptions fragments, the different prefixes are bound to the namespaces as given in Table 1.

Table 1 — Mapping of prefixes to namespaces in examples and text

Prefix	Corresponding namespace
ct	urn:mpeg:mpeg-v:2018:01-CT-NS
sedl	urn:mpeg:mpeg-v:2018:01-SEDL-NS
sev	urn:mpeg:mpeg-v:2018:01-SEV-NS
dia	urn:mpeg:mpeg21:2003:01-DIA-NS
si	urn:mpeg:mpeg21:2003:01-DIA-XSI-NS
mpeg7	urn:mpeg:mpeg7:schema:2004
xsi	http://www.w3.org/2001/XMLSchema-instance
xsd	http://www.w3.org/2001/XMLSchema

Unlike the informative descriptions examples, the normative specification of the syntax of tools in XML schema follows the namespace binding context defined in the relevant schema declaration such as the one defined in 5.3.

4 Sensory effects description language

4.1 General

This clause specifies the syntax and semantics of the sensory effects description language (SEDL) which provides basic building blocks for the authoring of sensory effect metadata.

4.2 Validation

Validating a document against the SEDL schema (as specified in W3C XML Schema) is necessary, but not sufficient, to determine its validity with respect to SEDL. After a document is validated against the SEDL schema, it shall also be subjected to additional validation rules. These additional rules are given below in the descriptions of the elements to which they pertain.

4.3 Processing

The processing model for the sensory effect metadata is defined as an XML processor (as specified by W3C XML) and the utilization of the elements and attributes as defined in the subsequent (sub)clauses.

NOTE The processing of the sensory effect metadata can follow existing XML decoding/parsing models such as the Document Object Model (DOM) or the Simple API for XML (SAX).

The time information that can be associated to sensory effects may be used for the synchronization with respect to other media assets.

EXAMPLE These other media assets can be video and/or audio.

4.4 Basic building blocks

4.4.1 General

This subclause specifies the syntax and semantics of the basic building blocks for authoring sensory effect metadata.

This document adopts the XML streaming instructions (XSI) as defined in ISO/IEC 21000-7 for the purpose of identifying process units and associating time information to them. In this context, a process unit is defined as a well-formed fragment of XML-based metadata that can be consumed as such and to which time information may be attached, indicating the point in time when it becomes available for consumption. A process unit is specified by one element named anchor element and by a process unit mode indicating how other connected elements are aggregated to this anchor to compose the process unit. Depending on the mode, the anchor element is not necessarily the root of the process unit. Anchor elements are ordered according to the navigation path of the XML document. Process units can overlap, i.e. some elements (including anchor elements) can belong to several process units. Additionally, the content provider can require that a given process unit be encoded as a random access point, i.e. that the resulting access unit does not require any other access units to be decoded. The syntax and semantics of the XML streaming instructions are fully specified in ISO/IEC 21000-7:2007, 8.6.

In addition to the XML streaming instructions, this document adopts the following basic time model for sensory effects metadata which is depicted in Figure 2 where *f* denotes *fade* and *d* denotes *duration*.

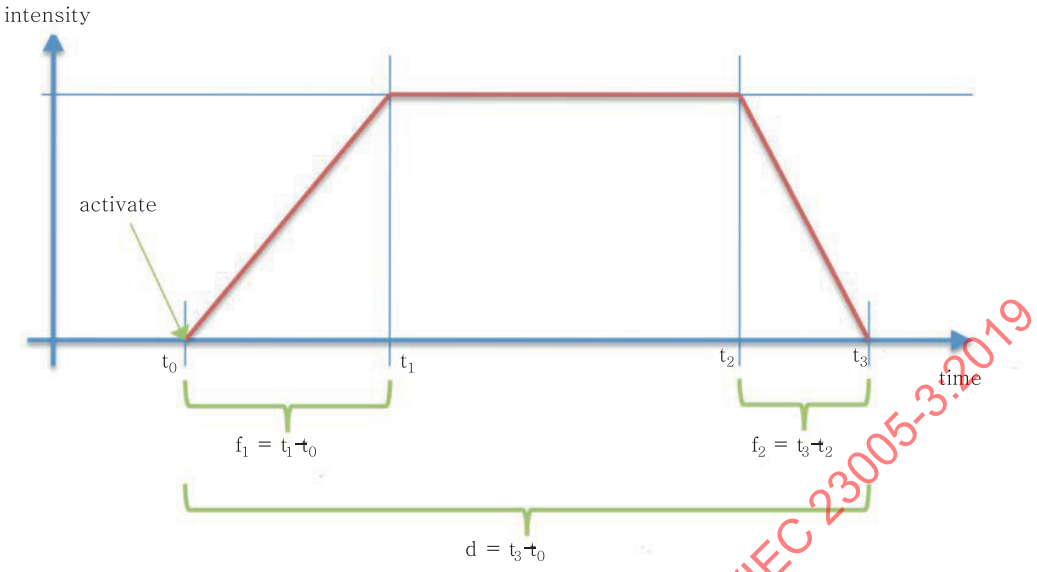


Figure 2 — Time model for sensory effect metadata

Each effect can be activated (i.e., t_0) and deactivated (i.e., t_3) at certain points in time. The deactivation of an effect can be explicitly defined (i.e., `activate="false"`) or indicated by means of a duration attribute during activation (i.e., $t_3 - t_0$). Furthermore, each effect can specify a fade-in (i.e., $t_1 - t_0$) or fade-out (i.e., $t_3 - t_2$) time within which the corresponding effect shall reach its specified intensity.

NOTE The actual implementation of some effects can require one or more elements as defined in the following. An example implementation of Figure 2 using the syntax as defined in the following is provided in 4.4.14.

4.4.2 Schema wrapper

The syntax of description tools specified in this subclause is provided as a collection of schema components, consisting notably in type definitions and element declarations. In order to form a valid schema document, these schema components should be gathered in a same document with the following declaration defining in particular the target namespace and the namespaces prefixes.

```
<?xml version="1.0"?>
<schema
  xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:sedl="urn:mpeg:mpeg-v:2018:01-SEDL-NS"
  xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004"
  xmlns:si="urn:mpeg:mpeg21:2003:01-DIA-XSI-NS"
  xmlns:ct="urn:mpeg:mpeg-v:2018:01-CT-NS"
  targetNamespace="urn:mpeg:mpeg-v:2018:01-SEDL-NS"
  elementFormDefault="qualified" attributeFormDefault="unqualified"
  version="ISO/IEC 23005-3" id="MPEG-V-SEDL.xsd">

  <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-DIA-XSI-NS" schemaLocation="http://standards.
iso.org/ittf/PubliclyAvailableStandards/MPEG-21_schema_files/dia-2nd/XSI-2nd.xsd"/>
  <import namespace="urn:mpeg:mpeg-v:2018:01-CT-NS" schemaLocation=" http://standards.iso.
org/ittf/PubliclyAvailableStandards/MPEG-V_schema_files/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>
```

4.4.3 Mnemonics for binary representations

The mnemonics are defined in ISO/IEC 23005-6:2019, 4.2.

4.4.4 Common header for binary representations

The common header is defined in ISO/IEC 23005-6:2019, 4.3.

4.4.5 Base datatypes and elements

4.4.5.1 Syntax

```
<attributeGroup name="SEMBaseAttributes">
  <attribute name="activate" type="boolean" use="optional"/>
  <attribute name="duration" type="positiveInteger" use="optional"/>
  <attribute name="fade" type="positiveInteger" use="optional"/>
  <attribute name="alt" type="anyURI" use="optional"/>
  <attribute name="priority" type="positiveInteger" use="optional"/>
  <attribute name="location" type="mpeg7:termReferenceType" use="optional"/>
  <attributeGroup ref="sedl:SEMAdaptabilityAttributes"/>
</attributeGroup>

<simpleType name="intensityValueType">
  <restriction base="float"/>
</simpleType>

<simpleType name="intensityRangeType">
  <restriction>
   <simpleType>
    <list itemType="float"/>
   </simpleType>
   <length value="2" fixed="true"/>
  </restriction>
</simpleType>

<attributeGroup name="SEMAdaptabilityAttributes">
  <attribute name="adaptType" type="sedl:adaptTypeType" use="optional"/>
  <attribute name="adaptRange" type="sedl:adaptRangeType" default="10" use="optional"/>
</attributeGroup>

<simpleType name="adaptTypeType">
  <restriction base="NMTOKEN">
   <enumeration value="strict"/>
   <enumeration value="under"/>
   <enumeration value="over"/>
   <enumeration value="both"/>
  </restriction>
</simpleType>

<simpleType name="adaptRangeType">
  <restriction base="unsignedInt">
   <minInclusive value="0"/>
   <maxInclusive value="100"/>
  </restriction>
</simpleType>

<element name="Declarations" type="sedl:DeclarationsType"/>
<element name="GroupOfEffects" type="sedl:GroupOfEffectsType"/>
<element name="Effect" type="sedl:EffectBaseType"/>
<element name="ReferenceEffect" type="sedl:ReferenceEffectType"/>
<element name="Parameter" type="sedl:ParameterBaseType"/>

<complexType name="SEMBaseType" abstract="true">
  <complexContent>
   <restriction base="anyType">
    <attribute name="id" type="ID" use="optional"/>
   </restriction>
```



```
  </complexContent>
</complexType>
```

4.4.5.2 Binary representation

SEMBaseAttributes {	Number of bits	Mnemonic
activateFlag	1	bslbf
durationFlag	1	bslbf
fadeFlag	1	bslbf
altFlag	1	bslbf
priorityFlag	1	bslbf
locationFlag	1	bslbf
if(activateFlag) {		
activate	1	bslbf
}		
if(durationFlag) {		
duration	32	uimsbf
}		
if(fadeFlag) {		
fade	32	uimsbf
}		
if(altFlag) {		
alt	See ISO/IEC 10646[9]	UTF-8
}		
if(priorityFlag) {		
priority	32	uimsbf
}		
if(locationFlag) {		
location	7	bslbf
}		
SEMAdaptabilityAttributes		SEMAdaptabilityAttributes
}		

SEMAdaptabilityAttributes {	Number of bits	Mnemonic
adaptTypeFlag	1	bslbf
adaptRangeFlag	1	bslbf
if(adaptTypeFlag) {		
adaptType	2	bslbf (Table 2)
}		
if(adaptRangeFlag) {		
adaptRange	7	bslbf
}		
}		

Declarations {	Number of bits	Mnemonic
DeclarationsType		DeclarationsType
}		

GroupOfEffects {	Number of bits	Mnemonic
GroupOfEffectsType		GroupOfEffectsType
}		

Effect {	Number of bits	Mnemonic
EffecetBaseType		EffectBaseType
}		

ReferenceEffect {	Number of bits	Mnemonic
ReferenceEffectType		RefernceEffectType
}		

Parameter {	Number of bits	Mnemonic
ParameterBaseType		ParameterBaseType
}		

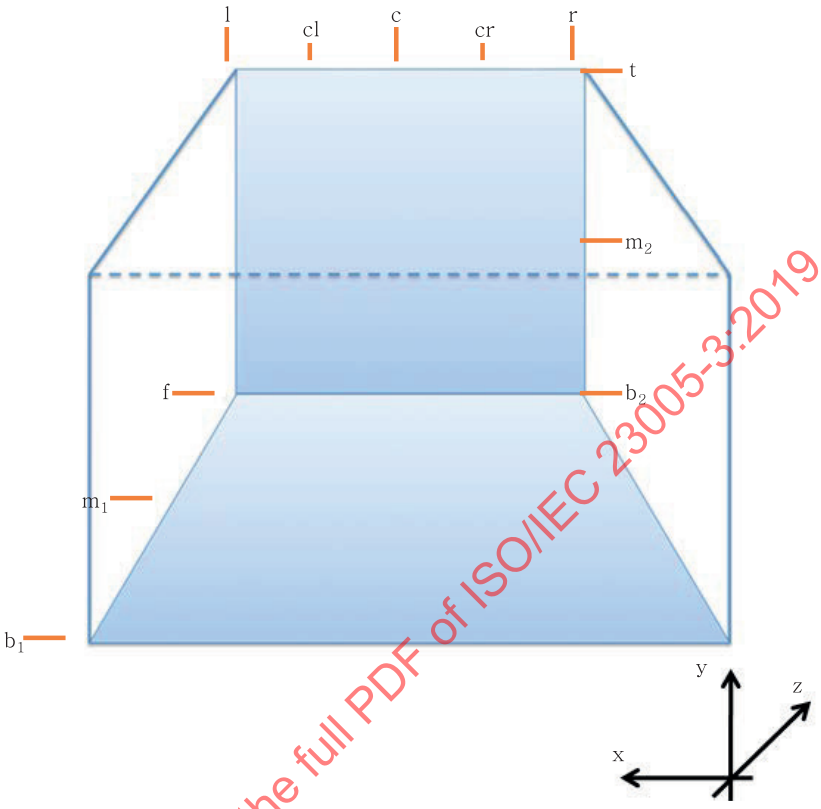
SEMBaseType {	Number of bits	Mnemonic
idFlag	1	bslbf
if(idFlag) {		
id	See ISO/IEC 10646[2]	UTF-8
}		
}		

4.4.5.3 Semantics

Semantics of the `SEMBaseAttributes`.

Name	Definition
`activateFlag`	This field, which is only present in the binary representation, indicates the presence of `activate` attribute. If it is set to "1", the `activate` attribute is following.
`activate`	Describes whether the effect shall be activated. A value of `true` means the effect shall be activated and `false` means the effect shall be deactivated.
`durationFlag`	This field, which is only present in the binary representation, indicates the presence of `duration` attribute. If it is set to "1", the `duration` attribute is following.
`duration`	Describes the duration according to the time scheme used. The time scheme used shall be identified by means of the `si:absTimeScheme` and `si:timeScale` attributes respectively.
`fadeFlag`	This field, which is only present in the binary representation, indicates the presence of `fade` attribute. If it is set to "1", the `fade` attribute is following.
`fade`	Describes the fade time according to the time scheme used within which the defined `intensity` shall be reached. The time scheme used shall be identified by means of the `si:absTimeScheme` and `si:timeScale` attributes respectively.
`altFlag`	This field, which is only present in the binary representation, indicates the presence of `alt` attribute. If it is set to "1", the `alt` attribute is following.

Name	Definition
`alt`	Describes an alternative effect identified by URI. NOTE 1 The alternative can point to an effect – or list of effects – within the same description or an external description. NOTE 2 The alternative can be used in case the original effect cannot be processed. EXAMPLE 1 The alternative effect is chosen because the original intended effect cannot be processed due to lack of devices supporting this effect.
`priorityFlag`	This field, which is only present in the binary representation, indicates the presense of `priority` attribute. If it is set to "1", the `priority` attribute is following.
`priority`	Describes the priority for effects with respect to other effects in the same group of effects sharing the same point in time when they should become available for consumption. A value of one indicates the highest priority and larger values indicate lower priorities. NOTE 3 The priority can by used to process effects – defined within a group of effects – according to the capabilities of the adaptation VR. EXAMPLE 2 The adaptation VR processes the individual effects of a group of effects according to their priority in descending order due to its limited capabilities. That is, effects with low priority can get lost.
`locationFlag`	This field, which is only present in the binary representation, indicates the presence of `location` attribute. If it is set to "1", the `location` attribute is following.
`location`	Describes the location from where the effect is expected to be received from the user's perspective according to the x-, y-, and z-axis as depicted in Figure 3 where *b1* denotes *back*, *m1* deontes *midway*, *f* dontes *front*, *l* denotes *left*, *cl* denotes *centerleft*, *c* denotes *center*, *cr* denoes *centerright*, *r* denotes *right*, *t* denotes *top*, *m2* denotes *middle*, and *b2* denotes *bottom*, respectively.

Name	Definition
	 **Figure 3 — Location model for sensory effect metadata and reference coordinate system** A classification scheme that may be used for this purpose is the `LocationCS` as defined in ISO/IEC 23005-6:2019, Annex A. The terms from the `LocationCS` shall be concatenated with the ":" sign in order of the x-, y-, and z-axis to uniquely define a location within the three-dimensional space. For referring to a group of locations, a wild card mechanism may be employed using the "*" sign. EXAMPLE 3 `urn:mpeg:mpeg-v:01-SI-LocationCS-NS:center:middle:front` defines the location as follows: center on the x-axis, middle on the y-axis, and front on the z-axis. That is, it describes all effects at the center, middle, front side of the user. EXAMPLE 4 `urn:mpeg:mpeg-v:01-SI-LocationCS-NS:left:*:midway` defines the location as follows: left on the x-axis, any location on the y-axis, and midway on the z-axis. That is, it describes all effects at the left, midway side of the user. EXAMPLE 5 `urn:mpeg:mpeg-v:01-SI-LocationCS-NS:*:*:back` defines the location as follows: any location on the x-axis, any location on the y-axis, and back on the z-axis. That is, it describes all effects at the back of the user. The binary representation for the LocationCS is defined in ISO/IEC 23005-6:2019, Annex A
`SEMAdaptabilityAttributes`	This field, which is only present in the binary representation, describes a group of attributes for the adaptability attributes of effects.

Semantics of the `intensityValueType` and `intensityRangeType`.

Name	Definition
`intensityValueType`	Tool for describing the intensity of the effect. Each effect shall define its intensity value using this datatype.
`intensityRangeType`	Tool for describing the intensity range of the effect. Each effect shall define its intensity range using this datatype.

Semantics of the `SEMAdaptabilityAttributes`.

Name	Definition
`adaptType`	Describes the preferred type of adaptation with the following possible instantiations: — `strict`: An adaptation by approximation may not be performed. — `under`: An adaptation by approximation may be performed with a smaller effect value than the specified effect value. NOTE 1 (1 – adaptRange) x intensity ~ intensity. — `over`: An adaptation by approximation may be performed with a greater effect value than the specified effect value. NOTE 2 intensity ~ (1 + adaptRange) x intensity. — `both`: An adaptation by approximation may be performed between the upper and lower bound specified by `adaptRange`. NOTE 3 (1 – adaptRange) x intensity ~ (1 + adaptRange) x intensity. In the binary description, Table 2 is use.
`adaptTypeFlag`	This field, which is only present in the binary representation, indicates the presence of `adaptType` attribute. If it is set to "1", the `adaptType` attribute is following.
`adaptRange`	Describes the upper and lower bound in percentage for the `adaptType`. If the `adaptType` is not present, `adaptRange` shall be ignored.
`adaptRangeFlag`	This field, which is only present in the binary representation, indicates the presence of `adaptRange` attribute. If it is set to "1", the `adaptRange` attribute is following.

