ONTOLOGY FOR MEDIA CREATION
PART 3F: IMAGES

VERSION 2.5

Motion Picture Laboratories May 1, 2024

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1 Introduction

An image is a visual representation of something. Its earliest use in English is from about 1200 CE. The word is derived from Latin *imago*, which means a copy, imitation, or likeness; a statue or picture, or a ghost.

In OMC, image is restricted to a two-dimensional visual representation. Ignoring rock carvings, some of which may be close to 300,000 years old, the earliest images are cave paintings, dating from 35,000 years ago. The oldest photograph is *Point de vue du Gras*, a heliograph of the view from a window in the French countryside. This is not that far from the first moving images, which started to appear in various forms in the 1870s and 1880s. Although the world has moved on to various ways of producing digital images, physical images are still part of media production.

This document describes the structural characteristics of physical and digital images. Their functional uses are spread across many other parts of the ontology, ranging from Concept Art to textures used in computer graphics.

1.1 Notational Conventions

In documents generally:

- The definition of a term included in the Dictionary is in bold, followed by the definition, e.g., **Creative Work:** A uniquely identified production.
- When a defined term is used in the text of a document, it is capitalized, for example in "The Production Scene is usually derived from a numbered scene in the Script," Production Scene and Script are defined in the Ontology. (Note, a word that is part of defined term may sometimes be capitalized by itself as a shorthand, e.g., "Scene" may be used to indicate "Narrative or Production Scene.")
- References to other Ontology Documents are in ***bold italic***, e.g., ***Part 3: Assets*** or ***Part 3A: Camera Metadata***

For Sample Attributes in the concept documents:

- If a data field or attribute is formally defined in this ontology or a connected ontology, it is italicized, e.g., *Setup* as an attribute refers to a defined concept.
- Attribute […] indicates an attribute can appear more than once, e.g., *Identifier* […]
- →Thing means that an attribute is expressed as a relationship to a Thing, e.g., the →*Script* attribute of Creative Work means there is a relationship Creative Work→*Script*
- A combination of the two indicates that the concept can have relationships to a set of things, e.g., →Components […]

- Many elements of the Ontology have a Context element. (See **Part 2: Context**.) Relationships declared in the Context are implied to have the item to which the Context is attached as their starting point, for example, Narrative Location→Context→Narrative Scene.

  Contextual relationships that are especially important to the concept being defined are given in the sample attributes tables as C→Thing or C→Thing […] as appropriate. These relationships can just as well be on the object that has the Context. For example, if Narrative Location has "C→Narrative Scene" as an attribute, it is ok to have the relationship directly on the Narrative Location or in its Context, e.g. Narrative Location→Narrative Scene or Narrative Location→Context→Narrative Scene.

  Some implementations (e.g. RDF) place these relationships directly on the class as well as allowing them in Context, and others (e.g. JSON) place all relationship in a Context.

2 Images

Image: A two-dimensional visual representation

Note: This definition, and those of Digital Image and Physical Image below, are taken from Part 3:Assets, which is normative.

2.1 Physical Image

Physical Image: An Image represented on physical media**.**

For use in the production process, the most important information about them in the production process is their size. Other domains, such as art history, archiving, and conservation, care about many other things as well, such as the surface on which the physical image is made (many kinds of paper, canvas, glass plate) and the medium used to produce the image (ink, watercolor, gelatin silver.)

OMC describes only the size of the physical image. Other attributes can be kept in the Custom data field. Information about the origins of an image can be kept in a Provenance record (***see Part 3B: Versions***.)

Sample Attributes for Physical Image

Term	**Definition**
Identifier […]	One or more identifiers for the Physical Image. At least one of these should be resolvable within the production environment.
Name	The name of the Physical Image
Description	A description of the Physical Image.
Dimensions	See ***Part 9: Utilities***. Physical images will generally not have a depth property.
Substrate	Optional. The underlying surface of the Physical Image, e.g. “paper” or “glass”.
Medium	Optional. The material(s) applied to the Substrate to make the Physical Image.
Custom Data	Anything that is application or workflow dependent that can’t be otherwise expressed in the Ontology or needs to be present in a particular format.
→ *Context* […]	Any Context for the Asset. See ***Part 2: Context***

Notes:

The Dimensions of a Physical Image should always have units, e.g. “in” or “mm”.

