P5 consists of (forms part of)

Domain:

        E3 Condition State

Range:

        E3 Condition State

Quantification:

        many to many (0,n:0,n)

Scope note:

It is assumed that the sub-states into which the condition state is analysed form a logical whole - although the entire story may not be completely known – and that the sub-states are in fact constitutive of the general condition state. For example, a general condition state of "in ruins" may be decomposed into the individual stages of decay.

This property describes the decomposition of an instance of E3 Condition State into discrete, subsidiary states.

This property is transitive and non-reflexive.

Examples:

■ The Condition State of the ruined Parthenon (E3) *consists of* the bombarded state after the explosion of a Venetian shell in 1687 (E3). (Mommsen, 1941)

In First Order Logic:

        P5(x,y) ⇒ E3(x)
        P5(x,y) ⇒ E3(y)
        [P5(x,y) ∧ P5(y,z)] ⇒ P5(x,z)
        P5(x,y) ⇒ ¬P5(y,x)

P9 consists of (forms part of)

Domain:

        E4 Period

Range:

E4 Period

Subproperty of:

E92 Spacetime Volume. P10i contains: E92 Spacetime Volume

Quantification:

many to many (0,n:0,n)

Scope note:

This property associates an instance of E4 Period with another instance of E4 Period that is defined by a subset of the phenomena that define the former. Therefore, the spacetime volume of the latter must fall within the spacetime volume of the former.

This property is transitive and non-symmetric.

Examples:

■ Cretan Bronze Age (E4) *consists of* Middle Minoan (E4). (Hood, 1971)

In First Order Logic:

$P9(x,y) \Rightarrow E4(x)$
$P9(x,y) \Rightarrow E4(y)$
$P9(x,y) \Rightarrow P10(y,x)$
$[P9(x,y) \wedge P9(y,z)] \Rightarrow P9(x,z)$
$P9(x,y) \Rightarrow \neg P9(y,x)$

P10 falls within (contains)

Domain:

E92 Spacetime Volume

Range:

E92 Spacetime Volume

Subproperty of:

E92 Spacetime Volume. P132 spatiotemporally overlaps with: E92 Spacetime Volume

Superproperty of:

E93 Presence. P166 was a presence of (had presence): E92 Spacetime Volume
E4 Period. P9i forms part of: E4 Period

Quantification:

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

Scope note:

This property associates an instance of E92 Spacetime Volume with another instance of E92 Spacetime Volume that falls within the latter. In other words, all points in the former are also points in the latter.

This property is transitive and reflexive.

Examples:

■ The Great Plague (E4) *falls within* The Gothic period (E4). (Porter, 2009)

In First Order Logic:

$P10(x,y) \Rightarrow E92(x)$
$P10(x,y) \Rightarrow E92(y)$
$P10(x,y) \Rightarrow P132(x,y)$
$P10(x,y) \wedge P10(y,z)] \Rightarrow P10(x,z)$
$P10(x,x)$

P46 is composed of (forms part of)

Domain:

E18 Physical Thing

Range:

E18 Physical Thing

Superproperty of:

E19 Physical Object. P56 bears feature (is found on): E26 Physical Feature

Quantification:

many to many (0,n:0,n)

Scope note:

This property associates an instance of E18 Physical Thing with another instance of Physical Thing that forms part of it. The spatial extent of the composing part is included in the spatial extent of the whole.

Component elements, since they are themselves instances of E18 Physical Thing, may be further analysed into sub-components, thereby creating a hierarchy of part decomposition. An instance of E18 Physical Thing may be shared between multiple wholes, for example two buildings may share a common wall. This property does not specify when and for how long a component element resided in the respective whole. If a component is not part of a whole from the beginning of existence or until the end of existence of the whole, the classes E79 Part Addition and E90 Part Removal can be used to document when a component became part of a particular whole and/or when it stopped being a part of it. For the time-span of being part of the respective whole, the component is completely contained in the place the whole occupies.

This property is intended to describe specific components that are individually documented, rather than general aspects. Overall descriptions of the structure of an instance of E18 Physical Thing are captured by the *P3 has note* property.

The instances of E57 Material of which an instance of E18 Physical Thing is composed should be documented using *P45 consists of (is incorporated in)*.

This property is transitive and non-reflexive

Examples:

■ The Royal carriage (E22) *forms part of* the Royal train (E22).
■ The "Hog's Back" (E24) *forms part of* the "Fosseway" (E24).

In First Order Logic:

$P46(x,y) \Rightarrow E18(x)$

$P46(x,y) \Rightarrow E18(y)$

$P46(x,y) \Rightarrow P132(x,y)$

$[P46(x,y) \wedge P46(y,z)] \Rightarrow P46(x,z)$

$P46(x,y) \Rightarrow (\exists uzw)[E93(u) \wedge P195i\ (x,u) \wedge\ E52(z) \wedge P164(u,z) \wedge\ E93(w) \wedge P195i\ (w,y) \wedge\ P164(w,z) \wedge P10(w,u)]$

$\neg P46(x,x)$

P69 has association with (is associated with)

Domain:

    <u>E29</u> Design or Procedure

Range:

    <u>E29</u> Design or Procedure

Quantification:

    many to many (0,n:0,n)

Scope note:

This property generalises relationships like whole-part, sequence, prerequisite or inspired by between instances of E29 Design or Procedure. Any instance of E29 Design or Procedure may be associated with other designs or procedures. The property is considered to be symmetrical unless otherwise indicated by *P69.1 has type*. The property is not transitive

The *P69.1 has type* property of *P69 has association with* allows the nature of the association to be specified reading from domain to range; examples of types of association between instances of E29 Design or Procedure include: has part, follows, requires, etc.

The property can typically be used to model the decomposition of the description of a complete workflow into a series of separate procedures.

