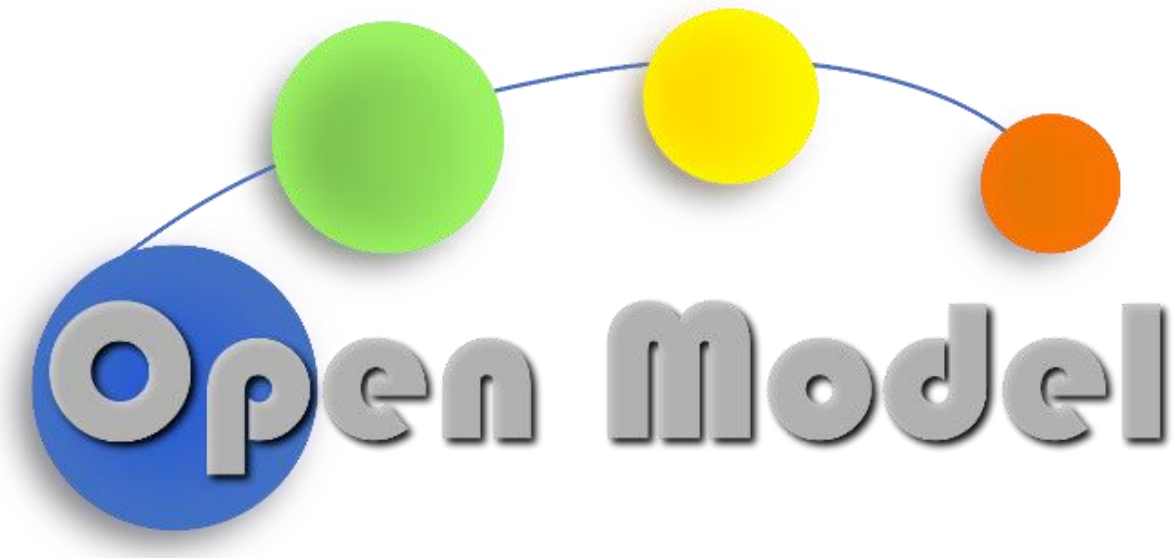
2023



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WP1-D1.2 EMMO MIDDLE LEVEL ONTOLOGY

D1.2- DATA REQUIREMENTS AND KPI'S

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Responsible	Emanuele Ghedini (UNIBO)
Author(s)	Emanuele Ghedini, Jesper Friis, Francesca L. Bleken
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ABSTRACT

This deliverable reports the EMMO branches with documentation (automatically generated through the development stack in Task 2.1 and published on https://emmo.info) for the middle level and perspective upper level support.

CHANGE HISTORY

Version	Date	Comment
0.1	2022-01-09	Initial version, by Emanuele Ghedini
0.2	2023-01-28	Revision by Emanuele Ghedini
0.3	2023-01-28	Added section about CHADA; Jesper Friis
0.4	2023-January	Revision by Emanuele Ghedini
0.5	2023-January	Revision by Jesper Friis
0.6	2023-January	Revision by Emanuele Ghedini
1/final	2023-01-31	Finalized by Emanuele Ghedini and Jesper Friis

DISSEMINATION LEVEL

PU	**Public**	**X**
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

TABLE OF CONTENT

D1.2 - EMMO MIDDLE LEVEL ONTOLOGY

1 INTRODUCTION

1.1 OVERVIEW

The deliverable reports on the EMMO OWL 2 DL middle level ontology modules that have been expanded with the contribution of OpenModel, in collaboration with other H2020 projects (mainly SimDOME and OntoTrans) to create a conceptual framework for the representation of the knowledge provided by the success stories in the OpenModel project.

The main objective is the expansion of the EMMO ontology by the further development of existing perspectives with the introduction of the concepts of **model** as semiotic sign and of **modelling** as semiotic process definition, of **workflow** and **validation**, maintaining full compatibility with the modules previously developed within the EMMO.

All results as been published in the EMMO GitHub repository, reachable easily at http://emmo.info. An automatically generated documentation using the annotations embedded in the OWL 2 DL ontology is also provided.

2 EMMO MODULES

The EMMO modules are summarised in Figure 1, defining the different ontological levels (top and middle) and highlighting in green the modules that have been developed with the contribution of the OpenModel project. It is possible to see that in order to modules such as workflow and models, several contributions to the top-level modules have been required.

