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oSIST ISO/DIS 24617-7:2019

01-oktober-2019

Upravljanje jezikovnih virov - Ogrodje za semantično označevanje - 7. del: Prostorske informacije

Language resource management -- Semantic annotation framework -- Part 7: Spatial information

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Gestion des ressources linguistiques -- Cadre d'annotation sémantique -- Partie 7: Information spatiale

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Ta slovenski standard je istoveten z: ISO/DIS 24617-7:2019

ICS:

01.020	Terminologija (načela in koordinacija)	Terminology (principles and coordination)
35.240.30	Uporabniške rešitve IT v informatiki, dokumentiranju in založništvu	IT applications in information, documentation and publishing

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DRAFT INTERNATIONAL STANDARD

ISO/DIS 24617-7

ISO/TC **37**/SC **4**

Secretariat: **KATS**

Voting begins on:
2019-06-20

Voting terminates on:
2019-09-12

Language resource management — Semantic annotation framework —

Part 7:
Spatial information

Gestion des ressources linguistiques — Cadre d'annotation sémantique —

Partie 7: Information spatiale

ICS: 01.020

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Reference number
ISO/DIS 24617-7:2019(E)

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Published in Switzerland

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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The committee responsible for this document is ISO/TC 37, *Language and Terminology*, Subcommittee SC 4, *Language resource management*.

This edition cancels and replaces the first edition (ISO 24617-7:2014(E)), which has been technically revised.

ISO 24617 consists of the following parts, under the general title *Language resource management — Semantic annotation framework (SemAF)*:

— *Part 1: Time and events (TimeML)*

— *Part 2: Dialogue acts (SemAF-DA)*

— *Part 4: Semantic roles (SemAF-SR)*

— *Part 5: Discourse structures (SemAF-DS)*

— *Part 6: Principles of semantic annotation (SemAF principles)*

— *Part 7: Spatial information*

— *Part 8: Semantic relations in discourse, core annotation schema (DR-core)*

— *Part 9: Reference (RAF)*

— *Part 10: Visual information (VoxML)*

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— *Part 11: Measurable quantitative information (MQI)*

— *Part 12: Quantification*

— *Part 13: Gestures*

— *Part 14: Spatial semantics*

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Introduction

The automatic recognition of spatial information in natural language is currently attracting considerable attention in the fields of computational linguistics and artificial intelligence. The development of algorithms that exhibit "spatial awareness" promises to add needed functionality to NLP systems, from named entity recognition to question-answering and text-based inference. However, in order for such systems to reason spatially, they require the enrichment of textual data with the annotation of spatial information in language. This involves a large range of linguistic constructions, including spatially anchoring events, descriptions of objects in motion, viewer-relative descriptions of scenes, absolute spatial descriptions of locations, and many other constructions.

This part of ISO 24617 was developed in collaboration with the spatial annotation working group at Brandeis University with the aim to provide an International Standard for the representation of spatial information relating to locations, motions and non-motion events in language.

NOTE The spatial annotation working group at Brandeis University is headed by James Pustejovsky, jampesp@cs.brandeis.edu, Brandeis University, Waltham, MA, U.S.A.

This part of ISO 24617 provides normative specifications not only for spatial information, but also for information content in motion and various other types of event in language.

The main parts of this part of ISO 24617 consist of the following:

a) Scope;

b) Normative references;

c) Terms and definitions;

d) List of tags or names of elements;

e) Overview;

f) Motivation and requirements;

g) Modifications: Changes introduced;

h) Specification of the spatial annotation structure;

i) Representation of static and dynamic spatial annotations.

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Clause 9 treats (i) by introducing an XML-based concrete syntax for representing spatial-related or motion-related annotations. This concrete syntax is based on the abstract syntax that is presented in Clause 8 with a metamodel as a part of (h). An informative annex A is provided with a brief introduction to the annotation and interpretation of quantified spatial entities and eventualities including motions and event-paths.

A formal semantics, based on the abstract syntax, will be provided as part of a future new work item within the semantic annotation framework. This will be coordinated with the temporal semantics and specification of ISO 24617-1 (TimeML), thereby producing a rich semantics that will be directly useable by practitioners in computational linguistics and other communities (see Clause 6). The multilingual extension of the spatial and motion-related annotation scheme presented in this document will also be treated in a separate part of the ISO 24617- series in the near future.

NOTE Although the schema and DTD are not part of the present document as normative annexes, they will both be found in a webpage managed by the Brandeis Spatial Annotation Working Group.