Examples:

- The procedure for glass blowing (E29) *has association with* the procedure for glass heating (E29). (Brooks, 1973)
- The set of instructions for performing Macbeth in Max Reinhardt's production in 1916 in Berlin at Deutsches Theater (E29) *has association with* the scene design drawing by Ernst Stern reproduced at http://www.glopad.org/pi/fr/record/digdoc/1003814 (E29) *has type* has part (E55).
- The preparation of parchment (E29) *has association with* soaking and unhairing of skin (E29) *has type* has part (E55).
- Stretching of skin (E29) *has association with* soaking and unhairing of skin (E29) *has type* follows (E55). (Poole and Reed, 1962)
- The plan for reassembling the temples at Abu Simbel (E29) *has association with* the plan for storing and transporting the blocks (E29) *has type* follows (E55). (Loubiere, 1995)

In First Order Logic:

$P69(x,y) \Rightarrow E29(x)$

$P69(x,y) \Rightarrow E29(y)$

$P69(x,y,z) \Rightarrow [P69(x,y) \wedge E55(z)]$

Properties:

P69.1 has type: <u>E55</u> Type

P73 has translation (is translation of)

Domain:

<u>E33</u> Linguistic Object

Range:

<u>E33</u> Linguistic Object

Subproperty of:

<u>E70</u> Thing. <u>P130</u>i features are also found on: <u>E70</u> Thing

Quantification:

many to many (0,n:0,n)

Scope note:

This property links an instance of E33 Linguistic Object (A), to another instance of E33 Linguistic Object (B) which is the translation of A.

When an instance of E33 Linguistic Object is translated into a new language a new instance of E33 Linguistic Object is created, despite the translation being conceptually similar to the source.

This property is non-symmetric.

Examples:

■ "Les Baigneurs" (E33) *has translation* "The Bathers" (E33). (Spiers & Surenne, 1854)

In First Order Logic:

$P73(x,y) \Rightarrow E33(x)$

$P73(x,y) \Rightarrow E33(y)$

$P73(x,y) \Rightarrow P130i(x,y)$

$P73(x,y) \Rightarrow \neg P73(y,x)$

P86 falls within (contains)

Domain:

<u>E52</u> Time-Span

Range:

<u>E52</u> Time-Span

Quantification:

many to many (0,n:0,n)

Scope note:

> This property describes the inclusion relationship between two instances of E52 Time-Span.
>
> This property supports the notion that the temporal extent of an instance of E52 Time-Span falls within the temporal extent of another instance of E52 Time-Span. It addresses temporal containment only, and no contextual link between the two instances of E52 Time-Span is implied. This property is transitive.

Examples:

> - The time-span of the Apollo 11 moon mission (E52) *falls within* the time-span of the reign of Queen Elizabeth II (E52). (Riley, 2009) (Robinson, 2000)

In First Order Logic:

> $P86(x,y) \Rightarrow E52(x)$
> $P86(x,y) \Rightarrow E52(y)$
> $[P86(x,y) \wedge P86(y,z)] \Rightarrow P86(x,z)$

P89 falls within (contains)

Domain:

> E53 Place

Range:

> E53 Place

Quantification:

> many to many, necessary, dependent (1,n:0,n)

Scope note:

> This property identifies an instance of E53 Place that falls wholly within the extent of another instance of E53 Place.
>
> It addresses spatial containment only and does not imply any relationship between things or phenomena occupying these places.
>
> This property is transitive and reflexive.

Examples:

> - The area covered by the World Heritage Site of Stonehenge (E53) *falls within* the area of Salisbury Plain (E53). (Pryor, 2016)

In First Order Logic:

> $P89(x,y) \Rightarrow E53(x)$
> $P89(x,y) \Rightarrow E53(y)$
> $[P89(x,y) \wedge P89(y,z)] \Rightarrow P89(x,z)$
> $P89(x,x)$

P106 is composed of (forms part of)

Domain:

> E90 Symbolic Object

Range:

> E90 Symbolic Object

Superproperty of:

> E73 Information Object. P165 incorporates (is incorporated in): E90 Symbolic Object

Quantification:

> many to many (0,n:0,n)

Scope note:

> This property associates an instance of E90 Symbolic Object with a part of it that is by itself an instance of E90 Symbolic Object, such as fragments of texts or clippings from an image.

> This property is transitive and non-reflexive.

Examples:

- This Scope note of property P106 (E33) *is composed of* 'fragments of texts' (E33).
- 'recognizable' (E90) *is composed of* 'ecognizabl' (E90).

In First Order Logic:

> $P106(x,y) \Rightarrow E90(x)$
> $P106(x,y) \Rightarrow E90(y)$
> $[P106(x,y) \wedge P106(y,z)] \Rightarrow P106(x,z)$
> $\neg P106(x,x)$

P121 overlaps with

Domain:

> E53 Place

Range:

> E53 Place

Quantification:

> many to many (0,n:0,n)

Scope note:

> This symmetric property associates an instance of E53 Place with another instance of E53 Place geometrically overlapping it.

> It does not specify anything about the shared area. This property is purely spatial. It does not imply that phenomena that define, by their extent, places related by *P121 overlaps with* have ever covered a common area at the same time or even coexisted. In contrast, spatiotemporal overlaps described by *P132 spatiotemporally overlaps* are the total of areas simultaneously covered by the related spacetime volumes.

This property is symmetric.

Examples:

- The territory of the United States as in 2020 (E53) *overlaps with* the Arctic (E53). (Gannett et al., 1904)
- The maximal extent of the Kingdom of Greece (1832-1973) (E53) *overlaps with* the maximal extent of the Republic of Turkey (29th October 1923 to now) (E53).

In First Order Logic:

$P121(x,y) \Rightarrow E53(x)$
$P121(x,y) \Rightarrow E53(y)$
$P121(x,y) \Rightarrow P121(y,x)$

P122 borders with

Domain:

E53 Place

Range:

E53 Place

Quantification:

many to many (0,n:0,n)

Scope note:

This symmetric property associates an instance of E53 Place with another instance of E53 Place which shares a part of its border.

This property is purely spatial. It does not imply that the phenomena that define, by their extent, places related by *P122 borders with* have ever shared a respective border at the same time or even coexisted. In particular, this may be the case when the respective common border is formed by a natural feature.

This property is not transitive. This property is symmetric.