Table 2 — adaptType

adaptType	Sementics
00	strict
01	under
10	over
11	both

Semantics of the SEM base elements.

Name	Definition
`Declarations`	Describes a declaration of sensory effects, group of sensory effects, or parameters. NOTE 1 The declarations can be used by reference using the `ReferenceEffect` element.
`Effect`	Describes a sensory effect.
`GroupOfEffects`	Describes a group of sensory effects. NOTE 2 The purpose of grouping is to remove some redundancy from its child elements. All attributes included here are inherited to its child elements.

Table 2 *(continued)*

Name	Definition
ReferenceEffect	Describes a reference to a sensory effect, group of sensory effects, or parameter. NOTE 3 The reference can point to a sensory effect, group of sensory effects, or parameter as defined within the same description or an external description by means of the Declarations element.
Parameter	Describes a parameter for a sensory effect. NOTE 4 The parameter may be used to declare complex properties to be used within sensory effects. As such, it shall be defined within the Declarations element.

Semantics of the SEMBaseType.

Name	Definition
SEMBaseType	Provides the topmost type of the base type hierarchy.
idFlag	This field, which is only present in the binary representation, indicates the presence of id attribute. If it is set to "1", the id attribute is following.
id	Identifies the id of the SEMBaseType.

4.4.6 Root element

4.4.6.1 Syntax

```
<element name="SEM">
  <complexType>
   <sequence>
    <element name="DescriptionMetadata"
type="sedl:DescriptionMetadataType" minOccurs="0" maxOccurs="1"/>
    <choice maxOccurs="unbounded">
     <element ref="sedl:Declarations"/>
     <element ref="sedl:GroupOfEffects"/>
     <element ref="sedl:Effect"/>
     <element ref="sedl:ReferenceEffect"/>
    </choice>
   </sequence>
   <anyAttribute namespace="##other" processContents="lax"/>
  </complexType>
</element>
```

4.4.6.2 Binary representation syntax

SEM {	Number of bits	Mnemonic
DescriptionMetadataFlag	1	bslbf
if(DescriptionMetadataFlag) {		
DescriptionMetadata		DescriptionMetadata
}		
NumOfElements		vluimsbf5
for(k=0;k<NumOfElements;k++) {		
ElementID[k]	4	uimsbf (Table 3)
Element[k]		Element
}		
anyAttributeType		anyAttributeType
}		

anyAttributeType {	Number of bits	Mnemonic
siAttibutes		siAttributeList

anyAttributeType {	Number of bits	Mnemonic
anyAttributeFlag	1	bslbf
if(anyAttributeFlag) {		
SizeOfanyAttribute		vluimsbf5
anyAttribute	SizeOfanyAttribute*8	bslbf
}		
}		

siAttributeList {	Number of bits	Mnemonic
anchorElementFlag	1	bslbf
encodeAsRAPFlag	1	bslbf
puModeFlag	1	bslbf
timeScaleFlag	1	bslbf
ptsDeltaFlag	1	bslbf
absTimeSchemeFlag	1	bslbf
absTimeFlag	1	bslbf
ptsFlag	1	bslbf
if(anchorElementFlag) {		
anchorElement	1	bslbf
}		
if(encodeAsRAPFlag) {		
encodeAsRAP	1	bslbf
}		
if(puModeFlag) {		
puMode	3	bslbf (Table 4)
}		
if(puModeFlag) {		
timeScale	32	uimsbf
}		
if(ptsDeltaFlag) {		
ptsDelta	32	uimsbf
}		
if(absTimeSchemeFlag) {		
absTimeSchemeLength		vluimsbf5
absTimeScheme	8*absTimeScheme Length	bslbf
}		
if(absTimeFlag) {		
absTimeLength		vluimsbf5
absTime	8*absTimeLength	bslbf
}		
if(ptsFlag) {		
pts		vluimsbf5
}		
}		

4.4.6.3 Semantics

Semantics of the SEM root element.

Name	Definition
SEM	Serves as the root element for sensory effects metadata.
DescriptionMetadataFlag	This field, which is only present in the binary representation, indicates the presence of the DescriptionMetadata element. If it is 1, then the DescriptionMetadata element is present, otherwise the DescriptionMetadata element is not present.
DescriptionMetadata	Describes general information about the sensory effects metadata. EXAMPLE 1 Creation information or Classification Scheme Alias.
NumOfElements	This field, which is only present in the binary representation, specifies the number of Element instances accommodated in the SEM.
ElementID	This field, which is only present in the binary representation, describes which SEM scheme shall be used. In the binary description, Table 3 is used.
Element	See 4.4.8, 4.4.9, 4.4.10, 4.4.11, and 4.4.12.
Declarations	See semantics of the SEM base elements.
Effect	See semantics of the SEM base elements.
GroupOfEffects	See semantics of the SEM base elements.
ReferenceEffect	See semantics of the SEM base elements.
anyAttribute	Provides an extension mechanism for including attributes from namespaces other than the target namespace. Attributes that shall be included are the XML streaming instructions as defined in ISO/IEC 21000-7 for the purpose of identifying process units and associating time information to them. EXAMPLE 2 si:timescale describes the time scale to be used.
anyAttributeType	Type of anyAttribute
siAttibutes	Make reference to follow siAttributeList
anyAttributeFlag	This field, which is only present in the binary representation, indicates the presence of anyAttribute attribute. If it is set to "1", the anyAttribute is following.
SizeOfanyAttribute	This field, which is only present in the binary representation, indicates the number of byte arrary for anyAttribute

Table 3 — Element ID

ElementID	Element
0	Reserved
1	Declarations
2	GroupOfEffects
3	Effect
4	ReferenceEffect
5	Parameter
6~15	Reserved

Semantics of the siAttributeList.

Name	Definition
anchorElementFlag	This field, which is only present in the binary representation, indicates the presence of the anchorElement attribute. If it is 1, then the anchorElement attribute is present, otherwise the anchorElement attribute is not present.

Table 3 *(continued)*

Name	Definition
encodeAsRAPFlag	This field, which is only present in the binary representation, indicates the presence of the encodeAsRAP attribute. If it is 1, then the encodeAsRAP attribute is present, otherwise the encodeAsRAP attribute is not present.
puModeFlag	This field, which is only present in the binary representation, indicates the presence of the puMode attribute. If it is 1, then the puMode attribute is present, otherwise the puMode attribute is not present.
timeScaleFlag	This field, which is only present in the binary representation, indicates the presence of the timeScale attribute. If it is 1, then the timeScale attribute is present, otherwise the timeScale attribute is not present.
ptsDeltaFlag	This field, which is only present in the binary representation, indicates the presence of the ptsDelta attribute. If it is 1, then the ptsDelta attribute is present, otherwise the ptsDelta attribute is not present.
absTimeSchemeFlag	This field, which is only present in the binary representation, indicates the presence of the activation attribute. If it is 1, then the activation attribute is present, otherwise the activation attribute is not present.
absTimeFlag	This field, which is only present in the binary representation, indicates the presence of the absTimeScheme attribute. If it is 1, then the absTimeScheme attribute is present, otherwise the absTimeScheme attribute is not present.
ptsFlag	This field, which is only present in the binary representation, indicates the presence of the pts attribute. If it is 1, then the pts attribute is present, otherwise the pts attribute is not present.
absTimeSchemeLength	This field, which is only present in the binary representation, specifies the length of each absTimeSchemeLength instance in bytes. The value of this element is the size of the largest absTimeSchemeLength instance, aligned to a byte boundary by bit stuffing using 0-7 '1' bits.
absTimeLength	This field, which is only present in the binary representation, specifies the length of each absTimeLength instance in bytes. The value of this element is the size of the largest absTimeLength instance, aligned to a byte boundary by bit stuffing using 0-7 '1' bits.
anchorElement	Describes whether the element shall be anchor element. A value of true (=1) means the element shall be anchor element and false (=0) means the element shall be not anchor element. The anchorElement allows one to indicate whether an XML element is an anchor element, i.e., the starting point for composing the process unit.
encodeAsRAP	Describes property indicates that the process unit shall be encoded as a random access point. A value of true (=1) means the process unit shall be encoded as a random access point and false (=0) means the process unit shall be not encoded as a random access point.
puMode	The puMode specifies how elements are aggregated to the anchor element to compose the process unit. For detailed information, see ISO/IEC 21000-7. Figure 4 shows an example for puMode = descendants which means that the process unit contains the anchor element and its descendant elements. Note that the anchor elements are pictured in white.

Table 3 *(continued)*

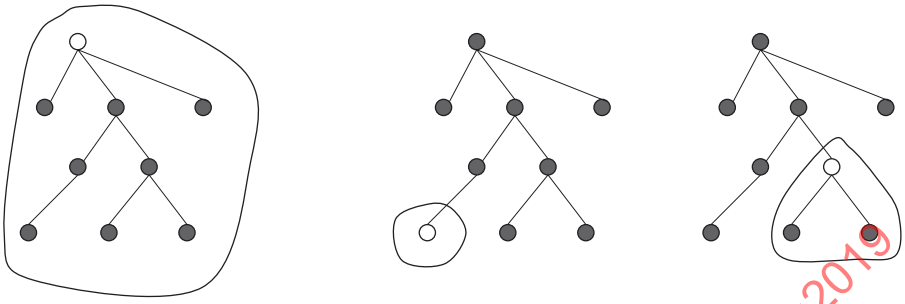
Name	Definition
	 **Figure 4 — Examples of process units: puMode = descendants** In the binary description, Table 4 is used.
timeScale	Describes a timescale.
ptsDelta	Describes a processing time stamp delta.
absTimeScheme	Describes an absolute time scheme.
absTime	Describes an absolute time.
pts	Describes a processing time stamp (PTS).

Table 4 — putMode

puMode	puModeType
000	self
001	ancestors
010	descendants
011	ancestorsDescendants
100	preceding
101	precedingSiblings
110	sequential
111	Reserved

4.4.7 Description metadata

4.4.7.1 Syntax

```
<complexType name="DescriptionMetadataType">
  <complexContent>
   <extension base="mpeg7:DescriptionMetadataType">
    <sequence>
     <element name="ClassificationSchemeAlias" minOccurs="0" maxOccurs="unbounded">
      <complexType>
       <complexContent>
        <extension base="sedl:SEMBaseType">
         <attribute name="alias" type="NMTOKEN" use="required"/>
         <attribute name="href" type="anyURI" use="required"/>
        </extension>
       </complexContent>
      </complexType>
     </element>
    </sequence>
   </extension>
  </complexContent>
</complexType>
```

4.4.7.2 Binary representation syntax

DescriptionMetadata {	Number of bits	Mnemonic
MPEG7DescriptionMetadata		Mpeg7:DescriptionMetadataType
ClassificationSchemeAliasFlag	1	bslbf
if(ClassificationSchemeAliasFlag) {		
NumOfClassSchemeAlias		vluimsbf5
for(k=0;k<NumOfClassSchemeAlias;k++){		
SEMBaseType[k]		SEMBaseType
alias[k]	See ISO/IEC 10646[9]	UTF-8
href[k]	See ISO/IEC 10646[9]	UTF-8
}		
}		
}		

4.4.7.3 Semantics

Semantics of the `DescriptionMetadata`.

Name	Definition
`DescriptionMetadataType`	`DescriptionMetadataType` extends `mpeg7:DescriptionMetadataType` and provides a sequence of classification schemes for usage in the `SEM` description.
`MPEG7DescriptionMetadata`	make reference to `MPEG7:DescriptionMetadata`
`ClassificationSchemeAliasFlag`	This field, which is only present in the binary representation, indicates the presence of the `ClassificationSchemeAlias` element. If it is 1, then the `ClassificationSchemeAlias` element is present, otherwise the `ClassificationSchemeAlias` element is not present.
`NumOfClassSchemeAlias`	This field, which is only present in the binary representation, specifies the number of Classification Scheme Alias instances accommodated in the `description metadata`.
`ClassificationSchemeAlias`	Describes an `alias` for a classification scheme referenced by URI.
`SEMBase`	Describes a base type of a Sensory Effect Metadata.
`alias`	Describes the alias assigned to the `ClassificationScheme`. The scope of the alias assigned shall be the entire description regardless of where the `ClassificationSchemeAlias` appears in the description.
`href`	Describes a reference to the classification scheme that is being aliased using a URI. The classification schemes defined in this document, whether normative of informative, shall be referenced by the `uri` attribute of the `ClassificationScheme` for that classification scheme.

4.4.8 Declarations

4.4.8.1 Syntax

```
<complexType name="DeclarationsType">
 <complexContent>
  <extension base="sedl:SEMBaseType">
   <choice maxOccurs="unbounded">
    <element ref="sedl:GroupOfEffects"/>
    <element ref="sedl:Effect"/>
    <element ref="sedl:Parameter"/>
   </choice>
  </extension>
 </complexContent>
</complexType>
```

4.4.8.2 Binary represenstation syntax

Declarations {	Number of bits	Mnemonic
SEMBaseType		SEMBaseType
NumOfElements		vluimsbf5
for(k=0;k<NumOfElements;k++) {		
ElementID[k]	4	bslbf
Element[k]		Element
}		
}		

*ElementID restricted 2, 3, 5

4.4.8.3 Semantics

Semantics of the `DeclarationsType`.

Name	Definition
`DeclarationsType`	Tool for describing a declaration of sensory effects, group of sensory effects, or parameters. NOTE The declarations can be used by reference using the `ReferenceEffect` element.
`Effect`	See semantics of the SEM base elements.
`GroupOfEffects`	See semantics of the SEM base elements.
`Parameter`	See semantics of the SEM base elements.
`SEMBaseType`	Describes a base type of a Sensory Effect Metadata.
`NumOfElements`	This field, which is only present in the binary representation, specifies the number of Element instances accommodated in the SEM.
`ElementID`	This field, which is only present in the binary representation, describes which SEM scheme shall be used. In the binary description, make reference to Table 3.
`Element`	This field describes a SEM scheme of which name is described by the value of `ElementID`.

4.4.9 Group of effects

4.4.9.1 Syntax

```
<complexType name="GroupOfEffectsType">
  <complexContent>
   <extension base="sedl:SEMBaseType">
    <choice minOccurs="2" maxOccurs="unbounded">
     <element ref="sedl:Effect"/>
     <element ref="sedl:ReferenceEffect"/>
    </choice>
    <attributeGroup ref="sedl:SEMBaseAttributes"/>
    <anyAttribute namespace="##other" processContents="lax"/>
   </extension>
  </complexContent>
</complexType>
```

4.4.9.2 Binary representation syntax

GroupOfEffects {	Number of bits	Mnemonic
SEMBaseType		SEMBaseType

GroupOfEffects {	Number of bits	Mnemonic
NumOfElements	5	uimsbf
for(k=0;k<NumOfElements;k++) {		
ElementID[k]	4	bslbf
Element[k]		Element
}		
SEMBaseAttributes		SEMBaseAttributes
anyAttribute		anyAttributeType
}		

4.4.9.3 Semantics

Semantics of the `GroupOfEffectsType`.

Name	Definition
`GroupOfEffectsType`	Tool for describing a group of two or more sensory effects. It provides user-defined combinational effect and reduces redundant description for repeat use of same type of effects. EXAMPLE `GroupOfEffectsType` can define an abstracted combinational effect comprised of vibration, light, and scent effect for repeated "boom" scene.
`Effect`	See semantics of the SEM base elements.
`NumOfElements`	This field, which is only present in the binary representation, specifies the number of Element instances accommodated in the SEM.
`ElementID`	This field, which is only present in the binary representation, describes which SEM scheme shall be used. In the binary description, make referece to Table 3. NOTE ElementID should be restricted to 3 or 4 as described in Table 3.
`Element`	This field describes a SEM scheme of which name is described by the value of `ElementID`.
`SEMBaseAttributes`	Describes a group of attributes for the group of effects.
`anyAttribute`	Provides an extension mechanism for including attributes from namespaces other than the target namespace. Attributes that shall be included are the XML streaming instructions as defined in ISO/IEC 21000-7 for the purpose of identifying process units and associating time information to them. EXAMPLE `si:pts` describes the point in time when the associated information shall become available to the application for processing.

4.4.10 Effect

4.4.10.1 Syntax

```
<complexType name="EffectBaseType" abstract="true">
  <complexContent>
   <extension base="sedl:SEMBaseType">
    <sequence minOccurs="0">
     <element name="SupplementalInformation"
     type="sedl:SupplementalInformationType" minOccurs="0"/>
    </sequence>
    <attribute name="autoExtraction" type="sedl:autoExtractionType"/>
    <attributeGroup ref="sedl:SEMBaseAttributes"/>
    <anyAttribute namespace="##other" processContents="lax"/>
   </extension>
  </complexContent>
</complexType>

<complexType name="SupplementalInformationType">
```

```
  <sequence>
   <element name="ReferenceRegion" type="mpeg7:SpatioTemporalLocatorType"/>
   <element name="Operator" type="sedl:OperatorType" minOccurs="0"/>
  </sequence>
</complexType>

<simpleType name="OperatorType">
  <restriction base="NMTOKEN">
   <enumeration value="average"/>
   <enumeration value="dominant"/>
  </restriction>
</simpleType>

<simpleType name="autoExtractionType">
  <restriction base="string">
   <enumeration value="audio"/>
   <enumeration value="visual"/>
   <enumeration value="both"/>
  </restriction>
</simpleType>
```

4.4.10.2 Binary representation syntax

Effect {	**Number of bits**	**Mnemonic**
EffectTypeID	8	uimsbf (Table 5)
EffectBaseType		EffectBaseType
EffectType		EffectType
}		

EffectBaseType {	**Number of bits**	**Mnemonic**
SupplementalInformationFlag	1	bslbf
autoExtractionFlag	1	bslbf
SEMBaseType		SEMBaseType
if(SupplementalInformationFlag) {		
SupplementalInformationType		SupplementalInformationType
}		
if(autoExtractionFlag) {		
autoExtraction	2	uimsbf (Table 7)
}		
SEMBaseAttributes		SEMBaseAttributes
anyAttribute		anyAttributeType
}		

SupplementalInformationType {	**Number of bits**	**Mnemonic**
OperatorFlag	1	bslbf
ReferenceRegion		SpatioTemporalLocatorType ISO/IEC 15938-5:2003
if(OperatorFlag) {		
Operator	3	bslbf (Table 6)
}		
}		

SpatioTemporalLocatorType {	**Number of bits**	**Mnemonic**
CoordFlag	1	bslbf

SpatioTemporalLocatorType {	Number of bits	Mnemonic
if(CoordFlag) {		
refLength		vluimsbf5
ref	8*refLength	bslbf
spatialRef	1	bslbf
}		
NumOfRefRegions		vluimsbf5
for(k=0;k<NumOfRefRegions;k++) {		
TypeOfTrajectory	2	bslbf
if(TypeOfTrajectory==”00”) {		
FigureTrajectory		FigureTrajectoryType
} else if(TypeOfTrajectory==”01”) {		
ParameterTrajectory		ParameterTrajectoryType
} else if(TypeOfTrajectory==”10”) {		
MediaTime		MediaTimeType
}		
}		
}		

4.4.10.3 Semantics

Semantics of the `EffectBaseType`.