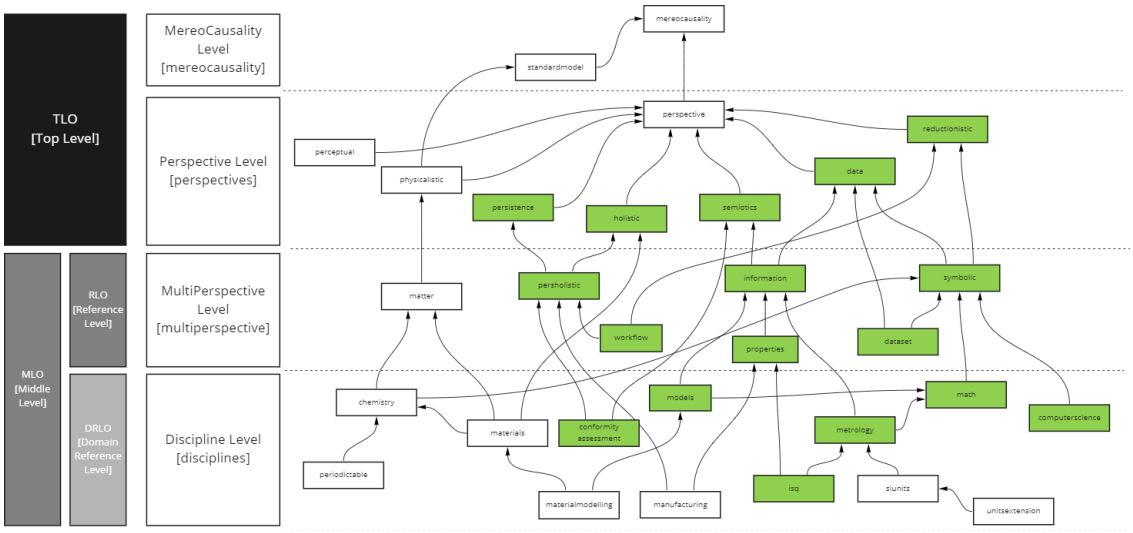


Figure 1 - Modules developed with the contribution of OpenModel

2.1 REDUCTIONISTIC MODULE

The reductionistic perspective module taxonomy is summarized in Figure 2. This perspective is characterized by the possibility to describe a whole as a rigid tessellation of tiles, that have been catalogued according to their interconnections, temporal or spatial. Such categorization led to the definition of tessellation structures that are paramount for the description of workflows, but at the same time are general enough to be applied to any composite entity that an EMMO user would like to represent.

The concepts of Well Formed (WF) or Non Well Formed (NWF) tile are rooted in the mereocausality foundations of the EMMO, and are elucidated in the classes annotations of the EMMO very top level, and are outside the scope of OpenModel. We refer to the annex for the description of these concepts.

Spatial, temporal and junction tiles, represent a covering categorization that refers only to the connections of a tile with its neighborhoods. The begin, end and through tiles, represents another covering categorization that refers to the topological nature of the tiles with respect to the whole tessellation.

