**1. E16 Measurement**

Changed to clarify that E16 Measurement requires observation, including an update to an example and the removal of two examples.

From

Subclass of: E13 Attribute Assignment

Scope note:

This class comprises actions measuring quantitative physical properties and other values that can be determined by a systematic, objective procedure of direct observation of particular states of physical reality. Properties of instances of E90 Symbolic Object may be measured by observing some of their representative carriers which may or may not be named explicitly. In the case that the carrier can be named, the property P16 used specific object (was used for): should be used to indicate the instance(s) of E18 Physical Thing that was used as the empirical basis for the measurement activity.

Examples include measuring the nominal monetary value of a collection of coins or the running time of a movie on a specific video cassette.

The E16 Measurement may use simple counting or tools, such as yardsticks or radiation detection devices. The interest is in the method and care applied, so that the reliability of the result may be judged at a later stage, or research continued on the associated documents. The date of the event is important for dimensions, which may change value over time, such as the length of an object subject to shrinkage. Methods and devices employed should be associated with instances of E16 Measurement by properties such as P33 used specific technique: E29 Design or Procedure, P125 used object of type: E55 Type, P16 used specific object (was used for): E70 Thing, whereas basic techniques such as "carbon 14 dating" should be encoded using P2 has type (is type of): E55 Type. Details of methods and devices reused or reusable in other instances of E16 Measurement should be documented for these entities rather than the measurements themselves, whereas details of particular execution may be documented by free text or by instantiating adequate sub-activities, if the detail may be of interest for an overarching query.

Regardless whether a measurement is made by an instrument or by human senses, it represents the initial transition from physical reality to information without any other documented information object in between within the reasoning chain that would represent the result of the interaction of the observer or device with reality. Therefore, inferring properties of depicted items using image material, such as satellite images, is not regarded as an instance of E16 Measurement, but as a subsequent instance of E13 Attribute Assignment. Rather, only the production of the images, understood as arrays of radiation intensities, is regarded as an instance of E16 Measurement. The same reasoning holds for other sensor data.

Examples:

* measurement of height of silver cup 232 on the 31st August 1997 (fictitious)
* the carbon 14 dating of the “Schoeninger Speer II” in 1996 [an about 400.000 year old complete Old Palaeolithic wooden spear found in Schoeningen, Niedersachsen, Germany in 1995] (Kouwenhoven, 1997)
* The pixel size of the jpeg version of Titian’s painting Bacchus and Ariadne from 1520–3, as freely downloadable from the National Gallery in London’s web page <<https://www.nationalgallery.org.uk/paintings/titian-bacchus-and-ariadne>> is 581600 pixels.
* The scope note of E21 Person in the Definition of the CIDOC Conceptual Reference Model Version 5.0.4 as downloaded from <<http://www.cidoc-crm.org/sites/default/files/cidoc_crm_version_5.0.4.pdf>> consists of 77 words.

In First Order Logic:

E16(x) ⇒ E13(x)

Properties:

P39 measured (was measured by): E1 CRM Entity

P40 observed dimension (was observed in): E54 Dimension

To:

Subclass of: E13 Attribute Assignment

Scope note:

This class comprises actions measuring quantitative physical properties that can be determined by a systematic, objective procedure of direct observation of particular states of physical reality.

An instance of E16 Measurement may use simple counting or tools, such as yardsticks or radiation detection devices. The interest is in the method and care applied, so that the reliability of the result may be judged at a later stage, or research continued from the associated documents. The date of the event is important for dimensions, which may change value over time, such as the length of an object subject to shrinkage. Methods and devices employed should be associated with instances of E16 Measurement by properties such as P33 used specific technique: E29 Design or Procedure, P125 used object of type: E55 Type, P16 used specific object (was used for): E70 Thing, whereas basic techniques such as "carbon 14 dating" should be encoded using P2 has type (is type of): E55 Type. Details of methods and devices reused or reusable in other instances of E16 Measurement should be documented for these entities rather than the measurements themselves, whereas details of particular execution may be documented by free text or by instantiating adequate sub-activities, if the detail may be of interest for an overarching query.

Regardless whether a measurement is made by an instrument or by human senses, it represents the initial transition from physical reality to information without any other documented information object in the reasoning chain that would represent the result of the interaction of the observer or device with reality. Therefore, determining properties of an instance of E90 Symbolic Object is regarded as an instance of E13 Attribute Assignment, which may be inferred from observing and measuring representative carriers. In the case that the carrier can be named, the property P16 used specific object (was used for): should be used to indicate the instance(s) of E18 Physical Thing that was used as the empirical basis for the attribute assignment. For instance, inferring properties of depicted items using image material, such as satellite images, is not regarded as an instance of E16 Measurement, but as a subsequent instance of E13 Attribute Assignment. Rather, only the production of the images, understood as arrays of radiation intensities, is regarded as an instance of E16 Measurement. The same reasoning holds for other sensor data.

Examples:

* measurement of height of silver cup 232 on the 31st August 1997 (fictitious)
* the carbon 14 dating of the “Schoeninger Speer II” in 1996 [The carbon 14 dating of an approximately 400.000 year old complete Old Palaeolithic wooden spear found in Schoeningen, Niedersachsen, Germany in 1995] (Kouwenhoven, 1997)

In First Order Logic:

E16(x) ⇒ E13(x)

Properties:

P39 measured (was measured by): E18 Physical Thing

P40 observed dimension (was observed in): E54 Dimension

**2. P39 measured (was measured by)**

Changed to reduce the range to E18, update the scope note and the second example.