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Language resource management — Semantic annotation framework — Part 7: Spatial information

1 Scope

This part of ISO 24617 provides a framework for encoding a broad range not only of spatial information, but also of spatiotemporal information relating to motion as expressed in natural language texts. This part of ISO 24617 includes references to locations, general spatial entities, spatial relations (involving topological, orientational, and metric values), dimensional information, motion events, paths, and event-paths triggered by motions.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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ISO 24612, *Language resource management – Linguistic annotation framework (LAF)*

ISO 24617-1, *Language resource management — Semantic annotation framework (SemAF) — Part 1: Time and events (TimeML)*

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ISO 24617-6, *Language resource management — Semantic annotation framework (SemAF) — Part 6: Principles of semantic annotation (SemAF principles)*

ISO/IEC 14977, *Information technology — Syntactic metalanguage — Extended BNF*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 24617-1, ISO 24617-6, and the following apply.

NOTE For the sake of easier reference, some of the terms are listed with XML element names (tags), as in **3.2 event, eventuality, <event>.**

3.1
document creation location
dcl
unique place or set of places associated with a document that represents the *location* (3.7) in which the document was created

Note 1 to entry: Some collaboratively written documents, such as GoogleDoc[1] documents and chat logs, might refer not only to a single location but also to a set of locations spread out across the world. Besides, for example, the

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creation place of the Hebrew bible or the creation place of each of the books in it is uncertain. The attribute @dcl will, therefore, have the value "false" which is to be understood to mean "unspecified", while the value "true" is to be understood to mean "specified".

3.2
event
eventuality
<event>
something that can be said to obtain or hold true, to happen or to occur

Note 1 to entry: This is a very broad notion of event, also known in the literature as “eventuality” and includes all kinds of actions, states, processes, etc. It is not to be confused with the narrower notion of event (as opposed to the notion of "state") as something that happens at a certain point in time (e.g. the clock striking two or waking up) or during a short period of time (e.g. laughing). In TimeML, the term “event” is used in a broader sense and is equivalent to the term “eventuality”.

[SOURCE ISO 24617-1:2012]

3.3
event-path
dynamic path
trajectory
dynamic route
<eventPath>
directed *path* (3.15) followed by a mover (3.12) and coincident with a *motion-event* (3.10)

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Note 1 to entry: Unlike (static) paths such as roads or circular tracks, event-paths are each triggered by a specific motion-event, characterized as being finite directed paths each with a start and an end.

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3.4
extent
textual segment which is string of character segments in text to be annotated

EXAMPLE Tokens, words, and non-contiguous phrases (e.g. a complex verb like "look ... up") are extents.

3.5
figure
entity that is considered the focal object, which is related to some reference object

3.6
ground
landmark
entity that acts as reference for a *figure* (3.5)

Note 1 to entry: The term “ground” is often called “landmark” by cognitive semanticists.

3.7
location
point or finite area that is positioned within a *space* (3.19) or a series of such points or areas

Note 1 to entry: *places* (16), *paths* (15), and *event-paths* (3.3) are subtypes of locations.

3.8
measure
<measure>

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magnitude of a spatial dimension or relation

EXAMPLE Distance is a spatial relation.

3.9
measure relation
<mLink>
link that relates a *measure* (3.8) to an object that is being measured

Note 1 to entry: The bounds of a measured object are sometimes specified for a measure relation. They can be points or areas like a city, or lines like a river or mountain range.

3.10
motion
motion-event
<motion>
action or process involving the translocation of a spatial object, transformation of some spatial property of an object, or change in the conformation of an object

Note 1 to entry: A motion is a particular kind of *eventuality* (3.2).

3.11
movement relation
<moveLink>
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link that relates a mover (3.12) to an event-path (3.3) which the mover (3.12) traverses
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Note 1 to entry: A movement link is triggered by a *motion* (3.10).

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3.12
mover
moving object
entity that undergoes a change of its location

Note 1 to entry: A mover can either be the agent of a motion as one who walked to the station or one that is simply caused to move like a stone thrown into a well, while the thrower is not considered to be the mover in the sense of the term defined here in 3.12.

3.13
non-cosuming tag
tag (3.19) that has no associated *extent* (3.4)

Note 1 to entry: The *extent* (3.4) of a non-consuming tag is a null string.