Name	Definition
`EffectTypeID`	This field, which is only present in the binary representation, specifies a descriptor identifier. The descriptor identifier indicates the descriptor type accommodated in the Effect. See Table 5.
`EffectBaseType`	`EffectBaseType` extends `SEMBaseType` and provides a base abstract type for a subset of types defined as part of the sensory effects metadata types.
`SupplementalInformationFlag`	This field, which is only present in the binary representation, indicates the presence of the `SupplementalInformation` element. If it is 1, then the `SupplementalInformation` element is present, otherwise the `SupplementalInformation` element is not present.
`autoExtractionFlag`	This field, which is only present in the binary representation, indicates the presence of the `autoExtraction` attribute. If it is 1, then the `autoExtraction` attribute is present, otherwise the `autoExtraction` attribute is not present.
`SEMBaseAttributes`	Describes a group of attributes for the effects.
`anyAttribute`	Provides an extension mechanism for including attributes from namespaces other than the target namespace. Attributes that shall be included are the XML streaming instructions as defined in ISO/IEC 21000-7 for the purpose of identifying process units and associating time information to them. EXAMPLE `si:pts` describes the point in time when the associated information shall become available to the application for processing.

Table 5 — EffectType ID

EffectType ID	EffectType
0	Reserved
1	LightType
2	FlashType

Table 5 *(continued)*

EffectType ID	EffectType
3	TemperatureType
4	WindType
5	VibrationType
6	SprayingType
8	FogType
9	ColorCorrectionType
10	RigidBodyMotionType
11	PassiveKinesthetic MotionType
12	PassiveKinesthetic ForceType
13	ActiveKinestheticType
14	TactileType
15	ParameterizedTactileType
16	BubbleType
17	ArrayedLightType
18	Reserved

Semantics of the `SupplementalInformationType`.

Name	Definition
`SupplementalInformationType`	Tool for describing supplemental information.
`ReferenceRegion`	Describes the reference region for automatic extraction from video. If the `autoExtraction` is not present or is not equal to video, this element shall be ignored. The localization scheme used is identified by means of the `mpeg7:SpatioTemporalLocatorType` that is defined in ISO/IEC 15938-5.
`OperatorFlag`	This field, which is only present in the binary representation, indicates the presence of the `Operator` element. If it is 1, then the `Operator` element is present, otherwise the `Operator` element is not present.
`Operator`	Describes the preferred type of operator for extracting sensory effects from the reference region of video with the following possible instantiations. — `average`: extracts sensory effects from the reference region by calculating average value. — `dominant`: extracts sensory effects from the reference region by calculating dominant value. In the binary description, Table 6 is used.

Table 6 — Operator

Operator	Sementics
000	Reserved
001	average
010	dominant
011~111	Reserved

Semantics of the `autoExtractionType`.

Name	Definition
`autoExtraction`	Describes whether an automatic extraction of sensory effects from the media resource, which is described by this sensory effect metadata, is preferable (but not required). The following values are available. — `audio`: the automatic extraction of sensory effects from the audio part of the media resource, which is described by this sensory effect metadata, is preferable. EXAMPLE Audio autoExtraction Type which is based on audio dynamics and acoustic feature of the media resource, can extract vibration, spraying, wind, etc. effect types. — `visual`: the automatic extraction of sensory effects from the visual part of the media resource, which is described by this sensory effect metadata, is preferable. EXAMPLE Visual autoExtraction Type which is based on color, brightness, motion detection, can extract various sensory effect types such as motion, light, flash, etc. — `both`: the automatic extraction of sensory effects from both the audio and visual part of the media resource, which is described by this sensory effect metadata, is preferable. If the autoextraction is on and the device is able to compute the effect, the result of the computation should overwrite the effect specified by the content designer. In the binary description, Table 7 is used.

Table 7 — autoExtraction

autoExtraction	autoExtractionType
00	audio
01	visual
10	both
11	Reserved

4.4.11 Reference effect

4.4.11.1 Syntax

```
<complexType name="ReferenceEffectType">
  <complexContent>
   <extension base="sedl:SEMBaseType">
    <attribute name="uri" type="anyURI" use="required"/>
    <attributeGroup ref="sedl:SEMBaseAttributes"/>
    <anyAttribute namespace="##other" processContents="lax"/>
   </extension>
  </complexContent>
</complexType>
```

4.4.11.2 Binary representation syntax

ReferenceEffect {	Number of bits	Mnemonic
SEMBaseType		SEMBaseType
uri	See ISO/IEC 10646[9]	UTF-8
SEMBaseAttributes		SEMBaseAttributes
anyAttribute		anyAttributeType
}		

4.4.11.3 Semantics

Semantics of the `ReferenceEffectType`.

Name	Definition
`ReferenceEffectType`	Tool for describing a reference to a sensory effect, group of sensory effects, or parameter.
`uri`	Describes a reference to a sensory effect, group of sensory effects, or parameter by a Uniform Resource Identifier (URI). Its target type shall be one – or derived – of `sedl:EffectBaseType`, `sedl:GroupOfEffectType`, or `sedl:ParameterBaseType`.
`SEMBaseAttributes`	Describes a group of attributes for the effects.
`anyAttribute`	Provides an extension mechanism for including attributes from namespaces other than the target namespace. Attributes that shall be included are the XML streaming instructions as defined in ISO/IEC 21000-7 for the purpose of identifying process units and associating time information to them. Attributes included here override the attribute values possibly defined within the sensory effect, group of effects or parameter referenced by the `uri`. EXAMPLE `si:pts` describes the point in time when the associated information shall become available to the application for processing.

4.4.12 Parameters

4.4.12.1 Syntax

```
<complexType name="ParameterBaseType" abstract="true">
  <complexContent>
   <extension base="sedl:SEMBaseType"/>
  </complexContent>
</complexType>

<complexType name="ColorCorrectionParameterType">
  <complexContent>
   <extension base="sedl:ParameterBaseType">
    <sequence>
     <element name="ToneReproductionCurves" type="ct:ToneReproductionCurvesType"
     minOccurs="0"/>
     <element name="ConversionLUT" type="ct:ConversionLUTType"/>
     <element name="ColorTemperature" type="ct:IlluminantType" minOccurs="0"/>
     <element name="InputDeviceColorGamut" type="ct:InputDeviceColorGamutType"
     minOccurs="0"/>
     <element name="IlluminanceOfSurround" type="mpeg7:unsigned12" minOccurs="0"/>
    </sequence>
   </extension>
  </complexContent>
</complexType>
```

4.4.12.2 Binary representation syntax

ParameterBaseType {	Number of bits	Mnemonic
SEMBaseType		SEMBaseType
}		

ColorCorrectionParameterType {	Number of bits	Mnemonic
ParameterBaseType		ParameterBaseType
ToneReproductionFlag	1	bslbf
ColorTemperatureFlag	1	bslbf
InputDeviceColorGamutFlag	1	bslbf

ColorCorrectionParameterType {	Number of bits	Mnemonic
IlluminanceOfSurroundFlag	1	bslbf
if(ToneReproductionFlag) {		
ToneReproductionCurves		ToneReproductionCurvesType
}		
ConversionLUT		ConversionLUTType
if(ColorTemperatureFlag) {		
ColorTemperature		IlluminantType
}		
if(InputDeviceColorGamutFlag) {		
InputDeviceColorGamut		InputDeviceColorGamutType
}		
if(IlluminanceOfSurroundFlag) {		
IlluminanceOfSurround	12	uimsbf
}		
}		

4.4.12.3 Semantics

Semantics of the `ParameterBaseType`.

Name	Definition
`ParameterBaseType`	Provides the topmost type of the parameter base type hierarchy.

Semantics of the `ColorCorrectionParameterType`.

Name	Definition
`ColorCorrectionParameterType`	A type defining the schema of the color correction effect.
`ToneReproductionFlag`	This field, which is only present in the binary representation, indicates the presence of the `ToneReproductionCurves` element. If it is 1, then the `ToneReproductionCurves` element is present, otherwise the `ToneReproductionCurves` element is not present.
`ToneReproductionCurves`	This curve shows the characteristics (e.g., gamma curves for R, G and B channels) of the input display device.
`ConversionLUT`	A look-up table (matrix) converting an image between an image color space (e.g. *RGB*) and a standard connection space (e.g. *CIE XYZ*).
`ColorTemperatureFlag`	This field, which is only present in the binary representation, indicates the presence of the `ColorTemperature` element. If it is 1, then the `ColorTemperature` element is present, otherwise the `ColorTemperature` element is not present.
`ColorTemperature`	An element describing a white point setting (e.g., D65, D93) of the input display device.
`InputDeviceColorGamutFlag`	This field, which is only present in the binary representation, indicates the presence of the `InputDeviceColorGamut` element. If it is 1, then the `InputDeviceColorGamut` element is present, otherwise the `InputDeviceColorGamut` element is not present.
`InputDeviceColorGamut`	An element describing an input display device color gamut, which is represented by chromaticity values of *R*, *G*, and *B* channels at maximum *DAC* values.
`IlluminanceOfSurroundFlag`	This field, which is only present in the binary representation, indicates the presence of the `IlluminanceOfSurround` element. If it is 1, then the `IlluminanceOfSurround` element is present, otherwise the `IlluminanceOfSurround` element is not present.

Name	Definition
IlluminanceOfSurround	An element describing an illuminance level of viewing environment. The illuminance is represented by lux.

4.4.12.4 Examples

EXAMPLE 1 This example shows the description of a color correction parameter with the following semantics.

```
<sedl:SEM>
   <sedl:Declarations>
      <sedl:Parameter xsi:type="sedl:ColorCorrectionParameterType" id="ccpt001">
         <sedl:ToneReproductionCurves>
            <ct:DAC_Value>0</ct:DAC_Value>
            <ct:RGB_Value>0 0 0</ct:RGB_Value>
            <ct:DAC_Value>255</ct:DAC_Value>
            <ct:RGB_Value>255 255 255</ct:RGB_Value>
         </sedl:ToneReproductionCurves>
         <sedl:ConversionLUT>
            <ct:RGB2XYZ_LUT mpeg7:dim="3 3">
               86.60 67.60 38.0
               46.00 137.0 16.5
               2.365 19.41 203.9
            </ct:RGB2XYZ_LUT>
            <ct:RGBScalar_Max>
               1.0 1.0 1.0
            </ct:RGBScalar_Max>
            <ct:Offset_Value>
               0.2150 0.2050 0.4250
            </ct:Offset_Value>
            <ct:Gain_Offset_Gamma mpeg7:dim="3 3">
               1.0228 -0.0228 1.6222
               1.0242 -0.0242 1.5624
               1.0220 -0.0220 1.6180
            </ct:Gain_Offset_Gamma>
            <ct:InverseLUT mpeg7:dim="3 3">
               0.0155 -0.0073 -0.0023
               -0.0052 0.0099 0.0002
               0.0003 -0.0009 0.0049
            </ct:InverseLUT>
         </sedl:ConversionLUT>
         <sedl:ColorTemperature>
            <ct:xy_Value x="0.1" y="0.8"/>
            <ct:Y_Value>100</ct:Y_Value>
         </sedl:ColorTemperature>
         <sedl:InputDeviceColorGamut>
            <ct:IDCG_Type>BARCO</ct:IDCG_Type>
            <ct:IDCG_Value mpeg7:dim="3 2">
               0.2835 0.6043
               0.1509 0.0624
               0.6244 0.3410
            </ct:IDCG_Value>
         </sedl:InputDeviceColorGamut>
         <sedl:IlluminanceOfSurround>500</sedl:IlluminanceOfSurround>
      </sedl:Parameter>
   </sedl:Declarations>
</sedl:SEM>
```

4.4.13 Additional validation rules

4.4.13.1 General

For the purpose of referencing, the additional validation rules are numbered.

4.4.13.2 The `SEM` element shall have a `si:timeScale` attribute.

4.4.13.3 The following rules shall apply on the `GroupOfEffects`.

4.4.13.3.1 A `GroupOfEffects` shall have a timestamp (i.e., `pts`, `ptsDelta`, or `absTime`).

4.4.13.3.2 A `GroupOfEffects` outside of a `Declarations` shall not have both a `pts` and an `absTime` at the same time.

4.4.13.3.3 A `GroupOfEffects` within a `Declarations` shall have only a `ptsDelta` for a timestamp.

4.4.13.4 The following rules shall apply on the `Effect`.

4.4.13.4.1 At least `activate`, `duration`, or `fade` shall be defined.

4.4.13.4.2 An `Effect` outside of a `GroupOfEffects` shall have a timestamp (i.e., `pts`, `ptsDelta`, or `absTime`).

4.4.13.4.3 An `Effect` within a `GroupOfEffects` shall have only a `ptsDelta` for a timestamp.

4.4.13.4.4 An `Effect` shall not have both a `pts` and an `absTime` at the same time.

4.4.13.4.5 An `Effect` within a `Declarations` shall have only a `ptsDelta` for a timestamp.

4.4.13.4.6 If `duration` is defined `activate` may not be defined.

4.4.13.4.7 If `fade` and `duration` are defined, `activate` may not be defined.

4.4.13.4.8 If `fade` is defined, intensity shall be defined.

NOTE The actual intensity is defined within the individual effecs by defining its value and range as an extension of `intensityValueType` and `intensityRangeType` respectively.

EXAMPLE `intensity-value` and `intensity-range`.

4.4.13.4.9 If two (or more) consecutive `Effect` elements of the same type share the same timestamp (i.e., `pts`, `ptsDelta`, or `absTime`) and the same location or overlap in time (i.e., `location`, `duration`, `activate` set to `true`/`false` resulting in overlap), only the latest in their order of appearance shall be used while retaining the semantics of the `priority` attribute.

NOTE It is possible to remove the other `Effect` elements from the description.

4.4.13.4.10 If fade and duration are defined, fade shall be less or equal to duration.

4.4.13.5 The following rules shall apply on the `ReferenceEffect`.

4.4.13.5.1 A `ReferenceEffect` outside of a `GroupOfEffects` shall have a timestamp (i.e., `pts`, `ptsDelta`, or `absTime`).

4.4.13.5.2 A `ReferenceEffect` within a `GroupOfEffects` shall have only a `ptsDelta` for a timestamp.

4.4.13.5.3 A `ReferenceEffect` shall not have both a `pts` and an `absTime` at the same time.

4.4.13.5.4 A `ReferenceEffect` within `Declarations` shall have only a `ptsDelta` for a timestamp.

4.4.14 Examples

EXAMPLE 1 The following example shows a possible usage of the basic building blocks.

```
<SEM>
  <DescriptionMetadata>
    <ClassificationSchemeAlias alias="..." href="..."/>
  </DescriptionMetadata>

  <Declarations>
    <!-- some declarations to be used here -->
  </Declarations>

  <GroupOfEffects ...>
    <Effect .../>
    <Effect .../>
  </GroupOfEffects>
  <ReferenceEffect uri="#eff1" .../>
  <Effect .../>
  <GroupOfEffects ...>
    <Effect .../>
    <Effect .../>
    <Effect .../>
  </GroupOfEffects>
  <ReferenceEffect uri="#eff1" .../>
  <!-- and so on -->
</SEM>
```

EXAMPLE 2 The following example shows a possible abstract implementation of Figure 2. Note that the example is declared as abstract because the attribute values refer to variables introduced in Figure 2 instead of using real values.

```
<Effect si:pts="t0" activate="true" fade="t1-t0" intensity-value="int"/>
<Effect si:pts="t2" activate="false" fade="t3-t2" intensity-value="0"/>
```

EXAMPLE 3 The following example shows an XML instance of sensory effect metadata with the XML streaming instructions.