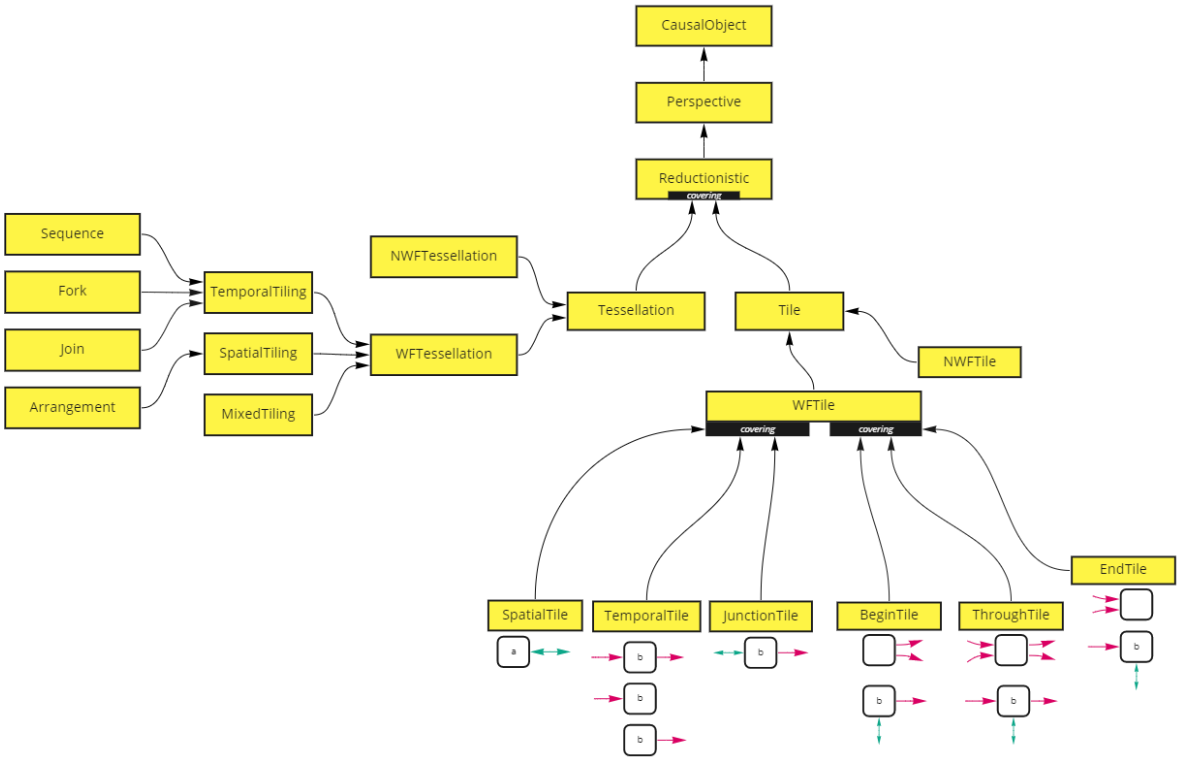


Figure 2 – Reductionistic perspective

Figure 3 shows the categorisation of different tiling, according to their topological structures, that can be used later in the workflow module to represent well known workflow types. Moreover, the

arrangement-type tiling can be used to build multi-dimensional spatial descriptions, when reference system dependent relations are added to the ontology, as shown in Figure 4. However, the expressive power of reductionistic approach can be understood looking at Figure 5 to Figure 7, were typical structures used to represent world entities are depicted and can be used fruitfully to describe workflows.

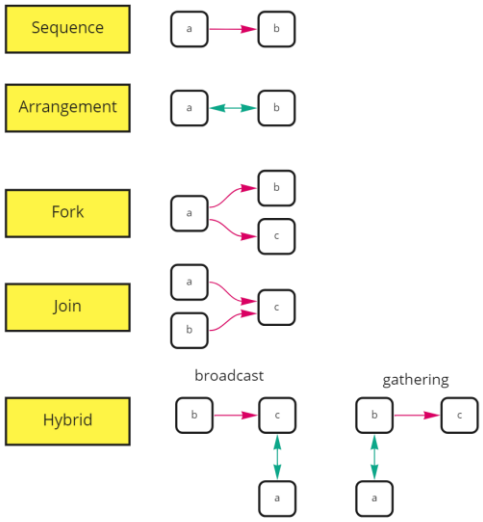


Figure 3 – Some basic tiling categories

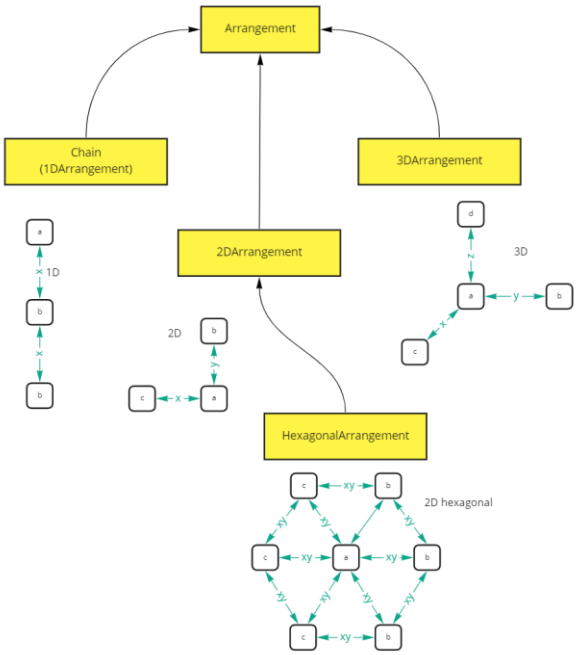


Figure 4 – Example of spatial structures representable as arrangements following the introduction of system of reference dependent relations.