Examples:

- Scotland in its 1603 borders (E53) *borders with* England in its 1603 borders (E53). (Crofton, 2015)

In First Order Logic:

$P122(x,y) \Rightarrow E53(x)$
$P122(x,y) \Rightarrow E53(y)$
$P122(x,y) \Rightarrow P122(y,x)$

P127 has broader term (has narrower term)

Domain:

E55 Type

Range:

E55 Type

Quantification:

        many to many (0,n:0,n)

Scope note:

        This property associates an instance of E55 Type with another instance of E55 Type that has a broader meaning.

        It allows instances of E55 Types to be organised into hierarchies. This is the sense of "broader term generic (BTG)" as defined in ISO 25964-2:2013 (International Organization for Standardization 2013).

        This property is transitive.

Examples:

        ■ dime (E55) *has broader term* coin (E55). (Yerkes, 1989)

In First Order Logic:

        $P127(x,y) \Rightarrow E55(x)$
        $P127(x,y) \Rightarrow E55(y)$
        $[P127(x,y) \wedge P127(y,z)] \Rightarrow P127(x,z)$

P130 shows features of (features are also found on)

Domain:

        E70 Thing

Range:

        E70 Thing

Superproperty of:

        E33 Linguistic Object. P73i is translation of: E33 Linguistic Object
        E18 Physical Thing. P128 carries (is carried by): E90 Symbolic Object

Quantification:

        many to many (0,n:0,n)

Scope note:

        This property generalises the notions of "copy of" and "similar to" into a directed relationship, where the domain expresses the derivative or influenced item and the range the source or influencing item, if such a direction can be established. The property can also be used to express similarity in cases that can be stated between two objects only, without historical knowledge about its reasons. The property expresses a symmetric relationship in case no direction of influence can be established either from evidence on the item itself or from historical knowledge. This holds in particular for siblings of a derivation process from a common source or non-causal cultural parallels, such as some weaving patterns.

        The *P130.1 kind of similarity* property of the *P130 shows features of (features are also found on)* property enables the relationship between the domain and the range to be further clarified, in the sense from domain to range, if applicable. For example, it may be expressed if both items are product "of the same mould", or if two texts "contain identical paragraphs".

If the reason for similarity is a sort of derivation process, i.e., that the creator has used or had in mind the form of a particular thing during the creation or production, this process should be explicitly modelled. In these cases, *P130 shows features of* can be regarded as a shortcut of such a process. However, the current model does not contain any path specific enough to infer this property. Specializations of the CIDOC CRM may however be more explicit, for instance describing the use of moulds etc.

This property is not transitive.

Examples:

- Mary Lamb's Cymbeline from Charles and Mary Lamb's Tales from Shakespeare (E89) *shows features of* William Shakespeare's Cymbeline (E89). (Carrington, 1954)
- The audio recording of Dante Alighieri's La divina commedia read by Enrico de Negri (E73) *shows features of* the text of Dante Alighieri's La divina commedia (E89). (Alighieri, 1956)

In First Order Logic:

$P130(x,y) \Rightarrow E70(x)$
$P130(x,y) \Rightarrow E70(y)$
$P130(x,y,z) \Rightarrow [P130(x,y) \land E55(z)]$

Properties:

P130.1 kind of similarity: E55 Type

P132 spatiotemporally overlaps with

Domain:

> E92 Spacetime Volume

Range:

> E92 Spacetime Volume

Superproperty of:

> E4 Period. P9 consists of (forms part of): E4 Period
> E92 Spacetime Volume. P10 falls within (contains): E92 Spacetime Volume

Quantification:

> many to many (0,n:0,n)

Scope note:

> This symmetric property associates two instances of E92 Spacetime Volume that have some of their extents in common. If only the fuzzy boundaries of the instances of E92 Spacetime Volume overlap, this property cannot be determined from observation alone and therefore should not be applied. However, there may be other forms of justification that the two instances of E92 Spacetime Volume must have some of their extents in common regardless of where and when precisely.

> If this property holds for two instances of E92 Spacetime Volume then it cannot be the case that *P133 is spatiotemporally separated* from also holds for the same two instances. Furthermore, there are cases where neither *P132 spatiotemporally overlaps with* nor *P133 is spatiotemporally separated from* holds between two instances of E92 Spacetime Volume. This would occur where only an overlap of the fuzzy boundaries of the two instances of E92 Spacetime Volume occurs and no other evidence is available.

> This property is symmetric

Examples:

> ■ The "Urnfield" period (E4*) spatiotemporally overlaps with* the "Hallstatt" period (E4. (Gimbutas, 1965)

In First Order Logic:

> P132(x,y) ⇒ E92(x)
> P132(x,y) ⇒ E92(y)
> P132(x,y) ⇒ P132(y,x)
> P132(x,y) ⇒ ¬P133(x,y)

P133 is spatiotemporally separated from

Domain:

> E92 Spacetime Volume

Range:

> E92 Spacetime Volume

Quantification:

many to many (0,n:0,n)

Scope note:

This symmetric property associates two instances of E92 Spacetime Volume that have no extents in common. If only the fuzzy boundaries of the instances of E92 Spacetime Volume overlap, this property cannot be determined from observation alone and therefore should not be applied. However, there may be other forms of justification that the two instances of E92 Spacetime Volume must not have any of their extents in common regardless of where and when precisely.

If this property holds for two instances of E92 Spacetime Volume then it cannot be the case that *P132 spatiotemporally overlaps with* also holds for the same two instances. Furthermore, there are cases where neither *P132 spatiotemporally overlaps with* nor *P133 is spatiotemporally separated from* holds between two instances of E92 Spacetime Volume. This would occur where only an overlap of the fuzzy boundaries of the two instances of E92 Spacetime Volume occurs and no other evidence is available.

This property is not transitive. This property is symmetric.