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<SEM
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="urn:mpeg:mpeg-v:2010:01-SEDL-NS"
xmlns:sev="urn:mpeg:mpeg-v:2010:01-SEV-NS"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004"
xmlns:ct="urn:mpeg:mpeg-v:2010:01-CT-NS"
xmlns:si="urn:mpeg:mpeg21:2003:01-DIA-XSI-NS"
xsi:schemaLocation="urn:mpeg:mpeg-v:2010:01-SEV-NS MPEG-V-SEV.xsd"
si:puMode="sequential"
si:anchorElement="true"
si:timeScale="1000">
  <DescriptionMetadata>
   <ClassificationSchemeAlias href="urn:mpeg:mpeg-v:01-SI-ColorCS-NS" alias="COLOR"/>
  </DescriptionMetadata>

  <Declarations>
   <Parameter xsi:type="ColorCorrectionParameterType" id="ccpt001">
    <ToneReproductionCurves>
     <ct:DAC_Value>0</ct:DAC_Value>
     <ct:RGB_Value>0 0 0</ct:RGB_Value>
     <ct:DAC_Value>255</ct:DAC_Value>
     <ct:RGB_Value>255 255 255</ct:RGB_Value>
    </ToneReproductionCurves>
    <ConversionLUT>
     <ct:RGB2XYZ_LUT mpeg7:dim="3 3">
      86.60 67.60 38.0
      46.00 137.0 16.5
      2.365 19.41 203.9
     </ct:RGB2XYZ_LUT>
     <ct:RGBScalar_Max>
      1.0 1.0 1.0
```

```
      </ct:RGBScalar_Max>
      <ct:Offset_Value>
       0.2150 0.2050 0.4250
      </ct:Offset_Value>
      <ct:Gain_Offset_Gamma mpeg7:dim="3 3">
       1.0228 -0.0228 1.6222
       1.0242 -0.0242 1.5624
       1.0220 -0.0220 1.6180
      </ct:Gain_Offset_Gamma>
      <ct:InverseLUT mpeg7:dim="3 3">
       0.0155 -0.0073 -0.0023
       -0.0052 0.0099 0.0002
       0.0003 -0.0009 0.0049
      </ct:InverseLUT>
     </ConversionLUT>
     <ColorTemperature>
      <ct:xy_Value x="0.1" y="0.8"/>
      <ct:Y_Value>100</ct:Y_Value>
     </ColorTemperature>
     <InputDeviceColorGamut>
      <ct:IDCG_Type>BARCO</ct:IDCG_Type>
      <ct:IDCG_Value mpeg7:dim="3 2">
       0.2835 0.6043
       0.1509 0.0624
       0.6244 0.3410
      </ct:IDCG_Value>
     </InputDeviceColorGamut>
      <IlluminanceOfSurround>500</IlluminanceOfSurround>
     </Parameter>
   </Declarations>

    <Effect xsi:type="sev:LightType" si:puMode="ancestorsDescendants"
si:anchorElement="true" activate="true" color=":COLOR:white" intensity-value="50"
intensity-range="0.0 100.0" duration="5000" si:pts="1000"/>
    <Effect xsi:type="sev:SprayingType" si:puMode="ancestorsDescendants"
si:anchorElement="true" activate="true" intensity-value="0.7" intensity-range="0.0 10.0"
duration="2000" si:pts="3000"/>

    <GroupOfEffects si:puMode="ancestorsDescendants" si:anchorElement="true"
id="explosion_effect" si:pts="20000">
     <Effect xsi:type="sev:FlashType" intensity-range="0.0 100.0" intensity-value="65.0"
color=":COLOR:white" duration="5000" activate="true" si:ptsDelta="0"/>
     <Effect xsi:type="sev:TemperatureType" intensity-range="0.0 100.0" intensity-
value="40.0"
duration="5000" activate="true" si:ptsDelta="0"/>
     <Effect xsi:type="sev:WindType" intensity-range="0.0 100.0" intensity-value="50.0"
duration="5000" activate="true" si:ptsDelta="0"/>
     <Effect xsi:type="sev:VibrationType" intensity-range="0.0 100.0" intensity-
value="60.0" duration="5000" activate="true" si:ptsDelta="0"/>
   </GroupOfEffects>
</SEM>
```

EXAMPLE 4 The following example shows an XML instance of an SEM root element with DescriptionMedata and Declaration (Processing unit #1) from the instance of EXAMPLE 3.

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<SEM
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="urn:mpeg:mpeg-v:2010:01-SEDL-NS"
xmlns:sev="urn:mpeg:mpeg-v:2010:01-SEV-NS"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004"
xmlns:ct="urn:mpeg:mpeg-v:2010:01-CT-NS"
xmlns:si="urn:mpeg:mpeg21:2003:01-DIA-XSI-NS"
xsi:schemaLocation="urn:mpeg:mpeg-v:2010:01-SEV-NS MPEG-V-SEV.xsd"
si:puMode="sequential"
si:anchorElement="true"
si:timeScale="1000">

    <DescriptionMetadata>
     <ClassificationSchemeAlias href="urn:mpeg:mpeg-v:01-SI-ColorCS-NS" alias="COLOR"/>
    </DescriptionMetadata>
```

```
   <Declarations>
    <Parameter xsi:type="ColorCorrectionParameterType" id="ccpt001">
     ...
    </Parameter>
   </Declarations>
</SEM>
```

EXAMPLE 5 The following example shows an XML instance of a light effect (Processing unit #2) from the instance of EXAMPLE 3.

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<SEM
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="urn:mpeg:mpeg-v:2010:01-SEDL-NS"
xmlns:sev="urn:mpeg:mpeg-v:2010:01-SEV-NS"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004"
xmlns:ct="urn:mpeg:mpeg-v:2010:01-CT-NS"
xmlns:si="urn:mpeg:mpeg21:2003:01-DIA-XSI-NS"
xsi:schemaLocation="urn:mpeg:mpeg-v:2010:01-SEV-NS MPEG-V-SEV.xsd"
si:puMode="sequential"
si:anchorElement="true"
si:timeScale="1000">

   <Effect xsi:type="sev:LightType" si:puMode="ancestorsDescendants"
si:anchorElement="true" activate="true" color=":COLOR:white" intensity-value="50"
intensity-range="0.0 100.0" duration="5000" si:pts="1000"/>
</SEM>
```

EXAMPLE 6 The following example shows an XML instance of a spraying effect (Processing unit #3) from the instance of EXAMPLE 3.

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<SEM
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="urn:mpeg:mpeg-v:2010:01-SEDL-NS"
xmlns:sev="urn:mpeg:mpeg-v:2010:01-SEV-NS"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004"
xmlns:ct="urn:mpeg:mpeg-v:2010:01-CT-NS"
xmlns:si="urn:mpeg:mpeg21:2003:01-DIA-XSI-NS"
xsi:schemaLocation="urn:mpeg:mpeg-v:2010:01-SEV-NS MPEG-V-SEV.xsd"
si:puMode="sequential"
si:anchorElement="true"
si:timeScale="1000">

   <Effect xsi:type="sev:SprayingType" si:puMode="ancestorsDescendants"
si:anchorElement="true" activate="true" intensity-value="0.7" intensity-range="0.0 10.0"
duration="2000" si:pts="3000"/>
</SEM>
```

EXAMPLE 7 The following example shows an XML instance of a group of effect (Processing unit #4) from the instance of EXAMPLE 3.

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<SEM
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="urn:mpeg:mpeg-v:2010:01-SEDL-NS"
xmlns:sev="urn:mpeg:mpeg-v:2010:01-SEV-NS"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004"
xmlns:ct="urn:mpeg:mpeg-v:2010:01-CT-NS"
xmlns:si="urn:mpeg:mpeg21:2003:01-DIA-XSI-NS"
xsi:schemaLocation="urn:mpeg:mpeg-v:2010:01-SEV-NS MPEG-V-SEV.xsd"
si:puMode="sequential"
si:anchorElement="true"
si:timeScale="1000">

   <GroupOfEffects si:puMode="ancestorsDescendants" si:anchorElement="true"
id="explosion_effect" si:pts="20000">
    <Effect xsi:type="sev:FlashType" intensity-range="0.0 100.0" intensity-value="65.0"
color=":COLOR:white" duration="5000" activate="true" si:ptsDelta="0"/>
    <Effect xsi:type="sev:TemperatureType" intensity-range="0.0 100.0" intensity-
```



```
value="40.0"
duration="5000" activate="true" si:ptsDelta="0"/>
    <Effect xsi:type="sev:WindType" intensity-range="0.0 100.0" intensity-value="50.0"
duration="5000" activate="true" si:ptsDelta="0"/>
    <Effect xsi:type="sev:VibrationType" intensity-range="0.0 100.0" intensity-
value="60.0" duration="5000" activate="true" si:ptsDelta="0"/>
  </GroupOfEffects>
</SEM>
```

5 Sensory effect vocabulary

5.1 General

This clause specifies syntax and semantics of the sensory effect vocabulary which comprises the following effects:

— light, colored light, flash light;

— temperature;

— wind;

— vibration;

— sprayer;

— scent;

— fog;

— color correction;

— rigid body motion;

— passive kinesthetic motion;

— passive kinesthetic force;

— active kinesthetic;

— tactile;

— bubble;

— arrayed light.

NOTE SEV has been designed in an extensible way and additional sensory effects can be added easily.

EXAMPLE Additional sensory effects may be added as extensions to sedl:EffectBaseType and conformance to SEDL.

5.2 Validation

Validating a document against the SEV schema (as specified in W3C XML Schema) is necessary, but not sufficient, to determine its validity with respect to SEV. After a document is validated against the SEV schema, it shall also be subjected to additional validation rules. These additional rules are given below in the descriptions of the elements to which they pertain.

5.3 Schema wrapper

The syntax of description tools specified in this subclause is provided as a collection of schema components, consisting notably in type definitions and element declarations. In order to form a valid

schema document, these schema components should be gathered in a same document with the following declaration defining in particular the target namespace and the namespaces prefixes.

```
<?xml version="1.0"?>
<schema
  xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:sedl="urn:mpeg:mpeg-v:2018:01-SEDL-NS"
  xmlns:sev="urn:mpeg:mpeg-v:2018:01-SEV-NS"
  xmlns:ct="urn:mpeg:mpeg-v:2018:01-CT-NS"
  xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004"
  targetNamespace="urn:mpeg:mpeg-v:2018:01-SEV-NS"
  elementFormDefault="qualified" attributeFormDefault="unqualified"
  version="ISO/IEC 23005-3" id="MPEG-V-SEV.xsd">

  <import namespace="urn:mpeg:mpeg-v:2018:01-SEDL-NS"
schemaLocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/
MPEG-V_schema_files/MPEG-V-SEDL.xsd"/>
  <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:mpeg-v:2018:01-CT-NS"
schemaLocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/
MPEG-V_schema_files/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>
```

5.4 Light effect

5.4.1 General

This subclause specifies syntax and semantics of a light effect.

5.4.2 Syntax

```
<complexType name="LightType">
  <complexContent>
   <extension base="sedl:EffectBaseType">
    <attribute name="color" type="ct:colorType" use="optional"/>
    <attribute name="intensity-value" type="sedl:intensityValueType" use="optional"/>
    <attribute name="intensity-range" type="sedl:intensityRangeType" use="optional"/>
   </extension>
  </complexContent>
</complexType>
```

5.4.3 Binary representation syntax

LightType {	**Number of bits**	**Mnemonic**
EffectBaseType		EffectBaseType
colorFlag	1	bslbf
intensityValueFlag	1	bslbf
intensityRangeFlag	1	bslbf
if(colorFlag) {		
color		colorType
}		
if(intensityValueFlag) {		
intensity-value	32	fsfb
}		
if(intensityRangeFlag) {		

LightType {	Number of bits	Mnemonic
intensity-range[0]	32	fsfb
intensity-range[1]	32	fsfb
}		
}		

5.4.4 Semantics

Semantics of the `LightType`.

Name	Definition
`LightType`	Tool for describing a light effect.
`colorFlag`	This field, which is only present in the binary representation, indicates the presence of the `color` attribute. If it is 1, then the `color` attribute is present, otherwise the `color` attribute is not present.
`intensityValueFlag`	This field, which is only present in the binary representation, indicates the presence of the `intensity-value` attribute. If it is 1, then the `intensity-value` attribute is present, otherwise the `intensity-value` attribute is not present.
`intensityRangeFlag`	This field, which is only present in the binary representation, indicates the presence of the `intensity-range` attribute. If it is 1, then the `intensity-range` attribute is present, otherwise the `intensity-range` attribute is not present.
color	Describes the color of the light effect as a reference to a classification scheme term or as RGB value. The binary representation is defined in ISO/IEC 23005-6. A CS that may be used for this purpose is the `ColorCS` defined in ISO/IEC 23005-6:2019, Annex A. EXAMPLE 1 `urn:mpeg:mpeg-v:01-SI-ColorCS-NS:alice_`blue would describe the color Alice blue.
`intensity-value`	Describes the intensity of the light effect in terms of illumination in lux.
`intensity-range`	Describes the range of the intensity value. EXAMPLE 2 [10,0^{-5} lux, 130,0 klx].

5.4.5 Additional validation rules

5.4.5.1 General

For the purpose of referencing the additional validation rules are numbered.

5.4.5.2 If `intensity-value` is present, `intensity-range` shall be present and vice versa.

5.4.5.3 The intensity-value shall be within the intensity-range.

5.4.6 Example

EXAMPLE 1 This example shows the description of a light effect with the following semantics. The intensity is 50,0 lux [within a range of (10^{-5},32 000) lux], i.e., approximately a family living room, with the color #FF0000. The light effect is activated at si:pts="0" and deactivated at si:pts="28".

```
<sedl:Effect xsi:type="sev:LightType" intensity-value="50.0" intensity-range="0.00001
32000.0" activate="true" color="#FF0000" si:pts="0"/>
...
<sedl:Effect xsi:type="sev:LightType" activate="false" color="#FF0000" si:pts="28"/>
```

EXAMPLE 2 This example shows the description of a light effect which uses the color scheme where the color is defined as a reference to the color classification scheme.

```
<sedl:DescriptionMetadata>
 <sedl:ClassificationSchemeAlias href="urn:mpeg:mpeg-v:01-SI-ColorCS-NS" alias="COLOR"/>
</sedl:DescriptionMetadata>
<sedl:Effect xsi:type="sev:LightType" intensity-value="50.0" intensity-range="0.00001
32000.0" duration="28" color=":COLOR:amber" si:pts="0"/>
```

EXAMPLE 3 This example shows the description of a light effect which disables the light effect on the left:middle:front only.

```
<sedl:DescriptionMetadata>
 <sedl:ClassificationSchemeAlias href="urn:mpeg:mpeg-v:01-SI-LocationCS-NS"
alias="WCS"/>
</sedl:DescriptionMetadata>
<sedl:Effect xsi:type="sev:LightType" location=":WCS:left:middle:front" activate="false"
si:pts="40" fade="1"/>
```

5.5 Flash effect

5.5.1 General

This subclause specifies syntax and semantics of a flash effect.

5.5.2 Syntax

```
<complexType name="FlashType">
  <complexContent>
   <extension base="sev:LightType">
    <attribute name="frequency" type="positiveInteger" use="optional"/>
   </extension>
  </complexContent>
</complexType>
```

5.5.3 Binary representation syntax

FlashType {	Number of bits	Mnemonic
LightType		LightType
frequencyFlag	1	bslbf
if(frequencyFlag) {		
frequency	8	uimsbf
}		
}		

5.5.4 Semantics

Semantics of the `FlashType`.

Name	Definition
`FlashType`	Tool for describing a flash effect.
`frequencyFlag`	This field, which is only present in the binary representation, indicates the presence of the `frequency` attribute. If it is 1, then the `frequency` attribute is present, otherwise the `frequency` attribute is not present.
`frequency`	Describes the number of flickering in times per second. EXAMPLE The value 10 means it will flicker 10 times for each second.

5.5.5 Example

EXAMPLE This example shows the description of a flash effect with the following semantics. The intensity is 20,0 klx [within a range of (10^{-5},32 000) lux], i.e., approximately full daylight (but not direct sunlight) with a duration of 5 seconds. The light flickers 10 times per second and the effect starts at si:pts="0".

```
<sedl:Effect xsi:type="sev:FlashType" intensity-value="20000.0" intensity-range="0.00001
32000.0" duration="5" frequency="10" si:pts="0"/>
```

5.6 Temperature effect

5.6.1 General

This subclause specifies syntax and semantics of a temperature effect.

5.6.2 Syntax

```
<complexType name="TemperatureType">
  <complexContent>
   <extension base="sedl:EffectBaseType">
    <attribute name="intensity-value" type="sedl:intensityValueType"
    use="optional"/>
    <attribute name="intensity-range" type="sedl:intensityRangeType"
    use="optional"/>
   </extension>
  </complexContent>
</complexType>
```

5.6.3 Binary representation syntax

TemperatureType {	Number of bits	Mnemonic
EffectBaseType		EffectBaseType
intensityValueFlag	1	bslbf
intensityRangeFlag	1	bslbf
if(intensityValueFlag) {		
intensity-value	32	fsfb
}		
if(intensityRangeFlag) {		
intensity-range[0]	32	fsfb
intensity-range[1]	32	fsfb
}		
}		

5.6.4 Semantics

Semantics of the `TemperatureType`.

Name	Definition
`TemperatureType`	Tool for describing a temperature effect.
`intensityValueFlag`	This field, which is only present in the binary representation, indicates the presence of the `intensity-value` attribute. If it is 1, then the `intensity-value` attribute is present, otherwise the `intensity-value` attribute is not present.
`intensityRangeFlag`	This field, which is only present in the binary representation, indicates the presence of the `intensity-range` attribute. If it is 1, then the `intensity-range` attribute is present, otherwise the `intensity-range` attribute is not present.

Name	Definition
intensity-value	Describes the intensity of the temperature effect in terms of heating/cooling in Celsius.
intensity-range	Describes the range of the intensity value. EXAMPLE [0.0, 100.0] on the Celsius scale.

5.6.5 Additional validation rules

5.6.5.1 General

For the purpose of referencing the additional validation rules are numbered.

5.6.5.2 If intensity-value is present, intensity-range shall be present and vice versa.

5.6.5.3 The intensity-value shall be within the intensity-range.

5.6.6 Example

EXAMPLE This example shows the description of a temperature effect with the following semantics. The intensity is 10° [within a range of (-10.0,100.0)°], i.e., relatively cold, with a duration of 2 s and the effect starts at si:pts="0".

```
<sedl:Effect xsi:type="sev:TemperatureType" intensity-value="10.5" intensity-range="-10.0
100.0" duration="2" si:pts="0"/>
```

5.7 Wind effect

5.7.1 General

This subclause specifies syntax and semantics of a wind effect.

5.7.2 Syntax

```
<complexType name="WindType">
  <complexContent>
   <extension base="sedl:EffectBaseType">
    <attribute name="intensity-value" type="sedl:intensityValueType" use="optional"/>
    <attribute name="intensity-range" type="sedl:intensityRangeType" use="optional"/>
   </extension>
  </complexContent>
</complexType>
```

5.7.3 Binary representation syntax

WindType {	Number of bits	Mnemonic
EffectBaseType		EffectBaseType
intensityValueFlag	1	bslbf
intensityRangeFlag	1	bslbf
if(intensityValueFlag) {		
intensity-value	32	fsfb
}		
if(intensityRangeFlag) {		
intensity-range[0]	32	fsfb
intensity-range[1]	32	fsfb
}		
}		

5.7.4 Semantics

Semantics of the `WindType`.

Name	Definition
`WindType`	Tool for describing a wind effect.
`intensityValueFlag`	This field, which is only present in the binary representation, indicates the presence of the `intensity-value` attribute. If it is 1, then the `intensity-value` attribute is present, otherwise the `intensity-value` attribute is not present.
`intensityRangeFlag`	This field, which is only present in the binary representation, indicates the presence of the `intensity-range` attribute. If it is 1, then the `intensity-range` attribute is present, otherwise the `intensity-range` attribute is not present.
`intensity-value`	Describes the intensity of the wind effect in terms of strength in Beaufort.
`intensity-range`	Describes the range of the intensity value. EXAMPLE [0.0, 12.0] on the Beaufort scale.

5.7.5 Additional validation rules

5.7.5.1 General

For the purpose of referencing the additional validation rules are numbered.

5.7.5.2 If `intensity-value` is present, `intensity-range` shall be present and vice versa.

5.7.5.3 The intensity-value shall be within the intensity-range.

5.7.6 Example

EXAMPLE This example shows the description of a wind effect with the following semantics. The intensity is 3,0 according to the Beaufort scale [within a range of (0.0 12.0) Beaufort], i.e., approximately a gently breeze, with a fade-in time of 5 s and the effect is activated at si:pts="0".