2.2 Digital Image

Digital images are probably the most common sort of Image in the production process. They come in a wide variety of formats. As with other digital asset types, OMC expresses information about the digital image rather than recreating the image itself. This allows parts of the workflow, including asset management systems, to do several things:

- Communicate details that can otherwise only be found by opening the image. This is especially important in cloud-based and other distributed environments and includes, for example, channel structure, color space, and the presence or absence of an alpha channel..
- Provide coarse levels of filtering, e.g. “is this image the size I need?” or “Does this setup of the workflow use the same color space as this image?”
- More reliably indicate the format of the file – relying on file extensions can be hazardous
- Connect digital images to the rest of the workflow using standard OMC mechanisms such as concept, depictions, and versions.

Digital Image: An Image stored digitally that represents individual pixel values.

Pixel values can represent color, transparency, or other information.

Sample Attributes for Digital Image

Term	Definition
Identifier […]	One or more identifiers for the Physical Image.. At least one of these should be resolvable within the production environment.
Name	The name of the Physical Image
Description	A description of the Physical Image.
Dimensions	Optional. See ***Part 9: Utilities***. Dimensions has width, height, and optional depth.
Codec	Optional. The codec used for encoding the Digital Image
File format	Optional. The format of the Digital Image’s containing file. Some codecs are self-containing, but others can be included inside multiple types of container.
Image Channels	See below.
->Color Space	See below.
Custom Data	Anything that is application or workflow dependent that can’t be otherwise expressed in the Ontology or needs to be present in a particular format.
→ *Context* […]	Any Context for the Asset. See ***Part 2: Context***

Notes:

OMC currently supports a single sample per pixel.

The depth field of the Dimensions of a Digital Image does not represent the bit depth or bits per pixel of the pixel values; rather, it is the number of planes of pixels, for example in an image used for a CG volume texture.

OMC does not provide information about the structure of the pixels, e.g. bit depth or the fundamental type (int, half, float) of the pixel value.

2.2.1 Image Channels

Image Channel: A component of an image that is sampled across its extent.

Examples:

- an RGB image has three channels: red, green, and blue.
- An image used as a Map for CG graphics can have just three channels (the colors); four channels (the colors plus an alpha or transparency channel); or one channel (an alpha or transparency value.) There are many other kinds of channels in computer graphics work.

Image Channels: A comma-separated string concatenating one or more of the Image Channel names.

The Image Channels property of a Digital Image is a comma separated list of channel names. It can be whatever the user or application decides, but for interoperability we recommend using a standard form whenever possible, such as the ones given for OpenEXR[1] images.

- “R,G,B,A” – red, green, blue, alpha.
- “Y, RY, BY” – for luminance/chroma images
- “AR,AG,AB” – alpha for colored mattes

Special-purpose Digital Images often have custom channel names.

[1] https://openexr.com/en/latest/TechnicalIntroduction.html

3 Color Spaces

Digital images are made up of pixels, each of which represents a color. There are many ways of encoding this, and there are ongoing industry standardization efforts, including ACES, OCIO, and OpenEXR. An application must be able to

- Communicate how it is using pixel values (colors) to other parts of the workflow
- Understand the pixel values it receives from external sources

There are two parts to understanding pixels:

- A color model, which defines the way colors are represented with numeric values. Examples include RGB, CMYK, and HSL.
- A color space, which defines the range[2] of colors that can be produced by a device. Examples include sRGB, generally used for images in the internet world) and Rec. 709 (used for HDTV.)

Color Space: A predefined encoding for communicating color appearance.

Color spaces are used when capturing, transforming, and displaying images.

