#### P7 took place at (witnessed) redefinition.

##### New definition

**P7 took place at (witnessed)**

Domain: E4 Period

Range: E53 Place

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

Scope note: This property describes the spatial location of an instance of E4 Period.

The related instance of E53 Place should be seen as a wider approximation of the geometric area within which the phenomena that characterise the period in question occurred, see below.  *P7 took place at (witnessed)* does not convey any meaning other than spatial positioning (frequently on the surface of the earth).  For example, the period “Révolution française” can be said to have taken place in “France in 1789”; the “Victorian” period may be said to have taken place in “Britain from 1837-1901” and its colonies, as well as other parts of Europe and North America. An instance of E4 Period can take place at multiple non-contiguous, non-overlapping locations.

Any place where something happened includes the spatial projection of the happening given in the same geometric reference system. For instance, HMS Victory, as the place of Lord Nelson's death, includes the location of his body relative to the hull of HMS Victory at the time of his death as the most precise location of his death. By the definition of *P161 has spatial projection*, an instance of E4 Period takes place on all its spatial projections to respective reference systems, that is, instances of E53 Place. Therefore, this property implies the more fully developed path from E4 Period through *P161 has spatial projection*, E53 Place, *P89 falls within* to E53 Place, where the intermediate place is also defined in the same geometric system.  both places are defined in the same geometric reference system. The relation between an instance of E53 Place and its reference system can conveniently be documented via the property *P157 is at rest relative to (provides reference space for)*.

Something that has happened at a given place can also be considered to have happened at a smaller place within it: for example, it is reasonable to say Ceasar's murder took place in Rome, but also on the Forum Romanum, and more precisely in the Curia. It is characteristic for different historical sources to use varying precision in such statements, without being in contradiction with each other. This may be due to lack of knowledge or to the relevance of the precision for the purpose of the statement. In information integration, the more precise statement improves the overall knowledge.

Examples:

* The period “Révolution française” (E4) *took place at* the area covered by France in 1789 (E53). (Bertaud, 2004)

In First Order Logic:

P7(x,y) ⇒ E4(x)

P7(x,y) ⇒ E53(y)

P7(x,y) ⇒ (∃z,u) [E53(z) ˄ P157(x,u) ˄ E18(u) ˄ P157(y,u) ˄ P157(z,u) ˄ P161(x,z) ˄ P89(z,y) ]

(∃u) [E4(x) ˄ P157(x,u) ˄ E18(u) ˄ E53(y) ˄ P157(y,u) ˄ E53(z) ˄ P157(z,u) ˄ E53(v) ˄ P157(v,u) ˄ P7(x,y) ˄ P161(x,z) ˄ P89(z,v) ˄ P89(v,y) ] ⇒  P7(x,v)]

##### Old definition

**P7 took place at (witnessed)**

Domain: E4 Period

Range: E53 Place

Superproperty of: E92 Spacetime Volume. P161 has spatial projection (is spatial projection of): E53 Place

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

Scope note: This property describes the spatial location of an instance of E4 Period.

The related instance of E53 Place should be seen as a wider approximation of the geometric area within which the phenomena that characterise the period in question occurred, see below.  *P7 took place at (witnessed)* does not convey any meaning other than spatial positioning (frequently on the surface of the earth).  For example, the period “Révolution française” can be said to have taken place in “France in 1789”; the “Victorian” period may be said to have taken place in “Britain from 1837-1901” and its colonies, as well as other parts of Europe and North America. An instance of E4 Period can take place at multiple non-contiguous, non-overlapping locations.

This property is a shortcut of the more fully developed path from E4 Period through *P161 has spatial projection*, E53 Place, *P89 falls within* to E53 Place. E4 Period is a subclass of E92 Spacetime Volume. By the definition of *P161 has spatial projection* an instance of E4 Period takes place on all its spatial projections, that is, instances of E53 Place. Something happening at a given place can also be considered to happen at a larger place containing the first. For example, the assault on the Bastille July 14th 1789 took place in the area covered by Paris in 1789 but also in the area covered by France in 1789.