```
<sedl:DescriptionMetadata>
  <sedl:ClassificationSchemeAlias alias="WCS" href="urn:mpeg:mpeg-v:01-SI-LocationCS-NS"/>
</sedl:DescriptionMetadata>
<sedl:Effect xsi:type="sev:WindType" fade="5" location=":WCS:*:*:front" intensity-
value="3.0" intensity-range="0.0 12.0" activate="true" si:pts="0"/>
```

5.8 Vibration effect

5.8.1 General

This subclause specifies syntax and semantics of a vibration effect.

5.8.2 Syntax

```
<complexType name="VibrationType">
  <complexContent>
   <extension base="sedl:EffectBaseType">
    <attribute name="intensity-value" type="sedl:intensityValueType"use="optional"/>
    <attribute name="intensity-range" type="sedl:intensityRangeType"use="optional"/>
   </extension>
  </complexContent>
</complexType>
```

5.8.3 Binary representation syntax

VibrationType {	Number of bits	Mnemonic
EffectBaseType		EffectBaseType
intensityValueFlag	1	bslbf
intensityRangeFlag	1	bslbf
if(intensityValueFlag) {		
intensity-value	32	fsfb
}		
if(intensityRangeFlag) {		
intensity-range[0]	32	fsfb
intensity-range[1]	32	fsfb
}		
}		

5.8.4 Semantics

Semantics of the `VibrationType`.

Name	Definition
`VibrationType`	Tool for describing a vibration effect.
`intensityValueFlag`	This field, which is only present in the binary representation, indicates the presence of the `intensity-value` attribute. If it is 1, then the `intensity-value` attribute is present, otherwise the `intensity-value` attribute is not present.
`intensityRangeFlag`	This field, which is only present in the binary representation, indicates the presence of the `intensity-range` attribute. If it is 1, then the `intensity-range` attribute is present, otherwise the `intensity-range` attribute is not present.
`intensity-value`	Describes the intensity of the vibration effect in terms of thefrequency according to the Hz scale.
`intensity-range`	Describes the range of the intensity value. EXAMPLE [0.0, 50.0] on the Hz scale

5.8.5 Additional validation rules

5.8.5.1 General

For the purpose of referencing the additional validation rules are numbered.

5.8.5.2 If `intensity-value` is present, `intensity-range` shall be present and vice versa.

5.8.5.3 The intensity-value shall be within the intensity-range.

5.8.6 Example

EXAMPLE This example shows the description of a vibration effect with the following semantics. The intensity is 4,1 according to the Hz scale [within a range of (0.0,50.0)], i.e., noticeable shaking items and rattling noises, with a duration of 7 s. The vibration has a fade-out time of 3 s and the effect starts at si:pts="0".

```
<sedl:Effect xsi:type="sev:VibrationType" intensity-value="4.1" intensity-range="0.0 50.0"
duration="7" fade="3" si:pts="0"/>
```

5.9 Spraying effect

5.9.1 General

This subclause specifies syntax and semantics of a spraying effect.

5.9.2 Syntax

```
<complexType name="SprayingType">
  <complexContent>
   <extension base="sedl:EffectBaseType">
    <attribute name="intensity-value" type="sedl:intensityValueType" use="optional"/>
    <attribute name="intensity-range" type="sedl:intensityRangeType" use="optional"/>
    <attribute name="sprayingType" type="mpeg7:termReferenceType"/>
   </extension>
  </complexContent>
</complexType>
```

5.9.3 Binary representation syntax

SprayingType {	Number of bits	Mnemonic
EffectBaseType		EffectBaseType
intensityValueFlag	1	bslbf
intensityRangeFlag	1	bslbf
sprayingTypeFlag	1	bslbf
if(intensityValueFlag) {		
intensity-value	32	fsfb
}		
if(intensityRangeFlag) {		
intensity-range[0]	32	fsfb
intensity-range[1]	32	fsfb
}		
if(sprayingTypeFlag) {		
sprayingType	8	bslbf
}		
}		

5.9.4 Semantics

Semantics of the `SprayingType`.

Name	Definition
`SprayingType`	Tool for describing a spraying effect.
`intensityValueFlag`	This field, which is only present in the binary representation, indicates the presence of the `intensity-value` attribute. If it is 1, then the `intensity-value` attribute is present, otherwise the `intensity-value` attribute is not present.
`intensityRangeFlag`	This field, which is only present in the binary representation, indicates the presence of the `intensity-range` attribute. If it is 1, then the `intensity-range` attribute is present, otherwise the `intensity-range` attribute is not present.
`sprayingTypeFlag`	This field, which is only present in the binary representation, indicates the presence of the `sprayingType` attribute. If it is 1, then the `sprayingType` attribute is present, otherwise the `sprayingType` attribute is not present.
`intensity-value`	Describes the intensity of the spraying effect in terms in ml/h.

Name	Definition
intensity-range	Describes the range of the intensity value. EXAMPLE [0,0, 10,0] ml/h.
sprayingType	Describes the type of the spraying effect as a reference to a classification scheme term. A CS that may be used for this purpose is the SprayingTypeCS defined in ISO/IEC 23005-6:2019, Annex A.

5.9.5 Additional validation rules

5.9.5.1 General

For the purpose of referencing the additional validation rules are numbered.

5.9.5.2 If intensity-value is present, intensity-range shall be present and vice versa.

5.9.5.3 The intensity-value shall be within the intensity-range.

5.9.6 Example

EXAMPLE This example shows the description of a water sprayer effect with the following semantics. The intensity is 0,7 ml/h [within a range of (0.0,10.0) ml/h] with a duration of 2 s and the effect starts at si:pts="0".

```
<sedl:Effect xsi:type="sev:SprayingType" intensity-value="0.7" intensity-range="0.0 10.0"
duration="2" sprayingType="urn:mpeg:mpeg-v:01-SI-SprayingTypeCS-NS:water" si:pts="0"/>
```

5.10 Scent effect

5.10.1 General

This subclause specifies syntax and semantics of a scent effect.

5.10.2 Syntax

```
<complexType name="ScentType">
  <complexContent>
   <extension base="sedl:EffectBaseType">
    <attribute name="scent" type="mpeg7:termReferenceType"  use="optional"/>
    <attribute name="intensity-value" type="sedl:intensityValueType" use="optional"/>
    <attribute name="intensity-range" type="sedl:intensityRangeType" use="optional"/>
   </extension>
  </complexContent>
</complexType>
```

5.10.3 Binary representation syntax

ScentType {	Number of bits	Mnemonic
EffectBaseType		EffectBaseType
scentFlag	1	bslbf
intensityValueFlag	1	bslbf
intensityRangeFlag	1	bslbf
if(scentFlag) {		
scent	9	bslbf
}		
if(intensityValueFlag) {		
intensity-value	32	fsfb

ScentType {	Number of bits	Mnemonic
}		
if(intensityRangeFlag) {		
intensity-range[0]	32	fsfb
intensity-range[1]	32	fsfb
}		
}		

5.10.4 Semantics

Semantics of the `ScentType`.

Name	Definition
`ScentType`	Tool for describing a scent effect.
`scentFlag`	This field, which is only present in the binary representation, indicates the presence of the `scent` attribute. If it is 1, then the `scent` attribute is present, otherwise the `scent` attribute is not present.
`intensityValueFlag`	This field, which is only present in the binary representation, indicates the presence of the `intensity-value` attribute. If it is 1, then the `intensity-value` attribute is present, otherwise the `intensity-value` attribute is not present.
`intensityRangeFlag`	This field, which is only present in the binary representation, indicates the presence of the `intensity-range` attribute. If it is 1, then the `intensity-range` attribute is present, otherwise the `intensity-range` attribute is not present.
`scent`	Describes the scent to use. A CS that may be used for this purpose is the ScentCS defined in ISO/IEC 23005-6:2019, Annex A.
`intensity-value`	Describes the intensity of the scent effect in ml/h
`intensity-range`	Describes the range of the intensity value. EXAMPLE [0,0, 10,0] ml/h.

5.10.5 Additional validation rules

5.10.5.1 General

For the purpose of referencing the additional validation rules are numbered.

5.10.5.2 If `intensity-value` is present, `intensity-range` shall be present and vice versa.

5.10.5.3 The intensity-value shall be within the intensity-range.

5.10.6 Example

EXAMPLE This example shows the description of a scent effect with the following semantics. The scent is lilac according to the classification scheme, the intensity is 0,1 ml/h [within a range of (0,0,10,0) ml/h] with a duration of 10 s and the effect starts at si:pts="0".

```
<sedl:DescriptionMetadata>
  <sedl:ClassificationSchemeAlias alias="SCENT" href="urn:mpeg:mpeg-v:01-SI-ScentCS-NS"/>
</sedl:DescriptionMetadata>
<sedl:Effect xsi:type="sev:ScentType" intensity-value="0.1" intensity-range="0.0 10.0"
duration="10" scent=":SCENT:lilac" si:pts="0"/>
```

5.11 Fog effect

5.11.1 General

This subclause specifies syntax and semantics of a fog effect.

5.11.2 Syntax

```
<complexType name="FogType">
  <complexContent>
   <extension base="sedl:EffectBaseType">
    <attribute name="intensity-value" type="sedl:intensityValueType" use="optional"/>
    <attribute name="intensity-range" type="sedl:intensityRangeType" use="optional"/>
   </extension>
  </complexContent>
</complexType>
```

5.11.3 Binary representation syntax

FogType {	Number of bits	Mnemonic
EffectBaseType		EffectBaseType
intensityValueFlag	1	bslbf
intensityRangeFlag	1	bslbf
if(intensityValueFlag) {		
intensity-value	32	fsfb
}		
if(intensityRangeFlag) {		
intensity-range[0]	32	fsfb
intensity-range[1]	32	fsfb
}		
}		

5.11.4 Semantics

Semantics of the `FogType`.

Name	Definition
`FogType`	Tool for describing a fog effect.
`intensityValueFlag`	This field, which is only present in the binary representation, indicates the presence of the `intensity-value` attribute. If it is 1, then the `intensity-value` attribute is present, otherwise the `intensity-value` attribute is not present.
`intensityRangeFlag`	This field, which is only present in the binary representation, indicates the presence of the `intensity-range` attribute. If it is 1, then the `intensity-range` attribute is present, otherwise the `intensity-range` attribute is not present.
`intensity-value`	Describes the intensity of the fog effect in ml/h.
`intensity-range`	Describes the range of the intensity value. EXAMPLE [0,0, 10,0] ml/h.

5.11.5 Additional validation rules

5.11.5.1 General

For the purpose of referencing the additional validation rules are numbered.

5.11.5.2 If `intensity-value` is present, `intensity-range` shall be present and vice versa.

5.11.5.3 The intensity-value shall be within the intensity-range.

5.11.6 Example

EXAMPLE This example shows the description of a fog effect with the following semantics. The intensity is 1,5 ml/h [within a range of (0,0,10,0) ml/h] with a duration of 20 s and the effect starts at si:pts="0".

```
<sedl:Effect xsi:type="sev:FogType" intensity-value="1.5" duration="20" si:pts="0"/>
```

5.12 Color correction effect

5.12.1 General

This subclause specifies syntax and semantics of a color correction effect.

5.12.2 Syntax

```
<complexType name="ColorCorrectionType">
  <complexContent>
   <extension base="sedl:EffectBaseType">
    <choice minOccurs="0">
     <element name="SpatioTemporalLocator" type="mpeg7:SpatioTemporalLocatorType"/>
     <element name="SpatioTemporalMask" type="mpeg7:SpatioTemporalMaskType"/>
    </choice>
    <attribute name="intensity-value" type="sedl:intensityValueType" use="optional"/>
    <attribute name="intensity-range" type="sedl:intensityRangeType" use="optional"
fixed="0 1"/>
   </extension>
  </complexContent>
</complexType>
```

5.12.3 Binary representation syntax

ColorCorrectionType {	**Number of bits**	**Mnemonic**
EffectBaseType		EffectBaseType
intensityValueFlag	1	bslbf
intensityRangeFlag	1	bslbf
regionChoiceFlag	1	bslbf
if(regionChoiceFlag) {		
regionTypeChoice	1	bslbf
if(regionTypeChoice) {		
SpatioTemporalLocator		SpatioTemporalLocatorType
}		
else {		
SpatioTemporalMask	See ISO/IEC 10646[9]	UTF-8
}		
}		
if(intensityValueFlag) {		
intensity-value	32	fsbf
}		
if(intensityRangeFlag) {		
intensity-range[0]	32	fsfb
intensity-range[1]	32	fsfb

ColorCorrectionType {	Number of bits	Mnemonic
}		
}		

5.12.4 Semantics

Semantics of the `ColorCorrectionType`.

Name	Definition
`ColorCorrectionType`	Tool for describing a color correction effect.
`intensityValueFlag`	This field, which is only present in the binary representation, indicates the presence of the `intensity-value` attribute. If it is 1, then the `intensity-value` attribute is present, otherwise the `intensity-value` attribute is not present.
`intensityRangeFlag`	This field, which is only present in the binary representation, indicates the presence of the `intensity-range` attribute. If it is 1, then the `intensity-range` attribute is present, otherwise the `intensity-range` attribute is not present.
`regionChoiceFlag`	This field, which is only present in the binary representation, indicates the presence of the choice. If it is 1, then the choice is present, otherwise the choice is not present.
`regionTypeChoice`	This field, which is only present in the binary representation, specifies the choice of the spatio-temporal region types. If it is 1, then the `SpatioTemporalLocator` is present, otherwise the `SpatioTemporalMask` is present.
`intensity-value`	Describes the intensity of the color correction effect in terms of "on" and "off" with respect to 1(on) and 0(off).
`intensity-range`	Describes the range of the intensity value, i.e., 1 (on) and 0 (off).
`SpatioTemporalLocator`	Describes the spatio-temporal localization of the moving region using `mpeg7:SpatioTemporalLocatorType` (optional), which indicates the regions in a video segment where the color correction effect is applied. The `mpeg7:SpatioTemporalLocatorType` is defined in ISO/IEC 15938-5.
`SpatioTemporalMask`	Describes a spatio-temporal mask that defines the spatio-temporal composition of the moving region (optional), which indicates the masks in a video segment where the color correction effect is applied. The `mpeg7:SpatioTemporalMaskType` is defined in ISO/IEC 15938-5.

5.12.5 Additional validation rules

5.12.5.1 General

For the purpose of referencing the additional validation rules are numbered.

5.12.5.2 If `intensity-value` is present, `intensity-range` shall be present and vice versa.

NOTE `intensity-range` has a `fixed` attribute and, thus, it cannotbe present explicitly as it is present implicitly.

5.12.5.3 The intensity-value shall be within the intensity-range.

5.12.6 Example

EXAMPLE The following example shows a possible usage of the color correction effect applied to spatio-temporal regions as depicted in Figure 5.

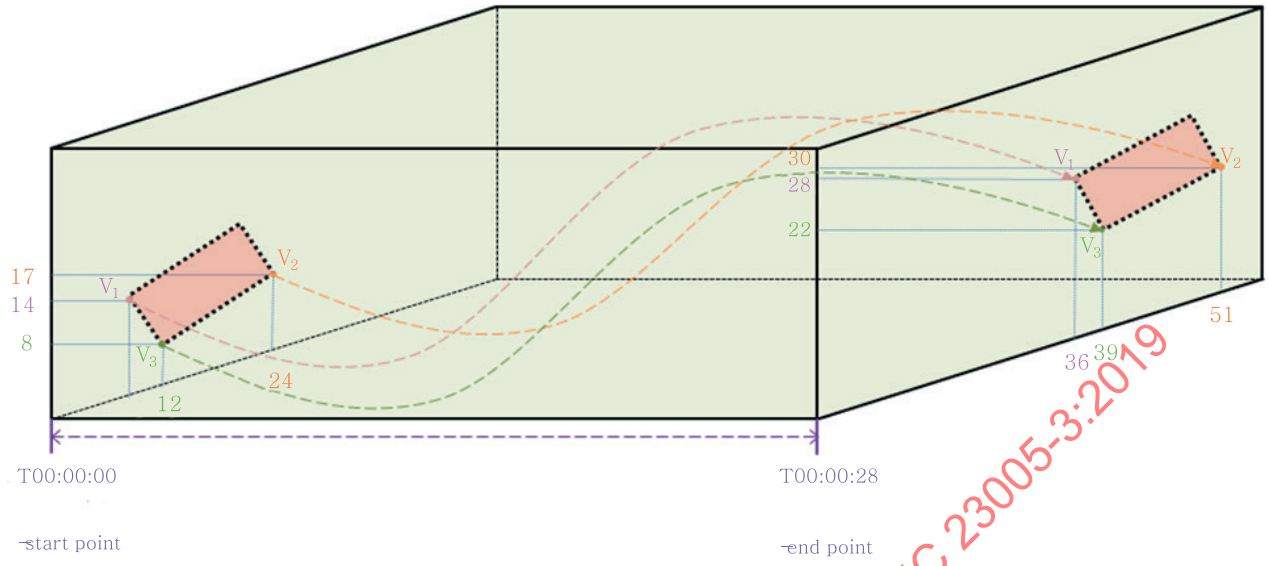


Figure 5 — Color correction effect applied to spatio-temporal regions

