# **Guidelines for using P81a, P81b, P82a, P82b**

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The range of the properties "P81 ongoing throughout" and "P82 at some time within" are defined in the CRM as E61 Time Primitive. Instance of E61 Time Primitive are defined as closed, contiguous intervals on the natural time dimension in which we live. “Closed” means that the endpoints belong to the interval. “Contiguous” means that there are no gaps between the endpoints in the interval (which holds for “intervals” in general).

The reason to describe time spans with inner and outer intervals is the existence of a very efficient algebra for calculating resulting areas of determinacy and indeterminacy (Cowley & Plexousakis 2000). Further, they are motivated by the British MIDAS Heritage standards [<https://en.wikipedia.org/wiki/MIDAS_Heritage>] and easy to define in Relational databases.

Since the E61 Time Primitive of the CRM cannot be expressed in RDF directly, in the official RDF implementation of the CIDOC CRM, we define four properties replacing P81 and P82 adequately using xsd:dateTime.

## **P81 ongoing throughout**

Property P81 describes the maximum known temporal extent of an E52 Time-Span, i.e. the extent it is ongoing throughout. It is replaced in this RDF version by the property "P81a\_end\_of\_the\_begin" and "P81b\_begin\_of\_the\_end", to be used together.

"P81a\_end\_of\_the\_begin" should be instantiated as the earliest point in time the user is sure that the respective temporal phenomenon is indeed ongoing. We call it “end\_of\_the\_begin”, because it also constitutes an upper limit to the end of the indeterminacy or fuzziness of the beginning of the described temporal phenomenon.

"P81b\_begin\_of\_the\_end" should be instantiated as the latest point in time the user is sure that the respective temporal phenomenon is indeed ongoing. We call it “begin\_of\_the\_end”, because it also constitutes a lower limit to the beginning of the indeterminacy or fuzziness of the end of the described temporal phenomenon.

It is correct to assign the same value to “P81a\_end\_of\_the\_begin” and “P81b\_begin\_of\_the\_end”, if no other positive knowledge exists. It is also correct not to instantiate P81 for a time span, if there is no evidence that the temporal phenomenon was definitely occurring at a particular time.

If a respective reasoning is installed, and no evidence exists about the point in time that the phenomenon was definitely ongoing, one may specify “P81a\_end\_of\_the\_begin” as being later than “P81b\_begin\_of\_the\_end”, indicating that the indeterminacy of knowledge (not of being) of the begin overlaps with the indeterminacy of knowledge (not of being) of the end. Formally, this constitutes a negative interval for *P81 ongoing throughout* (Holmen&Ore 2010).

If a value for “P81a\_end\_of\_the\_begin” is given with a precision less than that of xsd:dateTime (i.e. seconds), such as in days or years, the implementation should “round it up” to the last instant of this time expression, e.g. 1971 = Dec 31 1971 23:59:59. Respectively, for “P81b\_begin\_of\_the\_end” the implementation should “round it down”, e.g. 1971 = Jan 1 1971 0:00:00. If values are needed that are not within the range or precision of xsd:dateTime, e.g., for paleontology, this property should be extended with another, suitable data type.

[to note that this form is explicitly chosen against other potential ways to express imprecision, for the purpose of normalization and calculation. Potentially add that this works for any time interval year, month, day, minute, second etc.]

## **P82 at some time within**

Property P82 describes the narrowest known outer bounds of the temporal extent of an E52 Time-Span, i.e. that the described temporal phenomenon is definitely ongoing “at some time within” this interval. It is replaced in the official RDF version by the properties "P82a\_begin\_of\_the\_begin" and "P82b\_end\_of\_the\_end", to be used together.

"P82a\_begin\_of\_the\_begin" should be instantiated as the latest point in time the user is sure that the respective temporal phenomenon is indeed not yet happening. We call it “begin\_of\_the\_begin”, because it also constitutes a lower limit to the beginning of the indeterminacy or fuzziness of the beginning of the described temporal phenomenon.

"P82b\_end\_of\_the\_end" should be instantiated as the earliest point in time the user is sure that the respective temporal phenomenon is indeed no longer ongoing. We call it “end\_of\_the\_end”, because it also constitutes an upper limit to the end of the indeterminacy or fuzziness of the end of the described temporal phenomenon.

It is not correct to assign the same value to “P82a\_begin\_of\_the\_begin” and “P82b\_end\_of\_the\_end”. If a value for “P82a\_begin\_of\_the\_begin” is given with a precision less than that of xsd:dateTime (i.e. seconds), such as in days or years, the implementation should “round it down” to the first instant of this time expression, e.g. 1971 = Jan 1 1971 0:00:00. Respectively, for “P82b\_end\_of\_the\_end” the implementation should “round it up”, e.g. 1971 = Dec 31 1971 23:59:59.

It must always hold that “P82a\_begin\_of\_the\_begin” is before “P82b\_end\_of\_the\_end”, “P81a\_end\_of\_the\_begin” and “P81b\_begin\_of\_the\_end”.

It must always hold that “P82b\_end\_of\_the\_end” is after ““P82a\_begin\_of\_the\_begin”, “P81a\_end\_of\_the\_begin” and “P81b\_begin\_of\_the\_end”.

“P82a\_begin\_of\_the\_begin” and “P82b\_end\_of\_the\_end” should always be assigned a value for any past phenomenon. The scholarly practice of not giving outer bounds for an event, because they are not known down to a desired precision (e.g. of three years), is not helpful for automated reasoning. In that case, the machine may conclude that a historical event could have happened at the time of the dinosaurs. Therefore any value is better than no value, even if it is relatively far away from the most likely value. It is an error to associate any implicit degree of approximation with these values. Only for phenomena that may not yet have ended at the time of documentation the end of the time-span should not be specified.

References:

Holmen, Jon; Ore, Christian-Emil Smith. Deducing event chronology in a cultural heritage documentation system. I : Frischer, Bernard, Jane Webb Crawford and David Koller (eds), “Making History Interactive”. Computer Applications and Quantitative Methods in Archaeology (CAA). Proceedings of the 37th International Conference. Archaeopress 2010 ISBN 9781407305561

Wes Cowley, Dimitris Plexousakis: An Interval Algebra for Indeterminate Time. AAAI/IAAI 2000: 470-475