Examples:

- The "Hallstatt" period (E4) *is spatiotemporally separated from* the "La Tène" era (E4). (Marion, 2004)
- Kingdom of Greece (1831-1924) (E92) *is spatiotemporally separated from* Ottoman Empire (1299-1922) (E92).
- The path of the army of Alexander the Great (335-323 B.C.) (E7) *is spatiotemporally separated from* the Mauryan Empire (E4). (Lane Fox, 2004)

In First Order Logic:

P133(x,y) ⇒ E92(x)
P133(x,y) ⇒ E92(y)
P133(x,y) ⇒ P133(y,x)
P133(x,y) ⇒ ¬P132(x,y)

P134 continued (was continued by)

Domain:

E7 Activity

Range:

E7 Activity

Subproperty of:

E7 Activity. P15 was influenced by (influenced): E1 CRM Entity
E2 Temporal Entity. P176i starts before the start of (starts after the start of): E2 Temporal Entity

Quantification:

many to many (0,n:0,n)

Scope note:

This property associates two instances of E7 Activity, where the domain is considered as an intentional continuation of the range. A continuation of an activity may happen when the continued activity is still ongoing or after the continued activity has completely ended. The continuing activity may have started already before it decided to continue the other one. Continuation implies a coherence of intentions and outcomes of the involved activities.

This property is not transitive.

Examples:

- The construction of the Kölner Dom (Cologne Cathedral) , abandoned in the 15th century (E7), *was continued by* construction in the 19th century (E7). [The construction in the 19th century adapted the initial plans so as to preserve the intended appearance.] (Wolff, 1999)

In First Order Logic:

P134(x,y) ⇒ E7(x)
P134(x,y)⇒ E7(y)
P134(x,y) ⇒ P15(x,y)
P134(x,y) ⇒ P176i(x,y)

P139 has alternative form

Domain:

<u>E41</u> Appellation

Range:

<u>E41</u> Appellation

Quantification:

many to many (0,n:0,n)

Scope note:

This property associates an instance of E41 Appellation with another instance of E41 Appellation that constitutes a derivative or variant of the former and that may also be used for identifying items identified by the former, in suitable contexts, independent from the particular item to be identified. This property should not be confused with additional variants of names used characteristically for a single, particular item, such as individual nicknames. It is an asymmetric relationship, where the range expresses the derivative, if such a direction can be established. Otherwise, the relationship is symmetric. The relationship is not transitive.

Multiple names assigned to an object, which do not apply to all things identified with the specific instance of E41 Appellation, should be modelled as repeated values of *P1 is identified by (identifies)* of this object.

P139.1 has type allows the type of derivation to be refined, for instance "transliteration from Latin 1 to ASCII".

Examples:

- ■ "Martin Doerr" (E41) *has alternative form* "Martin Dörr" (E41) *has type* Alternate spelling (E55).
- ■ "Гончарова, Наталья Сергеевна" (E41) *has alternative form* "Gončarova, Natal´â Sergeevna" (E41) *has type* ISO 9:1995 transliteration (E55).
- ■ "Αθήνα" (E41) *has alternative form* "Athina" (E41) *has type* transcription (E55).

In First Order Logic:

$P139(x,y) \Rightarrow E41(x)$
$P139(x,y) \Rightarrow E41(y)$
$P139(x,y,z) \Rightarrow [P139(x,y) \wedge E55(z)]$
$P139(x,y) \Rightarrow P139(y,x)$
$\neg P139(x,x)$

Properties:

P139.1 has type: <u>E55</u> Type

P148 has component (is component of)

Domain:

<u>E89</u> Propositional Object

Range:

<u>E89</u> Propositional Object

Quantification:

many to many (0:n,0:n)

Scope note:

This property associates an instance of E89 Propositional Object with a structural part of it that is by itself an instance of E89 Propositional Object.

This property is transitive.

Examples:

- ■ Dante's "Divine Comedy" (E89) *has component* Dante's "Hell" (E89). (Alighieri, 1956)

In First Order Logic:

$P148(x,y) \Rightarrow E89(x)$
$P148(x,y) \Rightarrow E89(y)$
$[P148(x,y) \wedge P148(y,z)] \Rightarrow P148(x,z)$

P150 defines typical parts of (defines typical wholes for)

Domain

<u>E55</u> Type

Range:

<u>E55</u> Type

Quantification:

many to many (0,n:0,n)

Scope note:

This property associates an instance of E55 Type "A" with an instance of E55 Type "B", when items of type "A" typically form part of items of type "B", such as "car motors" and "cars".

It allows types to be organised into hierarchies based on one type describing a typical part of another. This property is equivalent to "broader term partitive (BTP)" as defined in ISO 2788 and "broaderPartitive" in SKOS.

This property is not transitive.

Examples:

■ car motors (E55) *defines typical parts of* cars (E55). (fictitious)

In First Order Logic:

P150(x,y) ⇒ E55(x)
P150(x,y) ⇒ E55(y)

P152 has parent (is parent of)

Domain:

E21 Person

Range:

E21 Person

Quantification:

many to many, necessary (2,n:0,n)

Scope note:

This property associates an instance of E21 Person with another instance of E21 Person who plays the role of the first instance's parent, regardless of whether the relationship is biological parenthood, assumed or pretended biological parenthood or an equivalent legal status of rights and obligations obtained by a social or legal act.

This property is, among others, a shortcut of the fully developed paths from E21 Person through *P98i was born,* E67 Birth*, P96 by mother* to E21 Person*,* and from E21 Person through *P98i was born,* E67 Birth*, P97 from father* to E21 Person.

This property is not transitive.

Examples:

■ Gaius Octavius (E21) *has parent* Julius Caesar (E21). (Bleicken & Bell, 2015)
■ Steve Jobs (E21) *has parent* Joanne Simpson (E21). [Biological mother] (Isaacson, 2011)
■ Steve Jobs (E21) *has parent* Clara Jobs (E21). [Adoption mother] (Isaacson, 2011)

In First Order Logic:

$P152(x,y) \Rightarrow E21(x)$

$P152(x,y) \Rightarrow E21(y)$

$P152(x,y) \Leftarrow (\exists z) [E67(z) \land P98i(x,z) \land P96(z,y)]$

$P152(x,y) \Leftarrow (\exists z) [E67(z) \land P98i(x,z) \land P97(z,y)]$

P165 incorporates (is incorporated in)

Domain:

E73 Information Object

Range:

E90 Symbolic Object

Subproperty of:

E90 Symbolic Object. P106 is composed of (forms part of): E90 Symbolic Object

Quantification:

many to many (0,n:0,n)

Scope note:

This property associates an instance of E73 Information Object with an instance of E90 Symbolic Object (or any of its subclasses) that was included in it.