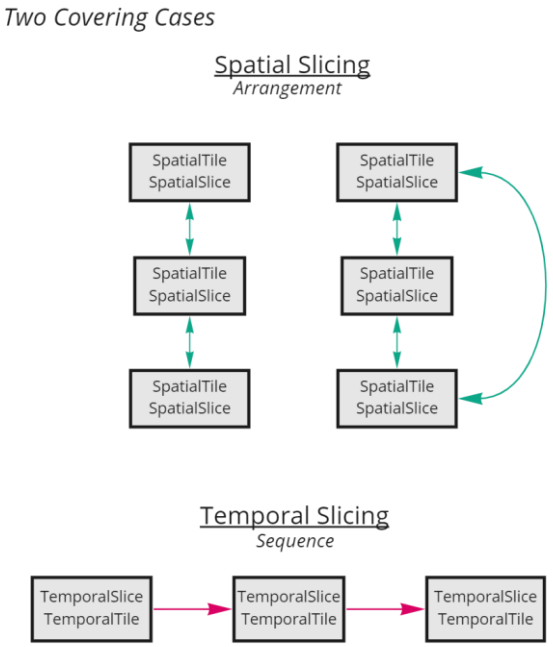


Figure 5 – Fundamental Slicing Tiling

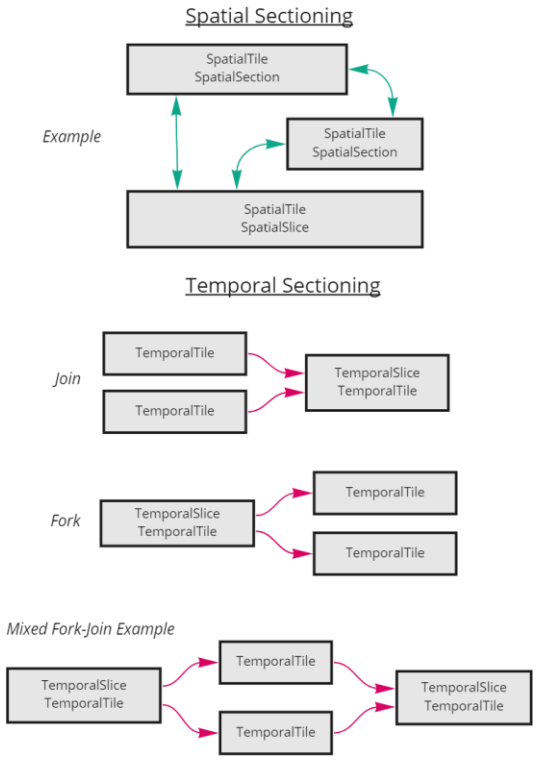


Figure 6 – Fundamental Sectioning Tiling

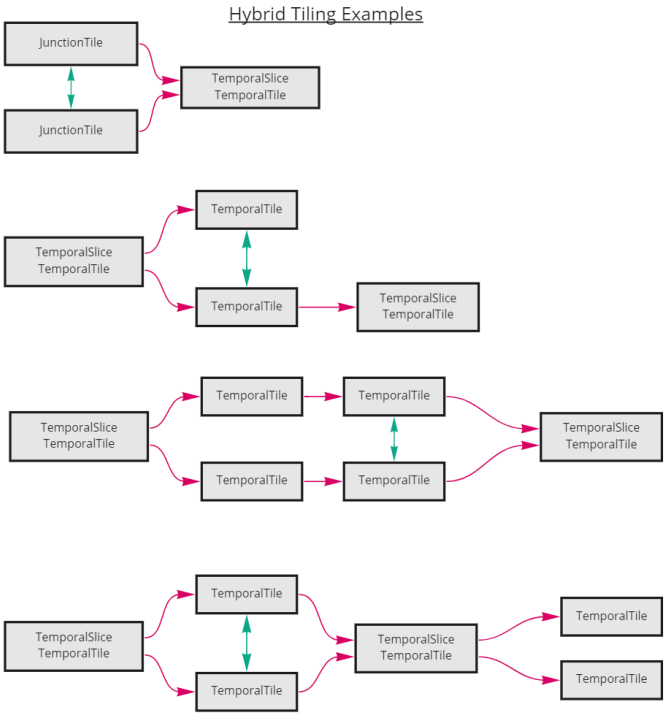


Figure 7 – Examples of hybrid tiling with slices and sections.

The reductionistic module has been developed in strong collaboration with the OntoTrans and Sim-DOME projects.