Examples:

* The period “Révolution française” (E4) *took place at* the area covered by France in 1789 (E53). (Bertaud, 2004)

In First Order Logic:

P7(x,y) ⇒ E4(x)

P7(x,y) ⇒ E53(y)

#### P161 has spatial projection (is spatial projection of) redefinition

##### New definition

**P161 has spatial projection (is spatial projection of)**

Domain: E92 Spacetime Volume

Range: E53 Place

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

Scope note: This property associates an instance of an instance of E92 Spacetime Volume with an instance of E53 Place that is the result of the spatial projection of the instance of the E92 Spacetime Volume on a reference space.

In general, there can be more than one useful reference space (for reference space see *P156 occupies* and *P157 is at rest relative to*) to describe the spatial projection of a spacetime volume, for example, in describing a sea battle, the difference between the battle ship and the seafloor as reference spaces. Thus, it can be seen that the projection is not unique.

The spatial projection is the actual spatial coverage of a spacetime volume, which normally has fuzzy boundaries except for instances of E92 Spacetime Volumes which are geometrically defined in the same reference system as the range of this property are an exception to this and do not have fuzzy boundaries. Modelling explicitly fuzzy spatial projections serves therefore as a common topological reference of different spatial approximations rather than absolute geometric determination, for instance for relating outer or inner spatial boundaries for the respective spacetime volumes.

The spatial projection is unique with respect to the reference system. For instance, there is exactly one spatial projection of Lord Nelson's dying relative to the ship HMS Victory, i.e., the location of his body relative to the ship HMS Victory at time of his death.

In case the domain of an instance of *P161 has spatial projection* is an instance of E4 Period, the spatial projection describes all areas that period was ever present at, for instance, the Roman Empire.

This property is part of the fully developed path from E18 Physical Thing through *P196 defines,* E92 Spacetime Volume, *P161 has spatial projection* to E53 Place, which in turn is implied by *P156 occupies (is occupied by).*

Examples:

* The Roman Empire (E4) *has spatial projection* all areas ever claimed by Rome (E53). (Clare & Edwards, 1992)

In First Order Logic:

P161(x,y) ⇒ E92(x)

P161(x,y) ⇒ E53(y)

(∃u) [E92(x) ˄ P157(x,u) ˄ E53(y) ˄ E53(z) ˄ E18(u) ˄ P157(y,u) ˄ P157(z,u) ˄ P161(x,y) ˄ P161(x,z) ] ⇒ (z = y)

 P161(x,y) ˄ E4(x) ⇒ P7(x,y)

##### Old definition

**P161 has spatial projection (is spatial projection of)**

Domain: E92 Spacetime Volume

Range: E53 Place

Subproperty of: E4 Period. P7 took place at (witnessed): E53 Place

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

Scope note: This property associates an instance of an instance of E92 Spacetime Volume with an instance of E53 Place that is the result of the spatial projection of the instance of the E92 Spacetime Volume on a reference space.

In general, there can be more than one useful reference space (for reference space see *P156 occupies* and *P157 is at rest relative to*) to describe the spatial projection of a spacetime volume, for example, in describing a sea battle, the difference between the battle ship and the seafloor as reference spaces. Thus, it can be seen that the projection is not unique.

The spatial projection is the actual spatial coverage of a spacetime volume, which normally has fuzzy boundaries except for instances of E92 Spacetime Volumes which are geometrically defined in the same reference system as the range of this property are an exception to this and do not have fuzzy boundaries. Modelling explicitly fuzzy spatial projections serves therefore as a common topological reference of different spatial approximations rather than absolute geometric determination, for instance for relating outer or inner spatial boundaries for the respective spacetime volumes.

In case the domain of an instance of *P161 has spatial projection* is an instance of E4 Period, the spatial projection describes all areas that period was ever present at, for instance, the Roman Empire.

This property is part of the fully developed path from E18 Physical Thing through *P196 defines,* E92 Spacetime Volume, *P161 has spatial projection* to E53 Place, which in turn is implied by *P156 occupies (is occupied by).*

This property is part of the fully developed path from E4 Period through *P161 has spatial projection*, E53 Place, *P89 falls within (contains)* to E53 Place, which in turn is shortcut by *P7 took place at (witnessed).*

Examples:

* The Roman Empire (E4) *has spatial projection* all areas ever claimed by Rome (E53). (Clare & Edwards, 1992)

In First Order Logic:

P161(x,y) ⇒ E92(x)

P161(x,y) ⇒ E53(y)