There are many predefined, named color spaces, and for many applications that is all that is needed. However, color libraries can expose configuration files[3], and digital images with custom configuration files need to access that file. In OMC this is represented as an Asset Functional Class applied to Digital Data structural entity.

An OMC Color Space is a combination of a color space name and an optional configuration file

Sample Attributes for Color Space

Attribute	**Description**
Name	The name of the colorspace object
Identifier […]	One or more identifiers for the color space object. At least one of these should be resolvable within the production environment; others might point to sources with more information.
Color Space Name	String. A reference to a predefined numeric encoding for communicating color appearance
-> *Color Space Configuration*	See below

[2] More precisely, this is the gamut of the color space.

[3] See https://opencolorio.readthedocs.io/en/latest/guides/authoring/authoring.html for the widely used OCIO library's configuration file.

Custom Data	Anything that is application or workflow dependent that can't be otherwise expressed in the Ontology or needs to be present in a particular format.
→ *Context* […]	

Notes:

Color Space Name should be taken, whenever possible, from standard color space names, such as those found in:

- OCIO (https://opencolorio.org/); please refer to the "Color Space Encodings for Texture Assets and CG Rendering" by the ASWF
- OIIO (https://openimageio.readthedocs.io/en/latest/stdmetadata.html and, in more depth, https://github.com/AcademySoftwareFoundation/OpenImageIO?tab=readme-ov-file); e.g. "lin_sRGB", "Rec709", or "GammaX.Y"
- ACES (https://acescentral.com/), formalized as SMPTE ST 2065-1 (https://www.smpte.org/standards/aces-standards); e.g. "ACES 2065-1", "ACEScg" or "ACESProxy"

The standard color spaces cover all stages of the production pipeline and include many application- and vendor-specific color spaces as well as the more generic ones given as examples above.

When a configuration file is present, an application uses color space name as a lookup key to find the appropriate color space definition. As an example, see "Color Spaces and Color Management Systems" in MaterialX (https://materialx.org/Specification.html)

Not all color spaces work with all image formats and color models. ACES2065-1 color space, for example, requires a 16 bit EXR format.

Color Space Configuration: A configuration file for a color management system.

Sample Attributes for Color Space Configuration

Attribute	**Description**
Name	The name of the Configuration File
Identifier […]	One or more identifiers for the Configuration File. At least one of these should be resolvable within the production environment; others might point to sources with more information.
Version	See **Part 3B: Versions** for the structure of this element.
Custom Data	Anything that is application or workflow dependent that can't be otherwise expressed in the Ontology or needs to be present in a particular format.

→ *Context* […]	

Notes:

Configuration File is a normal Asset Functional Class. Its Asset Structural Class is usually Digital Data.

Appendix A External Definitions

These are terms defined elsewhere in the Production Ontology, included here for ease of reference.

Media Creation Context: Informs scope within the construction process of a Creative Work.

See **Part 2: Context**

Asset: A physical or digital object or collection of objects specific to the creation of the Creative Work.

See **Part 3: Assets**

Camera Metadata: Capture-specific details and information about the Camera itself.

See **Part 3A: Camera Metadata**

Participant: The entities (people, organizations, or services) that are responsible for the production of the Creative Work.

See **Part 4: Participants**

Task: A piece of work to be done and completed as a step in the production process.

See **Part 5: Tasks**

Creative Work: A uniquely identified production.

See **Part 6: Creative Works**

Relationship: Describes and defines the connections between elements of the Ontology, such as Assets, Tasks, Participants, and Contexts.

See **Part 7: Relationships**

Infrastructure: The underlying systems and framework required for the production of the Creative Work; it is generally not specific to a particular Creative Work.

See **Part 8: Infrastructure**

Utilities: Common data models and data structures used in multiple places and in multiple ways in a larger system.

See **Part 9: Utilities**

Identifier: An identifier uniquely identifies an entity within a particular scope.

See **Part 9: Utilities**