2.2 WORKFLOW MODULE

The workflow module specialises the EMMO classes and relations to represents the concepts coming from the EMMC (and EMCC) domains, exploiting the expressive capabilities of mereocausality and semiotics.

This module:
- consolidate the way workflows are described with EMMO, representing the **topology** of a workflow (e.g. serial, parallel, forks, joins, end, begin) using mereocausality and reductionism
- represent the **granularity** of workflows, enabling a multiscale approach to workflows, expanding a task in subtasks, by looking at a task within a workflow as another workflow at lower granularity level (holism and reductionism)
- build a **taxonomy** for tasks and workflows (e.g., knowledge generators, data processing, data routing)
- capture **data flows** between tasks, including their **syntactical**, **semantical,** and **physical** aspects
- develop a **diagrammatic** approach to workflows that can be mapped to existing tools and standards (e.g., UML, BPMN)

The taxonomy of the workflow module is shown in Figure 8. Its connection with the reductionistic module is evident, together with the usage of the holistic branch to assert the relations between

tasks and workflow. This branch also pave the way for a further taxonomization of the workflows and tasks, as shown by the box on the right (an EMMC Task Group on workflows has been launched for that purpose).

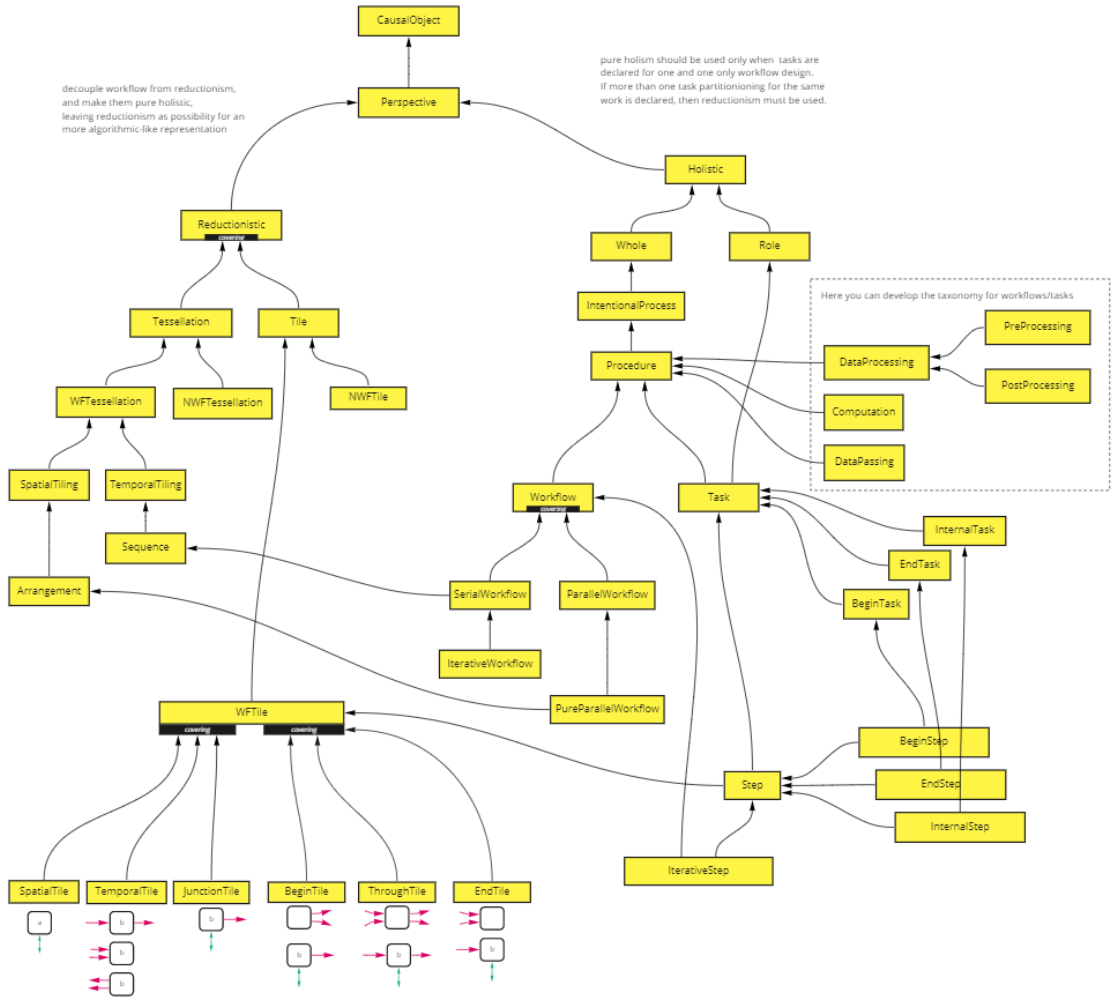


Figure 8 - Workflow EMMO Module Taxonomy

The possibility to describe the granularity of a workflow (i.e., to see it as a task for a higher level workflow and vice versa) is briefly depicted in Figure 9, where workflow *c* can be seen as the combination of *(a,b)* tasks, or of *(a,d,e)* tasks, if *b* is in itself considered as a workflow made of *(d,e)*.