EXAMPLE In an example, *John ate an apple but Mary a pear*, there are at least two ways of marking up the <event> tag, one with its extent or target filled in with a nonnull string of characters, or audio or visual elements and the other with an empty string:

a) John ate$_{e1}$ an apple, but Mary $\emptyset_{e2}$ a pear;
b) 1) <event xml:id="e1" target="ate"/>
2) <event xml:id="e2" target=" "/> (non-consuming <event> tag)

3.14
orientation(al) relation
directional relation
<oLink>

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link that relates one location as a *figure* (3.5) to another location as a *ground* (3.6) that expresses the spatial disposition or direction of a spatial object within a frame of reference

3.15
path
static path
route
<path>
location (3.7) that consists of a series of *locations* (3.7)

Note 1 to entry: A spatial object *path* is a location where the focus is on the potential for traversal or which functions as a boundary. This includes common nouns like *road*, *coastline,* and *river* and proper names like *Route 66* and *Kangamangus Highway*. Some nouns, such as *valley*, can be ambiguous. It can be understood as a *path* (3.15) in *we walked down the valley* or as a *place* (3.16) in *we live in the valley*.

Note 2 to entry: A path might be represented as an undirected graph whose vertices are *locations* (3.7) and whose edges signify continuity; i.e., unlike an event-path (3.3), a path has no inherent directionality.

3.16
place
<place>
geographic or administrative entity that is situated at a *location* (3.7)

3.17
qualitative spatial relation
topological link
<qsLink>
abstract static relation between *regions* (3.18) or *spaces* (3.19), expressing their connectedness or continuity

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3.18
region
connected, non-empty point-set defined by a domain and its boundary points

Note 1 to entry: The term "region" as defined here does not refer to a political or administrative region such as "the Canary Islands" or "Hong Kong, SAR", where SAR is the acronym of “Special Administrative Region”.

3.19
space
dimensional extent in which objects and *events* (3.2) have a relative position and direction

3.20
spatial entity, non-locational
<entity>
object that is situated at a unique *location* (3.7) for some period of time, and typically has the potential to undergo translocation

Note 1 to entry: A non-locational spatial entity, tagged <entity>, as defined here, is to be differentiated from genuine spatial entities that consists of three types of locational entities, places, paths, and event-paths. It is an object that participates in a spatial or motional relation. In *John is sitting in a car*, both *John* and *car* could be understood as *spatial entities* or as being the *figure* (3.5) and the *ground* (3.6), respectively, of the sitting-in situation.

Note 2 to entry: In the first edition of this document, non-locational spatial entities were tagged <spatialEntity>. It is now tagged <entity> to allow its use in both spatial and non-spatial contexts, as in: *I left a purse in the car* (spatial context) *that I had rented Φ* (non-spatial context) *last week.*

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3.21
spatial relation
<sRelation>
segment or series of segments of a text that rebounds to qualitative spatial (3.17) or *orientational* (3.14) *relations*, or to movement relations (3.11) indirectly through the specification of the bounds of paths (3.15) or event-paths (3.3)

3.22
tag
element name
name associated with textual segments for annotation or for a relation between these segments

Note 1 to entry: The following are three kinds of tag for annotation:
a) extent tag, which is associated with textual segments referring to basic entities or signals;
b) link tag, for representing spatial relations; and
c) root tag, for the closure of annotations.

4 List of tags

Table 1 — Tags with ID prefixes

Entities	Tags	ID prefixes	Examples	Comments
Basic Entities: Spatial Entities, Relations, and Eventualities				
place	<place>	pl	*Osaka, city*	
path	<path>	p	*Highway 1, street, river*	
non-locational spatial entity	<entity>	x	*(in a) car*	non-locational entities that are spatially involved
spatial relation	<sRelation>	sr	*in, on, north-east, from, to, for, towards*	type = “topological” | “directional” | “topoDirectional” | “pathDefining” | “goal-defining”
motion	<motion>	m	*drive, travel*	translocational
non-motional eventuality	<event>	e	*live, work*	inherited from ISO 24617-1 TimeML
event-path	<eventPath>	ep	*empty extent*	non-consuming tag, spatio-temorally definable
measure	<measure>	me	*500 miles 100 km/h*	extendible to spatio-temporal measures
Links: Link structures <@figure, @ground, @relType>				
qualitative spatial link	<qsLink>	qsL		Relates one location as a figure to
orientational link	<oLink>	oL		Relates one location to another possibly with some point of reference
movement link	<moveLink>	mvL		Relates a mover to an event-path
measure link	<mLink>	meL		Relates a measure to an object, possibly with the specification of its bounds
Root Element				
spatial annotation	<spatial>	sp		closure of spatial annotation

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