```
<sedl:Effect xsi:type="sev:ColorCorrectionType" intensity-value="1" intensity-range="0 1"
duration="28" si:pts="12000">
  <sev:SpatioTemporalLocator>
    <mpeg7:FigureTrajectory type="rectangle">
      <mpeg7:MediaTime>
        <mpeg7:MediaTimePoint>T00:00:00</mpeg7:MediaTimePoint>
        <mpeg7:MediaDuration>PT28S</mpeg7:MediaDuration>
      </mpeg7:MediaTime>
      <!-- Vertex 1 -->
      <mpeg7:Vertex>
        <mpeg7:KeyTimePoint>
          <mpeg7:MediaTimePoint>T00:00:00</mpeg7:MediaTimePoint>
          <mpeg7:MediaTimePoint>T00:00:28</mpeg7:MediaTimePoint>
        </mpeg7:KeyTimePoint>
        <!-- x coordinate -->
        <mpeg7:InterpolationFunctions>
          <mpeg7:KeyValue type="startPoint">8</mpeg7:KeyValue>
          <mpeg7:KeyValue type="secondOrder" param="1.0">36</mpeg7:KeyValue>
        </mpeg7:InterpolationFunctions>
        <!-- y coordinate -->
        <mpeg7:InterpolationFunctions>
          <mpeg7:KeyValue>14</mpeg7:KeyValue>
          <mpeg7:KeyValue>28</mpeg7:KeyValue>
        </mpeg7:InterpolationFunctions>
      </mpeg7:Vertex>
      <!-- Vertex 2 -->
      <mpeg7:Vertex>
        <mpeg7:KeyTimePoint>
          <mpeg7:MediaTimePoint>T00:00:00</mpeg7:MediaTimePoint>
          <mpeg7:MediaTimePoint>T00:00:28</mpeg7:MediaTimePoint>
        </mpeg7:KeyTimePoint>
        <!-- x coordinate -->
        <mpeg7:InterpolationFunctions>
          <mpeg7:KeyValue type="startPoint">24</mpeg7:KeyValue>
          <mpeg7:KeyValue type="secondOrder" param="1.0">51</mpeg7:KeyValue>
        </mpeg7:InterpolationFunctions>
        <!-- y coordinate -->
        <mpeg7:InterpolationFunctions>
          <mpeg7:KeyValue>17</mpeg7:KeyValue>
          <mpeg7:KeyValue>30</mpeg7:KeyValue>
        </mpeg7:InterpolationFunctions>
      </mpeg7:Vertex>
      <!-- Vertex 3 -->
```

```
      <mpeg7:Vertex>
        <mpeg7:KeyTimePoint>
          <mpeg7:MediaTimePoint>T00:00:00</mpeg7:MediaTimePoint>
          <mpeg7:MediaTimePoint>T00:00:28</mpeg7:MediaTimePoint>
        </mpeg7:KeyTimePoint>
        <!-- x coordinate -->
        <mpeg7:InterpolationFunctions>
          <mpeg7:KeyValue type="startPoint">12</mpeg7:KeyValue>
          <mpeg7:KeyValue type="secondOrder" param="1.0">39</mpeg7:KeyValue>
        </mpeg7:InterpolationFunctions>
        <!-- y coordinate -->
        <mpeg7:InterpolationFunctions>
          <mpeg7:KeyValue>8</mpeg7:KeyValue>
          <mpeg7:KeyValue>22</mpeg7:KeyValue>
        </mpeg7:InterpolationFunctions>
      </mpeg7:Vertex>
    </mpeg7:FigureTrajectory>
  </sev:SpatioTemporalLocator>
</sedl:Effect>
```

5.13 Rigid body motion effect

5.13.1 General

This subclause specifies syntax and semantics of a rigid body motion effect.

5.13.2 Syntax

```
<complexType name="RigidBodyMotionType">
  <complexContent>
   <extension base="sedl:EffectBaseType">
    <sequence>
     <element name="MoveToward" type="sev:MoveTowardType" minOccurs="0"/>
     <element name="TrajectorySamples" type="mpeg7:FloatMatrixType" minOccurs="0"/>
     <element name="Incline" type="sev:InclineType" minOccurs="0"/>
     <element name="Shake" type="sev:ShakeType" minOccurs="0"/>
     <element name="Wave" type="sev:WaveType" minOccurs="0"/>
     <element name="Spin" type="sev:SpinType" minOccurs="0"/>
     <element name="Turn" type="sev:TurnType" minOccurs="0"/>
     <element name="Collide" type="sev:CollideType" minOccurs="0"/>
    </sequence>
   </extension>
  </complexContent>
</complexType>

<complexType name="MoveTowardType">
  <attribute name="speed" type="float" use="optional"/>
  <attribute name="acceleration" type="float" use="optional"/>
  <attribute name="directionV" type="sev:MoveTowardAngleType" use="optional"
  default="0"/>
  <attribute name="directionH" type="sev:MoveTowardAngleType" use="optional"
  default="0"/>
  <attribute name="distance-range" type="sedl:intensityRangeType" use="optional"/>
  <attribute name="distance" type="float" use="optional"/>
</complexType>

<complexType name="InclineType">
  <attribute name="pitchSpeed" type="float" use="optional"/>
  <attribute name="pitchAcceleration" type="float" use="optional"/>
  <attribute name="rollSpeed" type="float" use="optional"/>
  <attribute name="rollAcceleration" type="float" use="optional"/>
  <attribute name="yawSpeed" type="float" use="optional"/>
  <attribute name="yawAcceleration" type="float" use="optional"/>
  <attribute name="pitch-range" type="sedl:intensityRangeType" use="optional"/>
  <attribute name="roll-range" type="sedl:intensityRangeType" use="optional"/>
  <attribute name="yaw-range" type="sedl:intensityRangeType" use="optional"/>
  <attribute name="pitch" type="sev:InclineAngleType" use="optional" default="0"/>
  <attribute name="roll" type="sev:InclineAngleType" use="optional" default="0"/>
  <attribute name="yaw" type="sev:InclineAngleType" use="optional" default="0"/>
```

```
</complexType>

<complexType name="ShakeType">
  <attribute name="direction" type="mpeg7:termReferenceType" use="optional"/>
  <attribute name="count" type="float" use="optional"/>
  <attribute name="distance-range" type="sedl:intensityRangeType" use="optional"/>
  <attribute name="distance" type="float" use="optional"/>
  <attribute name="interval" type="positiveInteger" use="optional"/>
</complexType>

<complexType name="WaveType">
  <attribute name="direction" type="mpeg7:termReferenceType" use="optional"/>
  <attribute name="startDirection" type="mpeg7:termReferenceType" use="optional"/>
  <attribute name="count" type="float" use="optional"/>
  <attribute name="distance-range" type="sedl:intensityRangeType" use="optional"/>
  <attribute name="distance" type="float" use="optional"/>
  <attribute name="interval" type="positiveInteger" use="optional"/>
</complexType>

<complexType name="SpinType">
  <attribute name="direction" type="mpeg7:termReferenceType" use="optional"/>
  <attribute name="count" type="float" use="optional"/>
  <attribute name="interval" type="positiveInteger" use="optional"/>
</complexType>

<complexType name="TurnType">
  <attribute name="direction" type="sev:TurnAngleType" use="optional"/>
  <attribute name="speed" type="float" use="optional"/>
  <attribute name="distance" type="float" use="optional"/>
</complexType>

<complexType name="CollideType">
  <attribute name="directionH" type="sev:MoveTowardAngleType" use="optional"
  default="0"/>
  <attribute name="directionV" type="sev:MoveTowardAngleType" use="optional"
  default="0"/>
  <attribute name="speed" type="float" use="optional"/>
</complexType>

<simpleType name="TurnAngleType">
  <restriction base="integer">
   <minInclusive value="-180"/>
   <maxInclusive value="180"/>
  </restriction>
</simpleType>

<simpleType name="InclineAngleType">
  <restriction base="integer">
   <minInclusive value="-359"/>
   <maxInclusive value="359"/>
  </restriction>
</simpleType>