In Figure 10 a mereotopological representation of two tasks is shown, representing the data passing between the two as an overcrossing entity. One of the key feature of the EMMO workflow is in fact to embed workflow description into the more generic mereocausality theory that is the foundation of the EMMO, leading to a representation of workflows as actual world entities and not abstract ones.

Finally, Figure 11 and Figure 12 show as the EMMO approach is ready to be mapped into an AiiDA based description of executable workflows, and that it can be used as designing platform for ExecFlow workflows.

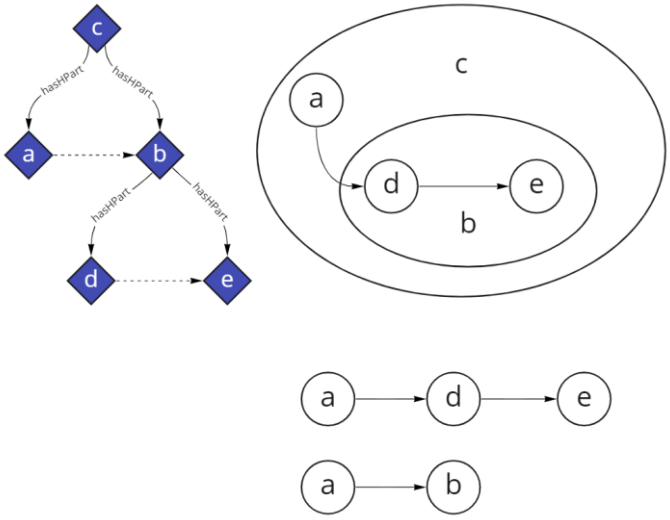


Figure 9 – Example of Granularity in Workflows

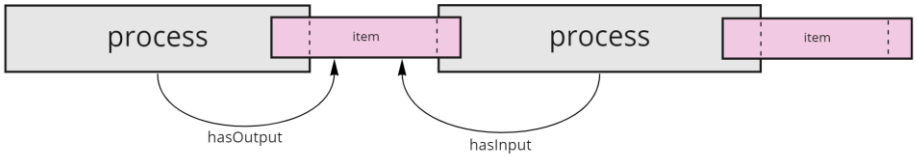


Figure 10 – Data passing between subsequent processes.