This property makes it possible to recognise the autonomous status of the incorporated signs, which were created in a distinct context, and can be incorporated in many instances of E73 Information Object, and to highlight the difference between structural and accidental whole-part relationships between conceptual entities.

It accounts for many cultural facts that are quite frequent and significant: the inclusion of a poem in an anthology, the re-use of an operatic aria in a new opera, the use of a reproduction of a painting for a book cover or a CD booklet, the integration of textual quotations, the presence of lyrics in a song that sets those lyrics to music, the presence of the text of a play in a movie based on that play, etc.

In particular, this property allows for modelling relationships of different levels of symbolic specificity, such as the natural language words making up a particular text, the characters making up the words and punctuation, the choice of fonts and page layout for the characters.

When restricted to information objects, that is, seen as a property with E73 Information Object as domain and range the property is transitive.

A digital photograph of a manuscript page incorporates the text of a manuscript page, if the respective text is defined as a sequence of symbols of a particular type, such as Latin characters, and the resolution and quality of the digital image is sufficient to resolve these symbols so they are readable on the digital image.

Examples:

■ The content of Charles-Moïse Briquet's 'Les Filigranes: dictionnaire historique des marques du papier' (E32) *incorporates* the visual aspect of the watermark used around 1358-61 by some Spanish papermaker(s) and identified as 'Briquet 4019' (E37). (Briquet, 1985)

- The visual content of Jacopo Amigoni's painting known as 'The Singer Farinelli and friends' (E36) *incorporates* the musical notation of Farinelli's musical work entitled 'La Partenza' (E73). (National Gallery of Victoria)
- The visual content of Nicolas Poussin's painting entitled 'Les Bergers d'Arcadie' (E36) *incorporates* the Latin phrase 'Et in Arcadia ego' (E33). (Wikipedia, 2020)

In First Order Logic:

$P165(x,y) \Rightarrow E73(x)$
$P165(x,y) \Rightarrow E90(y)$
$P165(x,y) \Rightarrow P106(x,y)$

P173 starts before or with the end of (ends after or with the start of)

Domain:

E2 Temporal Entity

Range:

E2 Temporal Entity

Superproperty of:

E2 Temporal Entity. P174 starts before the end of (ends after the start of): E2 Temporal Entity

Quantification:

many to many (0,n:0,n)

Scope note:

This property specifies that the temporal extent of the domain instance A of E2 Temporal Entity starts before or simultaneously with the end of the temporal extent of the range instance B of E2 Temporal Entity.

In other words, if A = [A^{start}, A^{end}] and B = [B^{start}, B^{end}], we mean $A^{start} \leq B^{end}$ is true.

This property is part of the set of temporal primitives P173 – P176, P182 – P185.

This property corresponds to the disjunction (logical OR) of the following Allen temporal relations (Allen, 1983): {before, meets, met-by, overlaps, starts, started-by, contains, finishes, finished-by, equals, during, overlapped by}.

Figure 8: Temporal entity A starts before or with the end of temporal entity B. Here A is longer than B

Figure 9: Temporal entity A starts before or with the end of temporal entity B. Here A is shorter than B

Examples:

- The legendary run from Marathon to Athens 490BC (E7) *starts before or with the end of* The Battle of Marathon 490BC (E7).
- LMIIB (E4) *P173i ends after or with the start of* the Tutankhamun period (1332-1323 B.C.E.) (E4). [Evidence for this is provided by the scarab seal found at Poros in a context of LMIIB. The scarab belongs to the type "nh.s n Jmn". During the Akhenaten period he production of these scarab seals stopped (the name of Amun is not referred to during his reign). So the scarab could not have been produced before the Tutankhamun period and is probably a later production.] (Karetsou, 2000

In First Order Logic:

$P173(x,y) \Rightarrow E2(x)$
$P173(x,y) \Rightarrow E2(y)$

P174 starts before the end of (ends after the start of)

Domain:

E2 Temporal Entity

Range:

E2 Temporal Entity

Subproperty of:

E2 Temporal Entity. P173 starts before or at the end of (ends after or with the start of): E2 Temporal Entity

Superproperty of:

E2 Temporal Entity. P175 starts before or with the start of (starts after or with the start of): E2 Temporal Entity

E2 Temporal Entity. P184 ends before or with the end of (ends with or after the end of): E2 Temporal Entity

Quantification:

many to many (0,n:0,n)

Scope note:

This property specifies that the temporal extent of the domain instance A of E2 Temporal Entity starts definitely before the end of the temporal extent of the range instance B of E2 Temporal Entity.

In other words, if A = [A^{start}, A^{end}] and B = [B^{start}, B^{end}], we mean $A^{start} < B^{end}$ is true.

This property is part of the set of temporal primitives P173 – P176, P182 – P185.

This property corresponds to a disjunction (logical OR) of the following Allen temporal relations (Allen, 1983): {before, meets, overlaps, starts, started-by, contains, finishes, finished-by, equals, during, overlapped by}

Typically, this property is a consequence of a known influence of some event on another event or activity, such as a novel written by someone being continued by someone else, or the knowledge of a defeat on a distant battlefield causing people to end their ongoing activities. This property is not transitive.