<simpleType name="MoveTowardAngleType">
  <restriction base="integer">
   <minInclusive value="0"/>
   <maxInclusive value="359"/>
  </restriction>
</simpleType>
```

5.13.3 Binary representation syntax

RigidBodyMotionEffect {	**Number of bits**	**Mnemonic**
EffectBaseType		EffectBaseType
MoveTowardFlag	1	bslbf
TrajectorySamplesFlag	1	bslbf
InclineFlag	1	bslbf
ShakeFlag	1	bslbf

RigidBodyMotionEffect {	**Number of bits**	**Mnemonic**
WaveFlag	1	bslbf
SpinFlag	1	bslbf
TurnFlag	1	bslbf
CollideFlag	1	bslbf
if(MoveTowardFlag) {		
MoveToward		MoveTowardType
}		
if(TrajectorySamplesFlag) {		
numberOfSamples	16	uimsbf
nbOfPositionAndOrientation	3	uimsbf
for(k=0;k<(numberOfSamples * nbOfPositionAndOrientation);k++) {		
tarajectorySampleArray [k]	32	fsfb
}		
}		
if(InclineFlag) {		
Incline		InclineType
}		
if(ShakeFlag) {		
Shake		ShakeType
}		
if(WaveFlag) {		
Wave		WaveType
}		
if(SpinFlag) {		
Spin		SpinType
}		
if(TurnFlag) {		
Turn		TurnType
}		
if(CollideFlag) {		
Collide		CollideType
}		
}		

MoveTowardType {	**Number of bits**	**Mnemonic**
speedFlag	1	bslbf
accelerationFlag	1	bslbf
directionVFlag	1	bslbf
directionHFlag	1	bslbf
distanceFlag	1	bslbf
distanceRangeFlag	1	bslbf
if(speedFlag) {		
speed	32	fsfb
}		

MoveTowardType {	Number of bits	Mnemonic
if(accelerationFlag) {		
acceleration	32	fsfb
}		
if(directionVFlag) {		
directionV	9	uimsbf
}		
if(directionHFlag) {		
directionH	9	uimsbf
}		
if(distanceFlag) {		
distance	32	fsfb
}		
if(distanceRangeFlag) {		
distance-range	32*2	fsfb
}		
}		

InclineType {	Number of bits	Mnemonic
pitchSpeedFlag	1	bslbf
pitchAccelerationFlag	1	bslbf
rollSpeedFlag	1	bslbf
rollAccelerationFlag	1	bslbf
yawSpeedFlag	1	bslbf
yawAccelerationFlag	1	bslbf
pitchRangeFlag	1	bslbf
yawRangeFlag	1	bslbf
rollRangeFlag	1	bslbf
pitchFlag	1	bslbf
rollFlag	1	bslbf
yawFlag	1	bslbf
if(pitchSpeedFlag) {		
pitchSpeed	32	fsfb
}		
if(pitchAccelerationFlag) {		
pitchAcceleration	32	fsfb
}		
if(rollSpeedFlag) {		
rollSpeed	32	fsfb
}		
if(rollAccelerationFlag) {		
rollAcceleration	32	fsfb
}		
if(yawSpeedFlag) {		
yawSpeed	32	fsfb
}		

InclineType {	Number of bits	Mnemonic
if(yawAccelerationFlag) {		
yawAcceleration	32	fsfb
}		
if(pitchRangeFlag) {		
pitch-range	32*2	fsfb
}		
if(rollRangeFlag) {		
roll-range	32*2	fsfb
}		
if(yawRangeFlag) {		
yaw-range	32*2	fsfb
}		
if(pitchFlag) {		
pitch	10	bslbf
}		
if(rollFlag) {		
roll	10	bslbf
}		
if(yawFlag) {		
yaw	10	bslbf
}		
}		

ShakeType {	Number of bits	Mnemonic
directionFlag	1	bslbf
countFlag	1	bslbf
distanceRangeFlag	1	bslbf
distanceFlag	1	bslbf
intervalFlag	1	bslbf
if(directionFlag) {		
direction	3	bslbf
}		
if(countFlag) {		
count	32	fsfb
}		
if(distanceRangeFlag) {		
distance-range	32*2	
}		
if(distanceFlag) {		
distance	32	fsfb
}		
if(intervalFlag) {		
interval	32	uimsbf
}		
}		

WaveType {	Number of bits	Mnemonic
directionFlag	1	bslbf
startDirectionFlag	1	bslbf
countFlag	1	bslbf
distanceRangeFlag	1	bslbf
distanceFlag	1	bslbf
intervalFlag	1	bslbf
if(directionFlag) {		
direction	2	bslbf
}		
if(startDirectionFlag) {		
startDirection	2	bslbf
}		
if(countFlag) {		
count	32	fsfb
}		
if(distanceRangeFlag) {		
distance-range	32*2	fsfb
}		
if(distanceFlag) {		
distance	32	fsfb
}		
if(intervalFlag) {		
interval	32	uimsbf
}		
}		

SpinType {	Number of bits	Mnemonic
directionFlag	1	bslbf
countFlag	1	bslbf
intervalFlag	1	bslbf
if(directionFlag) {		
direction	3	bslbf
}		
if(countFlag) {		
count	32	fsfb
}		
if(intervalFlag) {		
interval	32	uimsbf
}		
}		

TurnType {	Number of bits	Mnemonic
directionFlag	1	bslbf
speedFlag	1	bslbf
if(directionFlag) {		

TurnType {	Number of bits	Mnemonic
direction	9	simsbf
}		
if(speedFlag) {		
speed	32	fsfb
}		
if(distanceFlag) {		
Distance	32	fsfb
}		
}		

CollideType {	Number of bits	Mnemonic
speedFlag	1	bslbf
directionHFlag	1	bslbf
directionVFlag	1	bslbf
if(directionHFlag) {		
direction	9	uimsbf
}		
if(directionVFlag) {		
direction	9	uimsbf
}		
if(speedFlag) {		
Speed	32	fsfb
}		
}		

5.13.4 Semantics

Semantics of the `RigidBodyMotionType`.

Name	Definition
`RigidBodyMotionType`	Tool for describing a rigid body motion effect.
`MoveTowardFlag`	This field, which is only present in the binary representation, indicates the presence of the `MoveToward` element. If it is 1, then the `MoveToward` element is present, otherwise the `MoveToward` element is not present.
`MoveTorward`	This pattern covers three dimensional movement of 6DoF, which means changing the location without rotation (see Figure 6). The type is `sev:MoveTowardType`.

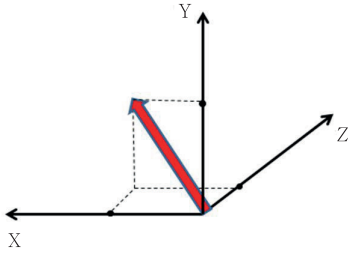
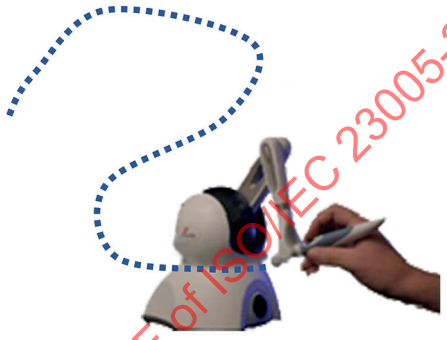
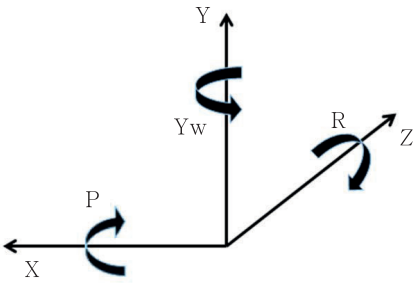
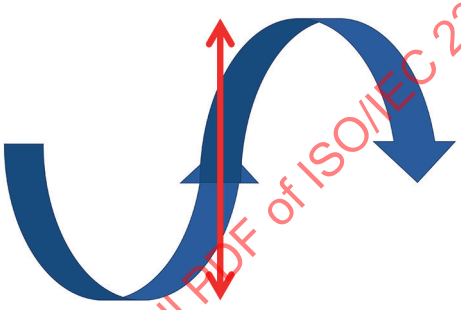
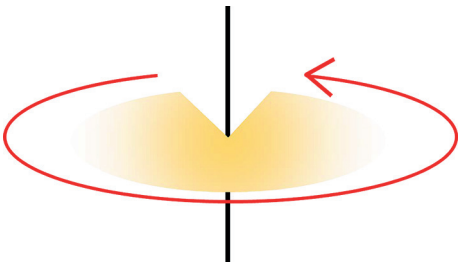
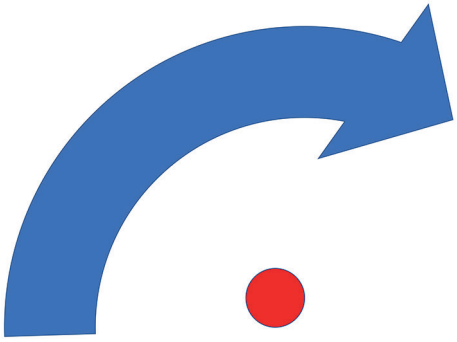
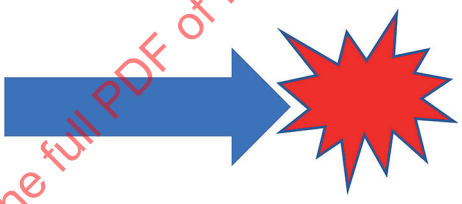


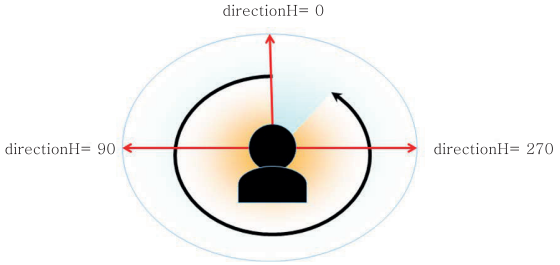
Figure 6 — MoveToward pattern

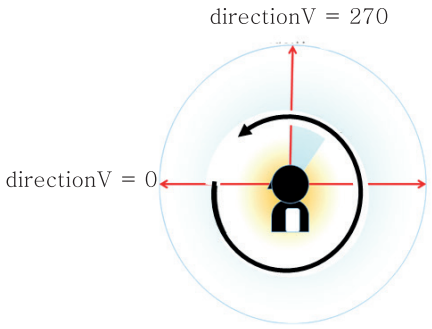
Name	Definition
TrajectorySamplesFlag	This field, which is only present in the binary representation, indicates the presence of the TrajectorySamples element. If it is 1, then the TrajectorySamples are present, otherwise the TrajectorySamples are not present.
TrajectorySamples	This pattern describes a set of position and orientation samples that the rigid body will follow (see Figure 7). The trajectory sample data is comprised with *m* by 6 matrix, where 6 columns contain three positions (Px, Py, Pz in millimetres) and three orientations (Ox, Oy, Oz in degrees) and where *m* rows indicates the number of samples. The sampling rate shall be calculated by *m*/duration.  **Figure 7 — TrajectorySamples pattern**
numberOfSamples	Describes the number of trajectory sample data.
nbOfPositionAndOrientation	Describes the number of position and orientation for trajectory sample data (usually 6).
tarajectorySampleArray	Describes numberOfSamples by nbOfPositionAndOrientation matrix of the trajectorySamples.
InclineFlag	This field, which is only present in the binary representation, indicates the presence of the Incline element. If it is 1, then the Incline element is present, otherwise the Incline element is not present.
Incline	This pattern covers pitching, yawing, and rolling motion of 6 DoF, which means changing the rotation without changing the location. The type is sev:InclineType. Figure 8 shows the rotation pattern for each axe whenere *P* denotes *pitch*, *Yw* denotes *yaw*, and *R* denotes *roll*.  **Figure 8 — Incline pattern**
ShakeFlag	This field, which is only present in the binary representation, indicates the presence of the Shake element. If it is 1, then the Shake element is present, otherwise the Shake element is not present.
Shake	This pattern is a continuous motion moving from one side to opposite side repeatedly (see Figure 9). This is an abstracted motion pattern which can be alternatively expressed by repetition of Move pattern. The type is sev:ShakeType.

Name	Definition
	 **Figure 9 — Shake pattern**
`WaveFlag`	This field, which is only present in the binary representation, indicates the presence of the `Wave` element. If it is 1, then the `Wave` element is present, otherwise the `Wave` element is not present.
`Wave`	This pattern is a continuous motion from side-up to side-down like the surface of water. (see Figure 10) This is an abstracted motion pattern which can be alternatively expressed by repetition of rolling or pitching of Incline pattern. The type is `sev:WaveType`.  **Figure 10 — Wave pattern**
`SpinFlag`	This field, which is only present in the binary representation, indicates the presence of the `Spin` element. If it is 1, then the `Spin` element is present, otherwise the `Spin` element is not present.
`Spin`	This pattern is a continuous turning based on a central point inside without change the place (see Figure 11). This is an abstracted motion pattern which can be alternatively expressed by repetition of yawing of Incline pattern. The type is `sev:SpinType`.  **Figure 11 — Spin pattern**
`TurnFlag`	This field, which is only present in the binary representation, indicates the presence of the `Turn` element. If it is 1, then the `Turn` element is present, otherwise the `Turn` element is not present.
`Turn`	This pattern is a motion of moving towards some direction (see Figure 12). This is an abstracted motion pattern which can be alternatively expressed by repetition of Move and Incline pattern. The type is `sev:TurnType`.

Name	Definition
	 Figure 12 — Turn pattern
CollideFlag	This field, which is only present in the binary representation, indicates the presence of the Collide element. If it is 1, then the Collide element is present, otherwise the Collide element is not present.
Collide	This pattern is a motion of moving object collides against something (see Figure 13). This is an abstracted motion pattern which can be alternatively expressed by repetition of Move and Incline pattern. The type is sev:CollideType.  Figure 13 — Collide pattern

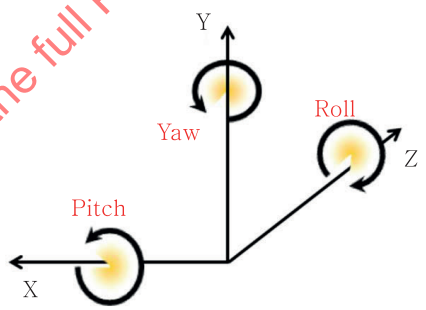
Semantics of the MoveTorwardType.

Name	Definition
speedFlag	This field, which is only present in the binary representation, indicates the presence of the speed attribute. If it is 1, then the speed attribute is present, otherwise the speed attribute is not present
speed	Describes the moving speed in terms of centimetre per second.
accelerationFlag	This field, which is only present in the binary representation, indicates the presence of the acceleration attribute. If it is 1, then the acceleration attribute is present, otherwise the acceleration attribute is not present
acceleration	Describes the acceleration in terms of centimetre per square second.
directionHFlag	This field, which is only present in the binary representation, indicates the presence of the directionH attribute. If it is 1, then the directionH attribute is present, otherwise the directionH attribute is not present
directionH	Describes the horizontal direction of moving in terms of angle (see Figure 14). The type is sev:MoveTowardAngleType. The angle starts from the front-center of the rigid body and increases with counter-clockwise (CCW).  Figure 14 — Horizontal direction model for MoveToward pattern

Name	Definition
directionVFlag	This field, which is only present in the binary representation, indicates the presence of the directionV attribute. If it is 1, then the directionV attribute is present, otherwise the directionV attribute is not present
directionV	Describes the vertical direction of moving in terms of angle (see Figure 15). The type is sev:MoveTowardAngleType. The angle starts from the front-center of rigid body and increases with CCW.  **Figure 15 — Vertical direction model for MoveToward pattern**
distanceFlag	This field, which is only present in the binary representation, indicates the presence of the distance attribute. If it is 1, then the distance attribute is present, otherwise the distance attribute is not present.
distance	Describes the distance between the origin and destination in terms of centimetre.
distanceRangeFlag	This field, which is only present in the binary representation, indicates the presence of the distance-range attribute. If it is 1, then the distance-range attribute is present, otherwise the distance-range attribute is not present.
distance-range	Describes the range of the distance value. EXAMPLE [-100, 100].

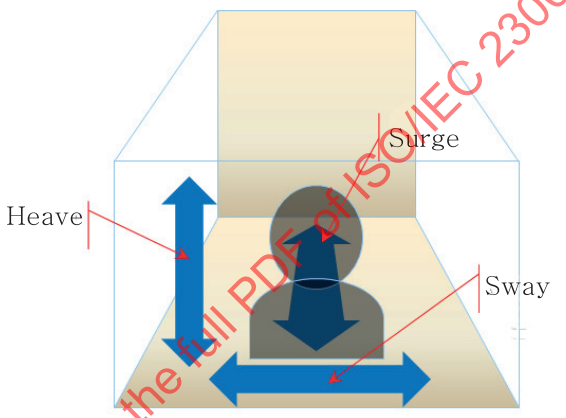
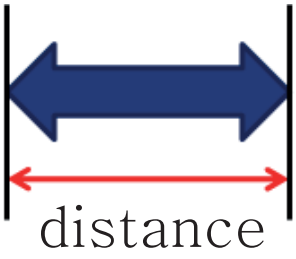
Semantics of the InclineType.

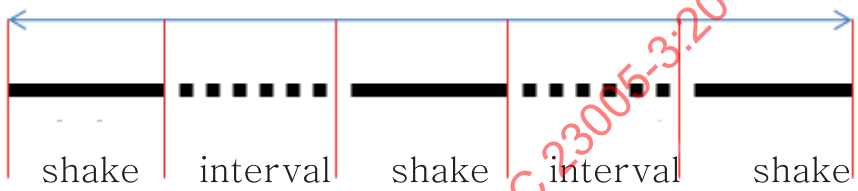
Name	Definition
pitchSpeedFlag	This field, which is only present in the binary representation, indicates the presence of the pitchSpeed attribute. If it is 1, then the pitchSpeed attribute is present, otherwise the pitchSpeed attribute is not present.
pitchSpeed	Describes the rotation speed based on X-axis in terms of degree per second.
pitchAccelerationFlag	This field, which is only present in the binary representation, indicates the presence of the pitchAcceleration attribute. If it is 1, then the pitchAcceleration attribute is present, otherwise the pitchAcceleration attribute is not present.
pitchAcceleration	Describes the acceleration based on X-axis in terms of degree per square second.
rollSpeedFlag	This field, which is only present in the binary representation, indicates the presence of the rollSpeed attribute. If it is 1, then the rollSpeed attribute is present, otherwise the rollSpeed attribute is not present.
rollSpeed	Describes the rotation speed based on Z-axis in terms of degree per second.
rollAccelerationFlag	This field, which is only present in the binary representation, indicates the presence of the rollAcceleration attribute. If it is 1, then the rollAcceleration attribute is present, otherwise the rollAcceleration attribute is not present.
rollAcceleration	Describes the acceleration based on Z-axis in terms of degree per square second.

Name	Definition
yawSpeedFlag	This field, which is only present in the binary representation, indicates the presence of the yawSpeed attribute. If it is 1, then the yawSpeed attribute is present, otherwise the yawSpeed attribute is not present.
yawSpeed	Describes the rotation speed based on Y-axis in terms of degree per second.
yawAccelerationFlag	This field, which is only present in the binary representation, indicates the presence of the yawAcceleration attribute. If it is 1, then the yawAcceleration attribute is present, otherwise the yawAcceleration attribute is not present.
yawAcceleration	Describes the acceleration based on Y-axis in terms of degree per square second.
pitchRangeFlag	This field, which is only present in the binary representation, indicates the presence of the pitch-range attribute. If it is 1, then the pitch-range attribute is present, otherwise the pitch-range attribute is not present.
pitch-range	Describes the range of the pitch value. EXAMPLE [-100, 100].
pitchFlag	This field, which is only present in the binary representation, indicates the presence of the pitchSpeed attribute. If it is 1, then the pitchSpeed attribute is present, otherwise the pitchSpeed attribute is not present.
pitch	Describes the rotation based on X-axis in terms of angle. Positive value means the rotation angle in the direction of pitch arrow, where P denotes pitch in Figure 16.  **Figure 16 — Direction model for Incline pattern** NOTE The pitch angle is increased with counter-clockwise.
rollRangeFlag	This field, which is only present in the binary representation, indicates the presence of the roll-range attribute. If it is 1, then the roll-range attribute is present, otherwise the roll-range attribute is not present.
roll-range	Describes the range of the roll value. EXAMPLE [-100, 100].
rollFlag	This field, which is only present in the binary representation, indicates the presence of the roll attribute. If it is 1, then the roll attribute is present, otherwise the roll attribute is not present.
roll	Describes the rotation based on Z-axis in terms of angle. Positive value means the rotation angle in the direction of roll arrow (R) as depicted in Figure 16. NOTE The roll angle is increased with counter-clockwise.
yawRangeFlag	This field, which is only present in the binary representation, indicates the presence of the yaw-range attribute. If it is 1, then the yaw-range attribute is present, otherwise the yaw-range attribute is not present.
yaw-range	Describes the range of the yaw value. EXAMPLE [-100, 100].
yawFlag	This field, which is only present in the binary representation, indicates the presence of the yaw attribute. If it is 1, then the yaw attribute is present, otherwise the yaw attribute is not present.

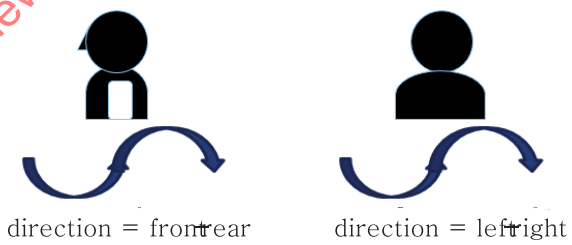
Name	Definition
yaw	Describes the rotation based on Y-axis in terms of angle. Positive value means the rotation angle in the direction of yaw arrow (Yw) as depicted in Figure 16. NOTE The yaw angle is increased with counter-clockwise.

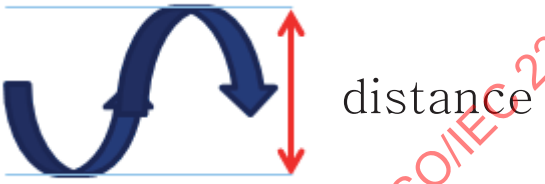
Semantics of the ShakeType.

Name	Definition
directionFlag	This field, which is only present in the binary representation, indicates the presence of the direction attribute. If it is 1, then the direction attribute is present, otherwise the direction attribute is not present.
direction	Describes the direction of the shake motion (see Figure 17). A CS that may be used for this purpose is the ShakeDirectionCS defined in ISO/IEC 23005-6:2019, Annex A.  **Figure 17 — Direction model for Shake pattern**
countFlag	This field, which is only present in the binary representation, indicates the presence of the count attribute. If it is 1, then the count attribute is present, otherwise the count attribute is not present.
count	Describes the times to shake during the duration time.
distanceRangeFlag	This field, which is only present in the binary representation, indicates the presence of the distance-range attribute. If it is 1, then the distance-range attribute is present, otherwise the distance-range attribute is not present.
distance-range	Describes the range of the distance value. EXAMPLE [-100, 100].
distanceFlag	This field, which is only present in the binary representation, indicates the presence of the distance attribute. If it is 1, then the distance attribute is present, otherwise the distance attribute is not present.
distance	Describes the distance between the two ends of the shaking motion in terms of centimetre (see Figure 18).
	 **Figure 18 — Distance for shaking motion**

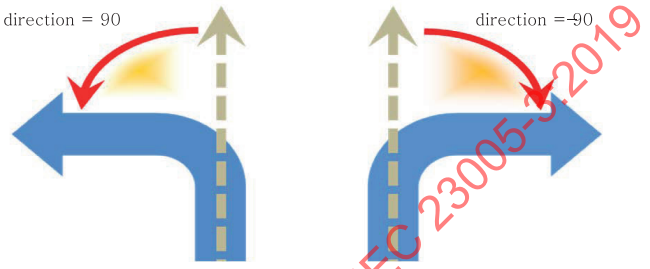
Name	Definition
intervalFlag	This field, which is only present in the binary representation, indicates the presence of the interval attribute. If it is 1, then the interval attribute is present, otherwise the interval attribute is not present.
interval	Describes a break time in the intervals of shake motions according to the time scheme used. The time scheme used shall be identified by means of the si:absTimeScheme and si:timeScale attributes respectively. NOTE The interval is illustrated in Figure 19.  **Figure 19 — Illustration of interval**

Semantics of the WaveType.

Name	Definition
directionFlag	This field, which is only present in the binary representation, indicates the presence of the direction attribute. If it is 1, then the direction attribute is present, otherwise the direction attribute is not present.
direction	Describes the direction of the wave motion (see Figure 20). A CS that may be used for this purpose is the WaveDirectionCS defined in ISO/IEC 23005-6:2019, Annex A.  **Figure 20 — Direction for waving motion**
startDirectionFlag	This field, which is only present in the binary representation, indicates the presence of the startDirection attribute. If it is 1, then the startDirection attribute is present, otherwise the startDirection attribute is not present.
startDirection	Describes whether it starts towards up direction or down direction (see Figure 21). A CS that may be used for this purpose is the WaveStartDirectionCS defined in ISO/IEC 23005-6:2019, Annex A.
	 **Figure 21 — Start direction for waving motion**
countFlag	This field, which is only present in the binary representation, indicates the presence of the count attribute. If it is 1, then the count attribute is present, otherwise the count attribute is not present.
count	Describes the times to wave during the duration time.

Name	Definition
distanceRangeFlag	This field, which is only present in the binary representation, indicates the presence of the distance-range attribute. If it is 1, then the distance-range attribute is present, otherwise the distance-range attribute is not present.
distance-range	Describes the range of the distance value. EXAMPLE [-100, 100].
distanceFlag	This field, which is only present in the binary representation, indicates the presence of the distance attribute. If it is 1, then the distance attribute is present, otherwise the distance attribute is not present.
distance	Describes the distance between the top and the bottom of the wave motion in centimetre (see Figure 22).  **Figure 22 — Distance for waving motion**
intervalFlag	This field, which is only present in the binary representation, indicates the presence of the interval attribute. If it is 1, then the interval attribute is present, otherwise the interval attribute is not present.
interval	Describes a break time in the intervals of wave motions according to the time scheme used. The time scheme used shall be identified by means of the si:absTimeScheme and si:timeScale attributes respectively.

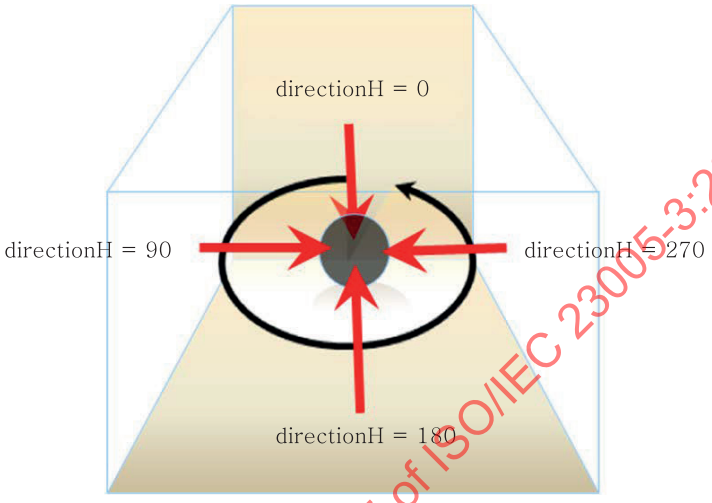
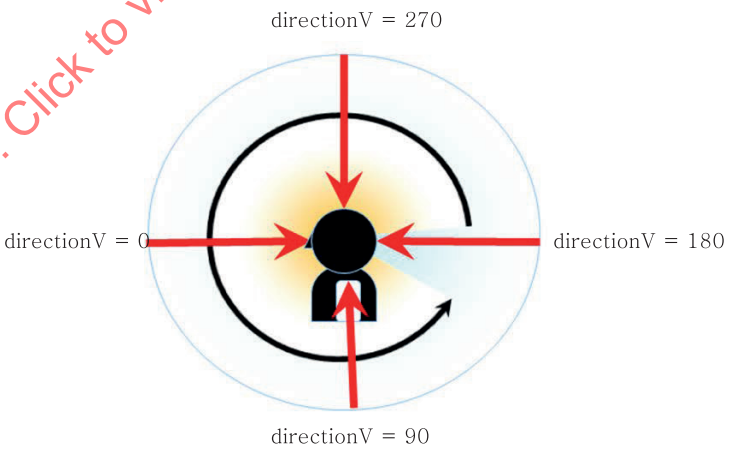
Semantics of the `TurnType`.

Name	Definition
`directionFlag`	This field, which is only present in the binary representation, indicates the presence of the `direction` attribute. If it is 1, then the `direction` attribute is present, otherwise the `direction` attribute is not present.
`direction`	Describes the turning direction in terms of angle (see Figure 23). The type is `sev:TurnAngleType`.  **Figure 23 — Direction for turn pattern**
`speedFlag`	This field, which is only present in the binary representation, indicates the presence of the `speed` attribute. If it is 1, then the `speed` attribute is present, otherwise the `speed` attribute is not present.
`speed`	Describes the turning speed in degree per second.
`distanceFlag`	This field, which is only present in the binary representation, indicates the presence of the `distance` attribute. If it is 1, then the `distance` attribute is present, otherwise the `distance` attribute is not present.
`Distance`	Describes the distance between the origin and destination in terms of centimetre.

Semantics of the `SpinType`.

Name	Definition
`directionFlag`	This field, which is only present in the binary representation, indicates the presence of the `direction` attribute. If it is 1, then the `direction` attribute is present, otherwise the `direction` attribute is not present.
`direction`	Describes the direction of the spinning based on the 3 axes. A CS that may be used for this purpose is the `SpinDirectionCS` defined in ISO/IEC 23005-6:2019, Annex A. NOTE 1 Forward-spin based on x axis (which is "xf" in the classification scheme) indicates the spinning direction by the pitch arrow. Otherwise, backward-spin based on x-axis (which is "xb" in the classification scheme) indicates the opposite spinning direction of "xf".
`countFlag`	This field, which is only present in the binary representation, indicates the presence of the `count` attribute. If it is 1, then the `count` attribute is present, otherwise the `count` attribute is not present.
`count`	Describes the times to spin during the duration time.
`intervalFlag`	This field, which is only present in the binary representation, indicates the presence of the `interval` attribute. If it is 1, then the `interval` attribute is present, otherwise the `interval` attribute is not present.
`interval`	Describes a break time in the intervals of spin motions according to the time scheme used. The time scheme used shall be identified by means of the `si:absTimeScheme` and `si:timeScale` attributes respectively.

Semantics of the `CollideType`.

Name	Definition
`directionH`	Describes the horizontal direction of receiving impact in terms of angle (see Figure 24). The type is `sev:MoveTowardAngleType`. The angle starts from the front-center of the rigid body and increases with CCW.  **Figure 24 — Horizontal direction model for collide pattern**
`directionHFlag`	This field, which is only present in the binary representation, indicates the presence of the `directionH` attribute. If it is 1, then the `directionH` attribute is present, otherwise the `directionH` attribute is not present.
`directionV`	Describes the vertical direction of receiving impact in terms of angle (see Figure 25). The type is `sev:TowardAngleType`. The angle starts from the front-center of rigid body and increases with CCW.
	 **Figure 25 — Vertical direction model for collide pattern**
`directionVFlag`	This field, which is only present in the binary representation, indicates the presence of the `directionV` attribute. If it is 1, then the `directionV` attribute is present, otherwise the `directionV` attribute is not present.
`speedFlag`	This field, which is only present in the binary representation, indicates the presence of the `speed` attribute. If it is 1, then the `speed` attribute is present, otherwise the `speed` attribute is not present.
`speed`	Describes the speed of colliding object in terms of centimetre per second.

5.13.5 Example

EXAMPLE 1 This example shows the description of a movetoward effect with the following semantics. The distance to the target position is 6 cm, and the direction is 30° in the vertical angle and 50°in the

horizontal angle. The moving speed is 3 cm per second and the duration is 2 s. The rigid body starts to move towards target position at si:pts="0" and stays at the target position until the duration time..