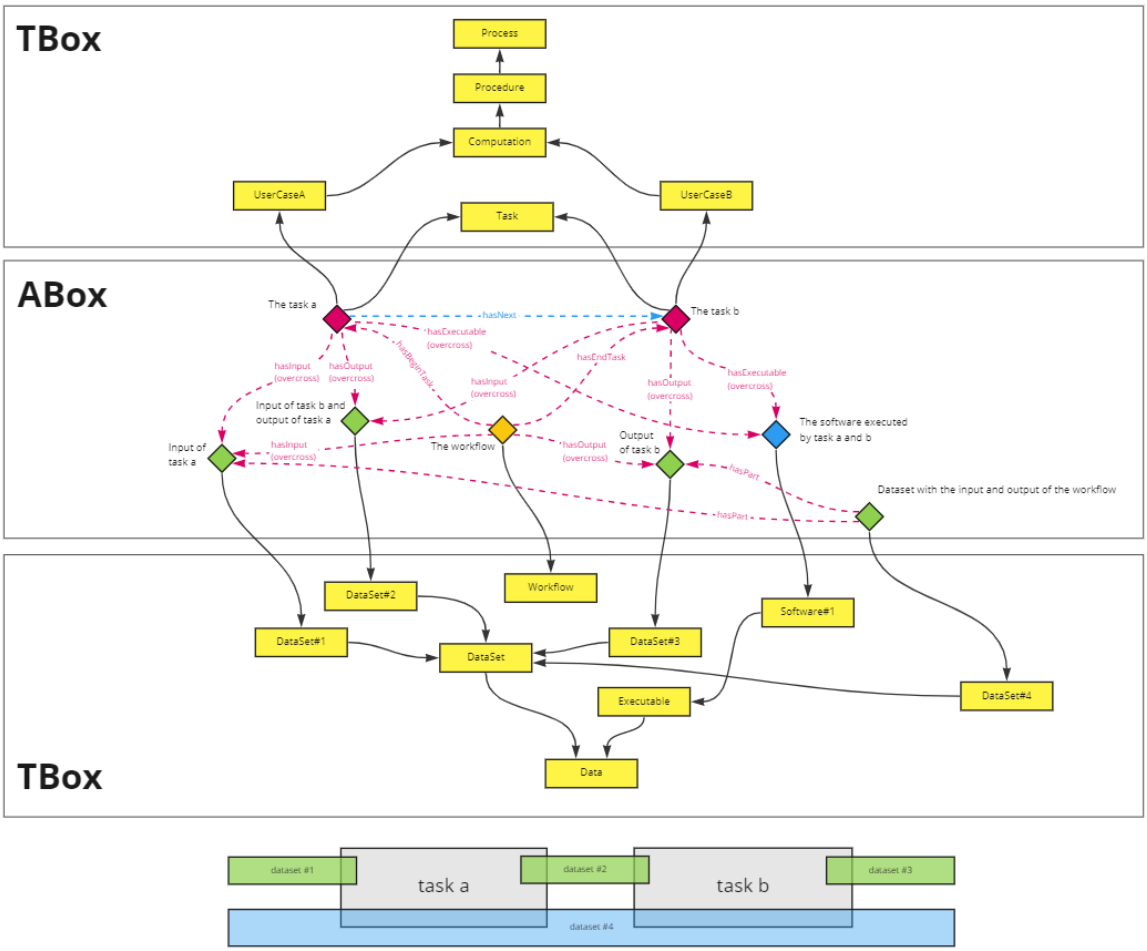


Figure 11 – Tbox and ABox representation of an actual workflow, ready to be mapped with ExecFlow

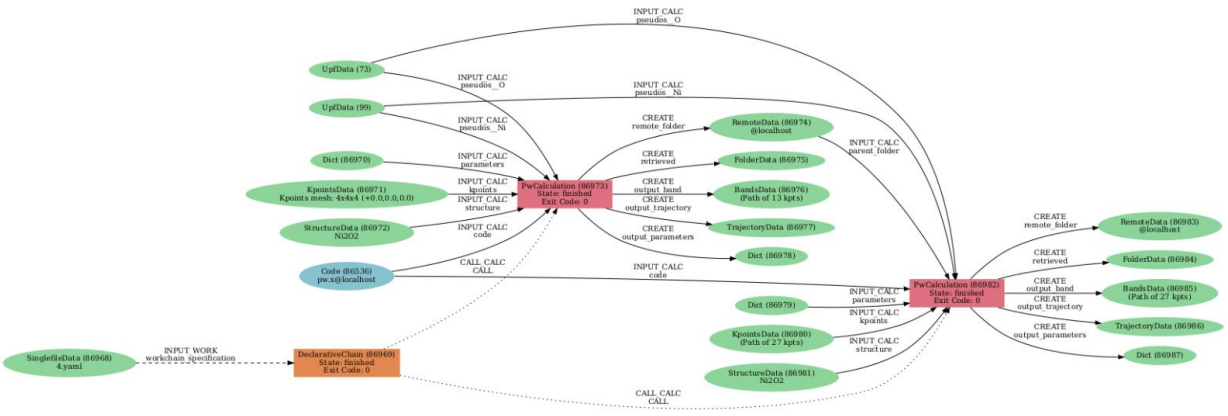


Figure 12 – The AiiDA based ExecFlow diagram of the workflow depicted in Figure 11

The workflow module has been developed in strong collaboration with the OntoTrans and SimDOME projects, but OpenModel will be the project that will make more extensive use of such results.

2.3 MODELS MODULE

The semiotic relations used to declare the properties of an object, according to a specific method of determination, is sketched in Figure 13. The schema clearly separates the semantics (i.e., what the properties is telling about an object), the syntactics (i.e., what is the data type of the property), and the semiotics (i.e., how the property has been generated), which is one of the most powerful features of the EMMO.