From

Domain: E16 Measurement

Range: E1 CRM Entity

Subproperty of: E13 Attribute Assignment. P140 assigned attribute to (was attributed by): E1 CRM Entity

Quantification:

many to one, necessary (1,1:0,n)

Scope note:

This property associates an instance of E16 Measurement with the instance of E1 CRM Entity to which it applied. An instance of E1 CRM Entity may be measured more than once. Material and immaterial things and processes may be measured, e.g., the number of words in a text, or the duration of an event.

Examples:

* 31 August 1997 measurement of height of silver cup 232 (E16) *measured* silver cup 232 (E22) (fictitious)

In First Order Logic:

P39(x,y) ⇒ E16(x)

P39(x,y) ⇒ E1(y)

P39(x,y) ⇒ P140(x,y)

To:

Domain: E16 Measurement

Range: E18 Physical Thing

Subproperty of: E13 Attribute Assignment. P140 assigned attribute to (was attributed by): E1 CRM Entity

Quantification: many to one, necessary (1,1:0,n)

Scope note:

This property associates an instance of E16 Measurement with the instance of E18 Physical Thing upon which it acted. The instance of E16 Measurement is specific to the measured object. An instance of E18 Physical Thing may be measured more than once with different results, constituting different instances of E16 Measurement.

Examples:

* 31 August 1997 measurement of height of silver cup 232 (E16) *measured* silver cup 232 (E22) (fictitious)
* the carbon 14 dating of the “Schoeninger Speer II” in 1996 (E16) *measured* the “Schoeninger Speer II” (E22) [The carbon 14 dating of an approximately 400.000 year old complete Old Palaeolithic wooden spear found in Schoeningen, Niedersachsen, Germany in 1995. See also
* E16 Measurement] (Kouwenhoven, 1997)

In First Order Logic:

P39(x,y) ⇒ E16(x)

P39(x,y) ⇒ E18(y)

P39(x,y) ⇒ P140(x,y)

**3. P140 assigned attribute to (was attributed by)**

Only updated the reference P39 measured as a sub-property of P140.

From:

Superproperty of:

E14  Condition Assessment. P34 concerned (was assessed by): E18 Physical Thing

E16 Measurement. P39 measured (was measured by): E1 CRM Entity

E17 Type Assignment. P41 classified (was classified by): E1 CRM Entity

To:

Superproperty of:

E14  Condition Assessment. P34 concerned (was assessed by): E18 Physical Thing

E16 Measurement. P39 measured (was measured by): E18 Physical Thing

E17 Type Assignment. P41 classified (was classified by): E1 CRM Entity

**4. P40 observed dimension (was observed in)**

Added a second example:

* the carbon 14 dating of the “Schoeninger Speer II” in 1996 (E16) *observed dimension* the carbon 14 based temporal distance from 1996 to the growth of the wood of the “Schoeninger Speer II” [The carbon 14 dating of an approximately 400.000 year old complete Old Palaeolithic wooden spear found in Schoeningen, Niedersachsen, Germany in 1995. See also E16 Measurement] (Kouwenhoven, 1997)

**5. P43 has dimension (is dimension of)**

Modified scope note to indicate that the long path through *P39i was measured* by applies to E18 Physical Thing and not E70 Thing (note that this change does not affect the domain of P43).

From:

Domain: E70  Thing

Range: E54 Dimension

Quantification: one to many, dependent (0,n:1,1)

Scope note:

This property records a E54 Dimension of some E70 Thing.

This property is a shortcut of the more fully developed path from E70 Thing through *P39i was measured by*, E16 Measurement, *P40 observed dimension*, to E54 Dimension. It offers no information about how and when an E54 Dimension was established, nor by whom.

An instance of E54 Dimension is specific to an instance of E70 Thing.

Examples:

* silver cup 232 (E22) *has dimension* height of silver cup 232 (E54) *has unit* (P91) mm (E58), *has value* (P90) 224 (E60) (fictitious)

In First Order Logic:

P43(x,y) ⇒ E70(x)

P43(x,y) ⇒ E54(y)

P43(x,y) ⇐ (∃z) [E16(z) ˄ P39i(x,z) ˄ P40(z,y)]

To

Domain: E70 Thing

Range: E54 Dimension

Quantification: one to many, dependent (0,n:1,1)

Scope note:

This property records a E54 Dimension of some E70 Thing.

It offers no information about how and when an instance of E54 Dimension was established, nor by whom. In the case that the recorded property is a result of a measurement of an instance of E18 Physical Thing, this property is a shortcut of the more fully developed path from E18 Physical Thing through *P39i was measured by*, E16 Measurement, *P40 observed dimension*, to E54 Dimension. It offers no information about how and when an E54 Dimension was established, nor by whom. Knowledge about an instance of E54 Dimension need not be result of a measurement; it may be the result of evaluating data or other information, which should be documented as an instance of E13 Attribute Assignment.

An instance of E54 Dimension is specific to an instance of E70 Thing.

Examples:

* silver cup 232 (E22) *has dimension* height of silver cup 232 (E54)  *has unit* (P91) mm (E58), *has value* (P90) 224 (E60) (fictitious)

In First Order Logic:

P43(x,y) ⇒ E70(x)

P43(x,y) ⇒ E54(y)

P43(x,y) ⇐ (∃z) [E16(z) ˄ P39i(x,z) ˄ P40(z,y)]