Figure 10: Temporal entity A starts before the end of temporal entity B. Here A is longer than B

Figure 11: Temporal entity A starts before the end of temporal entity B. Here A is shorter than B

Examples:

- The settling activity of the city of Assur (Ashur) (E7) *starts before the end of* The Tenth Dynasty of Egypt (E4). [There are some 200 - 300 years differences in the chronology of the First Intermediate Period, and Assur is dated to "about 2500 BC".] *(Pedersén, 1986)*

In First Order Logic:

$$P174(x,y) \Rightarrow E2(x)$$
$$P174(x,y) \Rightarrow E2(y)$$
$$P174(x,y) \Rightarrow P173(x,y)$$

P175 starts before or with the start of (starts after or with the start of)

Domain:

E2 Temporal Entity

Range:

E2 Temporal Entity

Subproperty of:

E2 Temporal Entity. P174 starts before the end of (ends after the start of): E2 Temporal Entity

Superproperty of:

E2 Temporal Entity. P176 starts before the start of (starts after the start of): E2 Temporal Entity

Quantification:

> many to many (0,n:0,n)

Scope note:

> This property specifies that the temporal extent of the domain instance A of E2 Temporal Entity starts before or simultaneously with the start of the temporal extent of the range instance B of E2 Temporal Entity.
>
> In other words, if A = [A^{start}, A^{end}] and B = [B^{start}, B^{end}], we mean A^{start} ≤ B^{start} is true.
>
> This property is part of the set of temporal primitives P173 – P176, P182 – P185.
>
> This property corresponds to a disjunction (logical OR) of the following Allen temporal relations (Allen, 1983): {before, meets, overlaps, starts, started-by, contains, finished-by, equals}
>
> In a model with fuzzy borders, this property will not be transitive.

Figure 12: Temporal entity A starts before or with the start of temporal entity B. Here A is longer than B

Figure 13: Temporal entity A starts before or with the start of temporal entity B. Here A is shorter than B

Examples:

> ■ The production of the scarab seal found in Poros in a context of LMIIIB (E12) *starts after or with the start of* Tutankhamun period (1332-1323 B.C) (E4). [The scarab stamp seal found in Poros was associated with finds dated to the LMIIIB period. The seal is dated to the Tutankhamun period or later because it belongs to the scarabs of type "nh.s n Jmn": During Akhenaten period, the production of this type of scarab seal stopped (the name of Amun is not referred to during his reign). Therefore, the scarab cannot have been produced before the Tutankhamun period and is probably a later production] (Karetsou, 2000)
> ■ The production of the cylindrical seal of the first Dynasty of Babylon found in Tholos B in Platanos (E12) *starts after or with the start of* the Hammurabi period of the kingdom (E4). [Of the cylindrical seal of the first Dynasty of Babylon found in tholos B in Platanos believed to connect king Hammurabi with the MM I period. Specifically, although the finding is believed to have been found in a MM I layer, it contained material from the MM III/YM I period. Therefore, the seal may be from the Hammurabi period or, it may be from a later period.] (Walberg, 1992.)

In First Order Logic:

> P175(x,y) ⇒ E2(x)
> P175(x,y) ⇒ E2(y)
> P175(x,y) ⇒ P174(x,y)

P176 starts before the start of (starts after the start of)

Domain:

E2 Temporal Entity

Range:

E2 Temporal Entity

Subproperty of:

E2 Temporal Entity. P175 starts before or with the start of (starts after or with the start of): E2 Temporal Entity

Superproperty of:

E7 Activity. P134i was continued by: E7 Activity

E2 Temporal Entity. P182 ends before or at the start of (starts after or with the end of): E2 Temporal Entity

Quantification:

many to many (0,n:0,n)

Scope note:

This property specifies that the temporal extent of the domain instance A of E2 Temporal Entity starts definitely before the start of the temporal extent of the range instance B of E2 Temporal Entity.

In other words, if $A = [A^{start}, A^{end}]$ and $B = [B^{start}, B^{end}]$, we mean $A^{start} < B^{start}$ is true.

This property is part of the set of temporal primitives P173 – P176, P182 – P185.

This property corresponds to a disjunction (logical OR) of the following Allen temporal relations (Allen, 1983): {before, meets, overlaps, contains, finished-by}. This property is transitive.

Figure 14: Temporal entity A starts before the start of temporal entity B. Here A is longer than B

Figure 15: Temporal entity A starts before the start of temporal entity B. Here A is shorter than B

In First Order Logic:

$P176(x,y) \Rightarrow E2(x)$

$P176(x,y) \Rightarrow E2(y)$

$$P176(x,y) \Rightarrow P175(x,y)$$
$$[P176(x,y) \wedge P176(y,z)] \Rightarrow P176(x,z)$$

P182 ends before or with the start of (starts after or with the end of)

Domain:

    E2 Temporal Entity

Range:

    E2 Temporal Entity

Subproperty of:

    E2 Temporal Entity. P176 starts before the start of (starts after the start of): E2 Temporal Entity
    E2 Temporal Entity. P185 ends before the end of (ends after the end of): E2 Temporal Entity

Superproperty of:

    E2 Temporal Entity. P183 ends before the start of (starts after the end of): E2 Temporal Entity

Quantification:

    many to many (0,n:0,n)

Scope note:

This property specifies that the temporal extent of the domain instance A of E2 Temporal Entity ends before or simultaneously with the start of the temporal extent of the range instance B of E2 Temporal Entity.

In other words, if A = [A^{start}, A^{end}] and B = [B^{start}, B^{end}], we mean A^{end} ≤ B^{start} is true.

This property is part of the set of temporal primitives P173 – P176, P182 – P185.

This property corresponds to a disjunction (logical OR) of the following Allen temporal relations (Allen, 1983): {before, meets}.
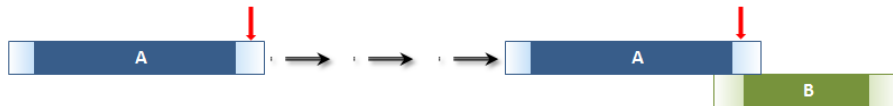

Figure 16: Temporal entity A ends before or with the start of temporal entity B. Here A is longer than B
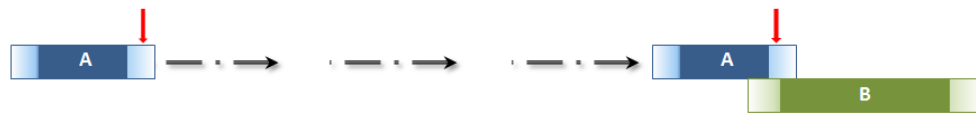