```
<sedl:Effect xsi:type="sev:RigidBodyMotionType" duration="2" si:pts="0">
  <sev:MoveToward directionV="30" directionH="50" distance="6"
     speed="3" />
</sedl:Effect>
```

It is possible to describe acceleration instead of speed.

```
<sedl:Effect xsi:type="sev:RigidBodyMotionType" duration="2" si:pts="0">
  <sev:MoveToward directionV="30" directionH="50" distance="6"
     acceleration="3" />
</sedl:Effect>
```

It is also possible to describe without speed or acceleration. In this case the semantics is that the rigid body starts to movetoward at si:pts="0" and should reach at the target position within the duration time, which implies that the speed is decided by the duration and the distance. According to the below example, the implied speed is 3 cm/s.

```
<sedl:Effect xsi:type="sev:RigidBodyMotionType" duration="2" si:pts="0">
  <sev:MoveToward directionV="30" directionH="50" distance="6"/>
</sedl:Effect>
```

EXAMPLE 2 This example shows the description of an incline effect with the following semantics. The target pitch angle is 30°. The rotation speed is 10° per second and the duration is 5 s. The rigid body starts to rotate towards target angle at si:pts="0" and stays at the target angle until the duration time.

```
<sedl:Effect xsi:type="sev:RigidBodyMotionType" duration="5" si:pts="0">
  <sev:Incline pitch="30" pitchSpeed="3.0"/>
</sedl:Effect>
```

It is possible to describe acceleration instead of speed.

```
<sedl:Effect xsi:type="sev:RigidBodyMotionType" duration="5" si:pts="0">
  <sev:Incline pitch="30" pitchAcceleration="3.0"/>
</sedl:Effect>
```

It is also possible to describe without speed or acceleration. In this case the semantics is that the rigid body starts to incline at si:pts="0" and should finish this motion during the duration time, which implies that the speed is decided by the duration and the angle.

```
<sedl:Effect xsi:type="sev:RigidBodyMotionType" duration="5" si:pts="0">
  <sev:Incline pitch="30"/>
</sedl:Effect>
```

EXAMPLE 3 This example shows the description of a shake effect with the following semantics. The moving direction is sway which means moving left and right repeatedly. The end-to-end distance is 10 cm and the duration is 5 s. The rigid body starts to shake at si:pts="0" and shake 5 times until the duration time.

```
<sedl:DescriptionMetadata>
  <sedl:ClassificationSchemeAlias alias="SHAKE"
     href="urn:mpeg:mpeg-v:01-SI-ShakeDirectionCS-NS"/>
</sedl:DescriptionMetadata>
<sedl:Effect xsi:type="sev:RigidBodyMotionType" duration="5" si:pts="0">
  <sev:Shake direction=":SHAKE:sway" distance="10" count="5"/>
</sedl:Effect>
```

EXAMPLE 4 This example shows the description of a wave effect with the following semantics. The wave direction is left-right and the distance is 10 cm, and the duration is 5 s. The rigid body starts to wave with the left side up at si:pts="0" and wave 5 times until the duration time.

```
<sedl:DescriptionMetadata>
  <sedl:ClassificationSchemeAlias alias="WAVE"
     href="urn:mpeg:mpeg-v:01-SI-WaveDirectionCS-NS"/>
<sedl:ClassificationSchemeAlias alias="WAVESTR"
     href="urn:mpeg:mpeg-v:01-SI-WaveStartDirectionCS-NS"/>
```

```
</sedl:DescriptionMetadata>
<sedl:Effect xsi:type="sev:RigidBodyMotionType" duration="5" si:pts="0">
  <sev:Wave direction=":WAVE:left_right"
        startDirection=":WAVESTR:up" count="5" distance="10"/>
</sedl:Effect>
```

EXAMPLE 5 This example shows the description of a turn effect with the following semantics. The turn direction is 30° and the turning speed is 6° per second and distance is 5 cm. The rigid body starts to turn (including move towards) in the right direction with the speed at si:pts="0" and stays during the duration time.

```
<sedl:Effect xsi:type="sev:RigidBodyMotionType" duration="5" si:pts="0">
  <sev:Turn direction="30" speed="6" distance=”5”/>
</sedl:Effect>
```

It is also possible to describe without speed. In this case the semantics is that the rigid body starts to turn in the right direction at si:pts="0" and should finish this motion during the duration time.

```
<sedl:Effect xsi:type="sev:RigidBodyMotionType" duration="5" si:pts="0">
  <sev:Turn direction="90" distance=”5”/>
</sedl:Effect>
```

EXAMPLE 6 This example shows the description of a spin effect with the following semantics. The spinning direction is “xf” which means forward spin based on x-axis. The spinning count is 5 times and the duration is 6 s which means the rigid body starts to spin at si:pts="0" and repeats 5 times for 6 s.

```
<sedl:DescriptionMetadata>
  <sedl:ClassificationSchemeAlias alias="SPIN"
     href="urn:mpeg:mpeg-v:01-SI-SpinDirectionCS-NS"/>
</sedl:DescriptionMetadata>
<sedl:Effect xsi:type="sev:RigidBodyMotionType" duration="6" si:pts="0">
  <sev:Spin direction=":SPIN:xf" count="5"/>
</sedl:Effect>
```

EXAMPLE 7 This example shows the description of a collide effect with the following semantics. The rigid body receives the colliding impact from the horizontal angle 90° and vertical angle 30° with the speed 220 cm per second.

```
<sedl:Effect xsi:type="sev:RigidBodyMotionType" si:pts="0">
  <sev:Collide directionH="90" directionV="30" speed="220"/>
</sedl:Effect>
```

5.14 Passive kinesthetic motion effect

5.14.1 General

This subclause specifies syntax and semantics of a passive kinesthetic motion effect.

5.14.2 Syntax

```
<complexType name="PassiveKinestheticMotionType">
  <complexContent>
   <extension base="sev:RigidBodyMotionType">
    <attribute name="updateRate" type="positiveInteger" use="required"/>
   </extension>
  </complexContent>
</complexType>
```

5.14.3 Binary representation syntax

PassiveKinestheticMotioin {	**Number of bits**	**Mnemonic**
RigidBodyMotionType		RigidBodyMotionType
updateRate	16	uimsbf
}		

5.14.4 Semantics

Semantics of the PassiveKinestheticMotionType.

Name	Definition
PassiveKinestheticMotionType	Tool for describing a passive kinesthetic motion effect. This type defines a passive kinesthetic motion mode. In this mode, a user holds the kinesthetic device softly and the kinesthetic device guides the user's hand according to the recorded motion trajectories that are specified by three positions and three orientations.
TrajectorySamples	Tool for describing a passive kinesthetic interaction. The passive kinesthetic motion data is comprised with m by 6 matrix, where 6 columns contain three positions (Px, Py, Pz in millimetres) and three orientations (Ox, Oy, Oz in degrees) and where m rows contain timescale data points. These six data are updated with the same m timeScale.
updateRate	Describes a number of data update times per second. EXAMPLE The value 20 means that the kinesthetic device will move to 20 different positions and orientations for each second.

5.14.5 Additional validation rules

5.14.5.1 General

For the purpose of referencing the additional validation rules are numbered.

5.14.5.2 A number of TrajectorySamples shall be in multiples of 6 since 6 samples include three positions and three orientations at each period Therefore number of rows is fixed to 6.

5.14.5.3 A number of TrajectorySamples at an update period shall not exceed the duration therefore updateRate attribute should be set.

5.14.6 Example

This example shows the description of a passive kinesthetic motion effect with the following semantics. The kinesthetic device moves to new positions and orientations according to the timeSamples. If 3 position and orientation data are given and updateRate is 3, then the kinesthetic device guides user's hand to three different positions and orientations for 1 s since 3 samples for position and orientation data are provided. Note that the passive kinesthetic motion effect is activated at si:pts="5".

```
<sedl:Effect xsi:type="sev:PassiveKinestheticMotionType" updateRate="3"
si:pts="5">
  <sev:TrajectorySamples mpeg7:dim="3 6">
     15 0 20 10 30 10      20 11 50 30 10  0
      0 10 10 10  0 15
  </sev:TrajectorySamples>
</sedl:Effect>
```

5.15 Passive kinesthetic force effect

5.15.1 General

This subclause specifies syntax and semantics of a passive kinesthetic force effect.

5.15.2 Syntax

```
<complexType name="PassiveKinestheticForceType">
  <complexContent>
   <extension base="sedl:EffectBaseType">
    <sequence>
     <element name="PassiveKinestheticForce" type="mpeg7:FloatMatrixType"/>
```

```
    </sequence>
    <attribute name="updateRate" type="positiveInteger" use="required"/>
   </extension>
  </complexContent>
</complexType>
```

5.15.3 Binary representation syntax

PassiveKinestheticForce {	Number of bits	Mnemonic
EffectBaseType		EffectBaseType
SizeOfForceRow	16	uimsbf
SizeOfForceColumn	4	uimsbf
for(k=0;k<(SizeOfforceRow* SizeOfforceColumn);k++) {		
force[k]	32	fsfb
}		
updateRate	16	uimsbf
}		

5.15.4 Semantics

Semantics of the `PassiveKinestheticMotionType`.

Name	Definition
`PassiveKinestheticForceType`	Tool for describing a passive kinesthetic force/torque effect. This type defines a passive kinesthetic force/torque mode. In this mode, a user holds the kinesthetic device softly and the kinesthetic device guides the user's hand according to the recorded force/toque histories.
`PassiveKinestheticForce`	Describes a passive kinesthetic force/torque sensation. The passive kinesthetic force/torque data are comprised with a m by 6 matrix, where 6 columns contain three forces (`Fx`, `Fy`, `Fz` in Newton) and three torques (`Tx`, `Ty`, `Tz` in Newton-millimetre) for force/torque trajectories. These six data are updated with the `updateRate`.
`SizeOfForceRow`	Describes a row size of force
`SizeOfForceColumn`	Describes a column size of force (Usually 6)
`force`	Describes a *m* by 6 matrix, where 6 columns contain three forces (`Fx`, `Fy`, `Fz` in Newton) and three torques (`Tx`, `Ty`, `Tz` in Newton-millimetre) for force/torque trajectories. *m* represents the number of position samples.
`updateRate`	Describes a number of data update times per second.

5.15.5 Additional validation rules

5.15.5.1 General

For the purpose of referencing the additional validation rules are numbered.

5.15.5.2 A data number of `PassiveKinestheticForce` shall be in multiples of 6 since 6 samples include three forces and three torques at each period. Therefore number of columns is fixed to 6

5.15.5.3 `PassiveKinestheticForce` effect element shall have `updateRate` attribute in parent element, on the other hand duration attribute shall not be described.

5.15.5.4 `PassiveKinestheticForce` effect element shall not be described with `ActiveKinesthetic` effect at the same time.

5.15.6 Examples

This example shows the description of a passive kinesthetic force effect with the following semantics. The kinesthetic device produces new forces and torques according to the update rate. If 3 forces and torques data are given and updateRate is 3, then the kinesthetic device produces forces and torques for 1 s since 3 samples for position and orientation data are provided. Note that the passive kinesthetic force effect is activated at si:pts="2".

```
<sedl:Effect xsi:type="sev:PassiveKinestheticForceType" updateRate="3" si:pts="2">
  <sev:PassiveKinestheticForce mpeg7:dim="3 6">
     3  0 0 0  3 0
     0  0 3 2  0 0
     0  0 3 0 10 5
  </sev:PassiveKinestheticForce>
</sedl:Effect>
```

5.16 Active kinesthetic effect

5.16.1 General

This subclause specifies syntax and semantics of an active kinesthetic effect.

5.16.2 Syntax

```
<complexType name="ActiveKinestheticType">
  <complexContent>
   <extension base="sedl:EffectBaseType">
    <sequence>
     <element name="ActiveKinesthetic" type="sev:ActiveKinestheticForceType"/>
    </sequence>
   </extension>
  </complexContent>
</complexType>

<complexType name="ActiveKinestheticForceType">
  <attribute name="fx" type="float" use="optional"/>
  <attribute name="fy" type="float" use="optional"/>
  <attribute name="fz" type="float" use="optional"/>
  <attribute name="tx" type="float" use="optional"/>
  <attribute name="ty" type="float" use="optional"/>
  <attribute name="tz" type="float" use="optional"/>
</complexType>
```

5.16.3 Binary representation syntax

ActiveKinesthetic{	**Number of bits**	**Mnemonic**
EffectBaseType		EffectBaseType
txFlag	1	bslbf
tyFlag	1	bslbf
tzFlag	1	bslbf
fxFlag	1	bslbf
fyFlag	1	bslbf
fzFlag	1	bslbf
if(txFlag) {		
tx	32	fsfb
}		
if(tyFlag) {		
ty	32	fsfb
}		
if(tzFlag) {		

ActiveKinesthetic {	Number of bits	Mnemonic
tz	32	fsfb
}		
if(fxFlag) {		
fx	32	fsfb
}		
if(fyFlag) {		
fy	32	fsfb
}		
if(fzFlag) {		
fz	32	fsfb
}		
}		

5.16.4 Semantics

Semantics of the `ActiveKinestheticType`.

Name	Definition
`ActiveKinestheticType`	Tool for describing an active kinesthetic effect. This type defines an active kinesthetic interaction mode. In this mode, when a user touches an object by his/her will, then the computed contact forces and torques are provided.
`ActiveKinesthetic`	Describes an active kinesthetic interaction.
`ActiveKinestheticForceType`	Tool for describing three forces (`fx`, `fy`, `fz`) and torques (`tx`, `ty`, `tz`) for each axis in an active kinesthetic mode. Force is represented in the unit of N (Newton) and torque is represented in the unit of Nmm (Newton-millimetre).
`txFlag`	This field, which is only present in the binary representation, indicates the presence of the `tx` attribute. If it is 1, then the `tx` attribute is present, otherwise the `tx` attribute is not present.
`tyFlag`	This field, which is only present in the binary representation, indicates the presence of the `ty` attribute. If it is 1, then the `ty` attribute is present, otherwise the `ty` attribute is not present.
`tzFlag`	This field, which is only present in the binary representation, indicates the presence of the `tz` attribute. If it is 1, then the `tz` attribute is present, otherwise the `tz` attribute is not present.
`fxFlag`	This field, which is only present in the binary representation, indicates the presence of the `fx` attribute. If it is 1, then the `fx` attribute is present, otherwise the `fx` attribute is not present.
`fyFlag`	This field, which is only present in the binary representation, indicates the presence of the `fy` attribute. If it is 1, then the `fy` attribute is present, otherwise the `fy` attribute is not present.
`fzFlag`	This field, which is only present in the binary representation, indicates the presence of the `fz` attribute. If it is 1, then the `fz` attribute is present, otherwise the `fz` attribute is not present.
`Tx`	Torque for x-axis in an active kinesthetic mode. Torque is represented in the unit of Nmm (Newton-millimetre).
`Ty`	Torque for y-axis in an active kinesthetic mode. Torque is represented in the unit of Nmm (Newton-millimetre).
`Tz`	Torque for z-axis in an active kinesthetic mode. Torque is represented in the unit of Nmm (Newton-millimetre).
`Fx`	Force for x-axis in an active kinesthetic mode. Force is represented in the unit of N (Newton).