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Part 3: Sensory information

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Partie 3: Information sensorielle

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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.

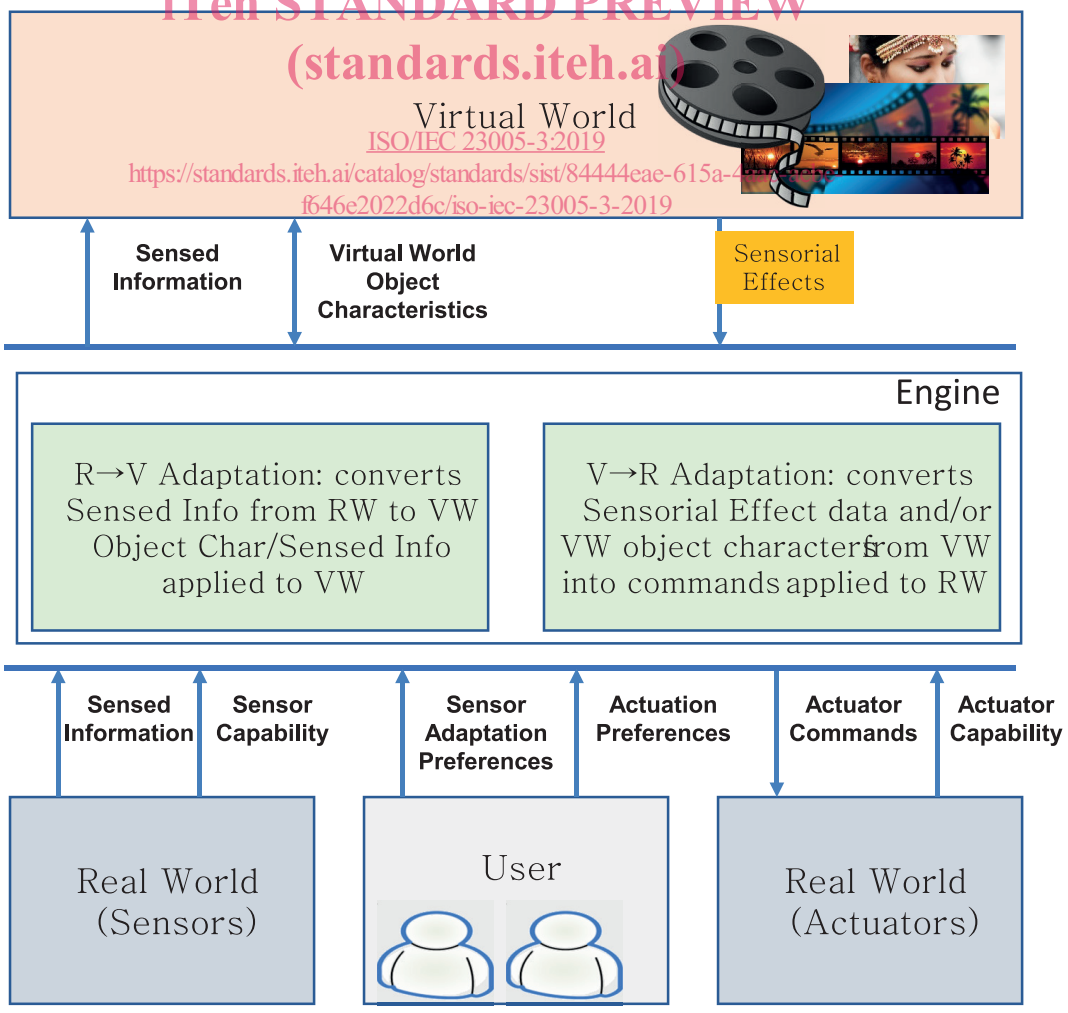

Figure 1 — Scope of ISO/IEC 23005-3 marked with a yellow box

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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Electronics and Telecommunications Research Institute (ETRI)	218 Gajeongro, Yuseong-gu, Daejeon, 305-700, Republic of Korea
Konkuk University	Department of Textile Engineering, 1 Hwayang-dong, Kwangjin-gu, Seoul 143-701, Republic of Korea
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*.

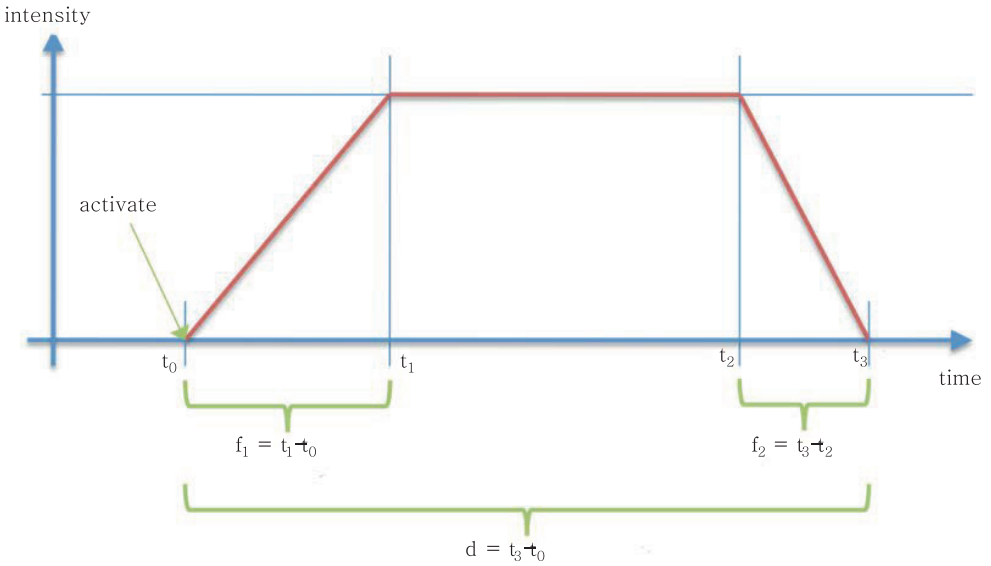

Figure 2 — Time model for sensory effect metadata

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
}		