Figure 17: Temporal entity A ends before or with the start of temporal entity B. Here A is shorter than B

Examples:

■ Lerna III (E4) *ends before or with the start of* Lerna IV (E4). ["The site at Lerna probably was not left uninhabited for long after the destruction of the House of the Tiles and the raising of the tumulus. If there was a gap corresponding to the earliest stage of EH III in the Argolid, as has been suggested by some (see, e.g., Manning 1995: 55–60), it was a brief one. In Rutter's view,

the short life of the Fourth Settlement began ca. 2200/2150 b.c. and ended ca. 2050/2000 b.c."]
(Banks & Reese, 2013)

■ The use of LH I graves of Krisa in Phocis (E4) *ends before or with the start of* LH III phase of reuse of the graves of Krisa in Phocis (E4). ["…a *possible* hiatus in the occupation of certain sites such as the settlement of Krisa in Phocis, which was well occupied in the MH and LHIII periods. LHIIB pottery from this settlement has already been identified, but no certain example of LHIIA pottery.] (Phialon 2018)

In First Order Logic:

$$P182(x,y) \Rightarrow E2(x)$$
$$P182(x,y) \Rightarrow E2(y)$$
$$P182(x,y) \Rightarrow P176(x,y)$$
$$P182(x,y) \Rightarrow P185(x,y)$$

P183 ends before the start of (starts after the end of)

Domain:

E2 Temporal Entity

Range:

E2 Temporal Entity

Subproperty of:

E2 Temporal Entity. P182 ends before or at the start of (starts after or with the end of): E2 Temporal Entity

Quantification:

many to many (0,n:0,n)

Scope note:

This property specifies that the temporal extent of the domain instance A of E2 Temporal Entity ends definitely before the start of the temporal extent of the range instance B of E2 Temporal Entity.

In other words, if A = [A^{start}, A^{end}] and B = [B^{start}, B^{end}], we mean A^{end} < B^{start} is true.

This property is part of the set of temporal primitives P173 – P176, P182 – P185.

This property corresponds to the following Allen temporal relation (Allen, 1983) : {before}.
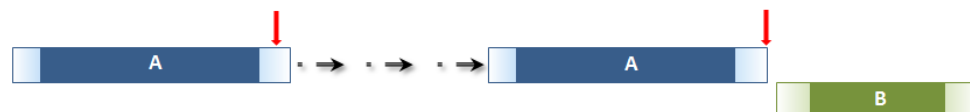
This property is transitive.

Figure 18: Temporal entity A ends before the start of temporal entity B. Here A is longer than B

Figure 19: Temporal entity A ends before the start of temporal entity B. Here A is shorter than B

Examples:

- Gisle taking office as Bishop of Linköping 1139 AD (E7) *ends before the start of* The Guta saga composition (E65). (Peel, 1999)
- Troy VII (E4) *ends before the start of* Troy VIII (E4). [uninhabited for some 200 years]
- The use of the Tomb Four from Nikitopoulou group in Nihoria in the MHIII-LHI period (E4) *ends before the start of* the period of reuse of the Tomb Four from Nikitopoulou group in LHIIIA (E4). ["Of the six tombs excavated in the Nikitopoulou group […] the finds in Tomb Four are of MH II or MH III-LH I date, with the exception of the finds with the Northern group of material, which is uniformly dated to LHIIA2, end the ewer in the middle of the floor, dated LHIIIA1. […] The preserved evidence seems clearly to indicate use in the MHIII-LHI use in the MHIII-LHI period followed by a period of reuse in LHIIIA, a pattern matched at architecturally similar sites such as *13:Kaminia* and *10:Gouvalári*"] (Boyd, 2002)

In First Order Logic:

$$P183(x,y) \Rightarrow E2(x)$$
$$P183(x,y) \Rightarrow E2(y)$$
$$P183(x,y) \Rightarrow P182(x,y)$$
$$[P183(x,y) \land P183(y,z)] \Rightarrow P183(x,z)$$

P184 ends before or with the end of (ends with or after the end of)

Domain:

    E2 Temporal Entity

Range:

    E2 Temporal Entity

Subproperty of:

    E2 Temporal Entity. P174 starts before the end of (ends after the start of): E2 Temporal Entity

Superproperty of:

    E2 Temporal Entity. P185 ends before the end of (ends after the end of): E2 Temporal Entity

Quantification:

    many to many (0,n:0,n)

Scope note:

    This property specifies that the temporal extent of the domain instance A of E2 Temporal Entity ends before or simultaneously with the end of the temporal extent of the range instance B of E2 Temporal Entity.

    In other words, if A = [A^{start}, A^{end}] and B = [B^{start}, B^{end}], we mean A^{end} ≤ B^{end} is true.

    This property is part of the set of temporal primitives P173 – P176, P182 – P185.

This property corresponds to a disjunction (logical OR) of the following Allen temporal relations (Allen, 1983): {before, meets, overlaps, finished by, start, equals, during, finishes}.

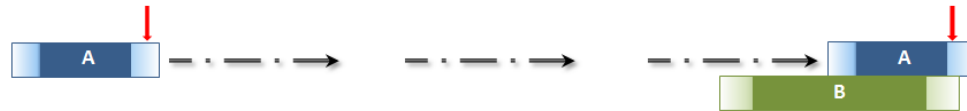*Figure 20: Temporal entity A ends before or with the end of temporal entity B. Here A is longer than B*

Figure 21: Temporal entity A ends before or with the end of temporal entity B. Here A is shorter than B

In First Order Logic:

$P184(x,y) \Rightarrow E2(x)$
$P184(x,y) \Rightarrow E2(y)$
$P184(x,y) \Rightarrow P174(x,y)$

P185 ends before the end of (ends after the end of)

Domain:

E2 Temporal Entity

Range:

E2 Temporal Entity

Subproperty of:

E2 Temporal Entity. P184 ends before or with the end of (ends with or after the end of): E2 Temporal Entity

Superproperty of:

E2 Temporal Entity. P182 ends before or at the start of (starts after or with the end of): E2 Temporal Entity

Quantification:

many to many (0,n:0,n)

Scope note:

This property specifies that the temporal extent of the domain instance A of E2 Temporal Entity ends definitely before the end of the temporal extent of the range instance B of E2 Temporal Entity.

In other words, if A = [A^{start}, A^{end}] and B = [B^{start}, B^{end}], we mean $A^{end} < B^{end}$ is true.

This property is part of the set of temporal primitives P173 – P176, P182 – P185.

This property corresponds to a disjunction (logical OR) of the following Allen temporal relations (Allen, 1983): {before, meets, overlaps, starts, during}.
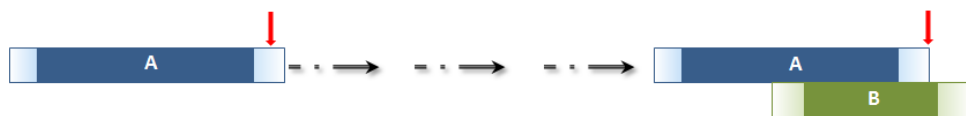
This property is transitive.

Figure 22: Temporal entity A ends before the end of temporal entity B. Here A is longer than B

Figure 23: Temporal entity A ends before the end of temporal entity B. Here A is shorter than B

In First Order Logic:

$$P185(x,y) \Rightarrow E2(x)$$
$$P185(x,y) \Rightarrow E2(y)$$
$$P185(x,y) \Rightarrow P184(x,y)$$
$$[P185(x,y) \wedge P185(y,z)] \Rightarrow P185(x,z)$$

P189 approximates (is approximated by)

Domain:

E53 Place

Range:

E53 Place

Quantification:

many to many (0,n:0,n)

Scope note:

This property associates an instance of E53 Place with another instance of E53 Place, which is defined in the same reference space, and which is used to approximate the former. The property does not necessarily state the quality or accuracy of this approximation, but rather indicates the use of the first instance of place to approximate the second.

In common documentation practice, find or encounter spots e.g., in archaeology, botany or zoology are often related to the closest village, river or other named place without detailing the relation, e.g., if it is located within the village or in a certain distance of the specified place. In this case the stated "phenomenal" place found in the documentation can be seen as approximation of the actual encounter spot without more specific knowledge.

In more recent documentation often point coordinate information is provided that originates from GPS measurements or georeferencing from a map. This point coordinate information does not state the actual place of the encounter spot but tries to approximate it with a "declarative" place. The accuracy depends on the methodology used when creating the coordinates. It may be dependent on technical limitations like GPS accuracy but also on the method where the GPS location is taken in relation to the measured feature. If the methodology is known a maximum

deviation from the measured point can be calculated and the encounter spot or feature may be related to the resulting circle using an instance of *P171 at some place within*.

This property is not transitive.

Examples:

- [40°31'17.9"N 21°15'48.3"E] (E53) *approximates* Kastoria, Greece, TGN ID: 7010880 (E53). [The approximating declarative place with point shape is defined in terms of coordinates taken from https://sws.geonames.org/735927]
- [40°31'00.1"N 21°16'00.1"E] (E53) *approximates* Kastoria, Greece, TGN ID: 7010880 (E53). [The approximating declarative place with point shape is defined in terms of coordinates taken from http://vocab.getty.edu/page/tgn/7010880]
- [40°04'60.0"N 22°21'00.0"E] (E53) *approximates* Mount Olympus National Park, Greece (E53). [The approximating declarative place with point shape is defined in terms of coordinates taken from https://www.geonames.org/6941814]

In First Order Logic:

P189(x,y) ⇒ E53(x)
P189(x,y) ⇒ E53 (y)
P189 (x,y,z) ⇒ [P189(x,y) ∧ E55(z)]

Properties:

P189.1 has type: E55 Type

P198 holds or supports (is held or supported by)

Domain:

E18 Physical Thing

Range:

E18 Physical Thing

Quantification:

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

Scope Note:

This property relates one instance of E18 Physical Thing which acts as a container or support to a supported or contained instance of E18 Physical Thing. Typical examples of E18 Physical Things which are intended to function as a container or support include shelves, folders or boxes. These containers or supports provide a stable surface which is intended for other physical objects to be placed upon for storage, display, transport or other similar functions.

This property is a shortcut of the more fully developed path from E18 Physical Thing through *P59 has section*, E53 Place, *P53i is former or current location of,* to E18 Physical Thing. It is not a sub-property of P46 is composed of, as the held or supported object is not a component of the container or support.

This property can be used to avoid explicitly instantiating the E53 Place which is defined by an instance of E18 Physical Thing, especially when the only intended use of that instance of E18 Physical Thing is to act as a container or surface for the storage of other instances of E18 Physical

Thing. The place's existence is defined by the existence of the container or surface, and will go out of existence at the same time as the destruction of the container or surface.

This property is transitive.

Examples:

- Archival folder "6" (E22) *holds or supports* the piece of paper carrying the text of a letter from Lawrence Alloway to Sylvia Sleigh (E22).
  [http://archives2.getty.edu:8082/xtf/view?docId=ead/2003.M.46/2003.M.46.xml;chunk.id=aspace_ref12_kf7;brand=default]
- Archival folder "17" (E22) *holds or supports the* daguerreotype that shows the image of Henry Ward Beecher as a young man (E22).
  [https://archives.yale.edu/repositories/12/archival_objects/1402266]
- Box "88" (E22) *holds or supports* folder "17" (E22).
  [https://archives.yale.edu/repositories/12/archival_objects/1402266]
- Bookshelf "GRI-708.1" (E22) *holds or supports* the book entitled "Catalog of Paintings in the J. Paul Getty Museum" (E22). (Potts, 2015)

In First Order Logic:

$P198(x,y) \Rightarrow E18(x)$

$P198(x,y) \Rightarrow E18(y)$

$[P198(x,y) \wedge P198(y,z)] \Rightarrow P198(x,z)$

$[P198(x,y) \wedge P198(z,y)] \Rightarrow [P198(x,z) \vee P198(z,x)]$

$P198(x,y) \Leftarrow (\exists z) [E53(z) \wedge P59(x,z) \wedge P53i(z,y)]$