Following the same semiotic-based approach, an extension of the *emmo:Icon* concept has been designed to capture the many ways in which models may relate to the object that they stand for and is shown in Figure 14. The term "icon" will be used as a general term comprising all possible model types. After detailed discussion, the term "model" has not been used as preferred label, to avoid domain-biased interpretations, since this term is often used referring to different concepts. Cognition is the semiotic process that relates an icon to the semiotic object it stands for.

The models module has been developed in strong collaboration with the OntoTrans and SimDOME projects.

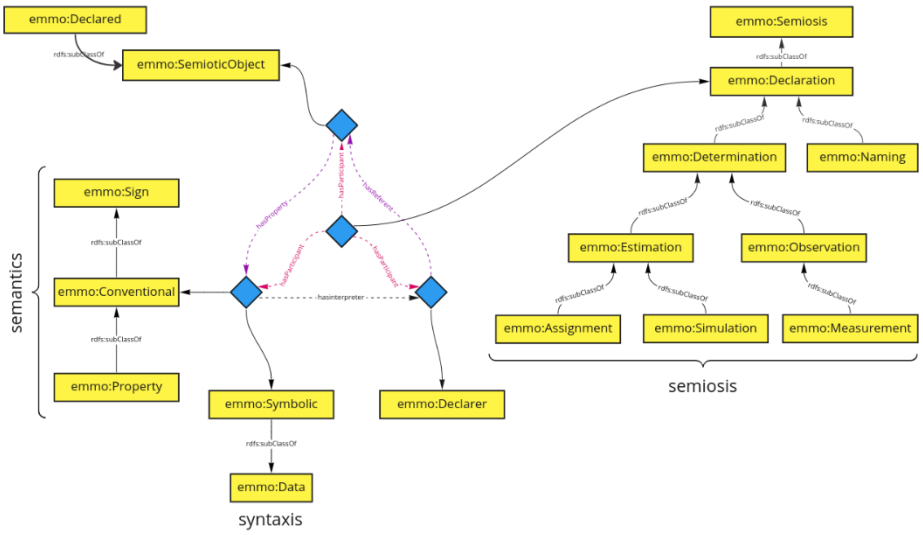


Figure 13 – Semiotic representation of the property declaration for a generic object

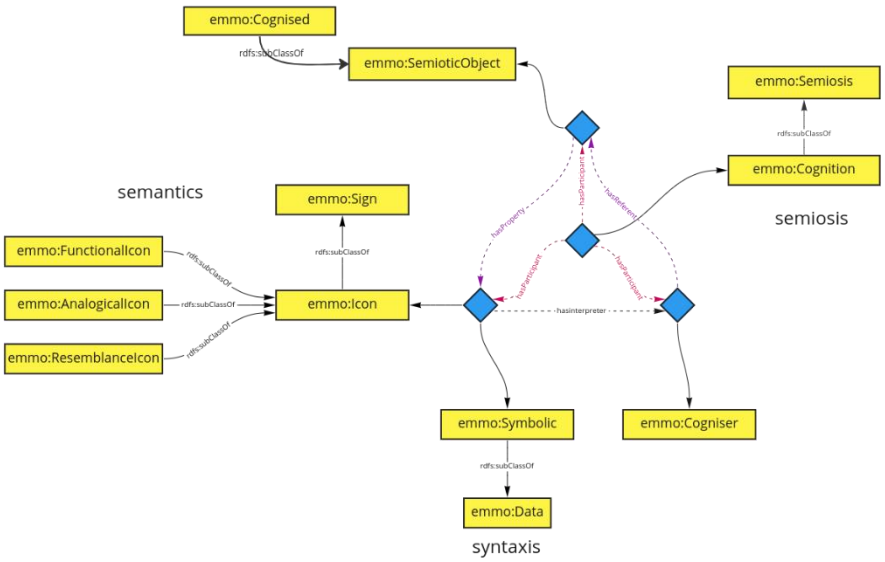


Figure 14 – Semiotic representation of the icon cognition for a generic object

2.3.1 ICON

An icon is a sign that stands for an object by resembling or imitating it, in shape, function or by sharing a similar logical structure. This category of sign has been identified as the most general category encompassing all the possible concepts commonly addressed by the term “model”. Based on these considerations, the icon concept has been classified in sub-classes, taking inspiration from Peirce semiotics that distinguishes icons as image, diagram, and metaphor.

In EMMO, the icon concept has been specialised according to the way in which the icon represents the object, distinguishing between analogic, functional, and resemblance icon as represented in the graphical scheme below in Figure 15.

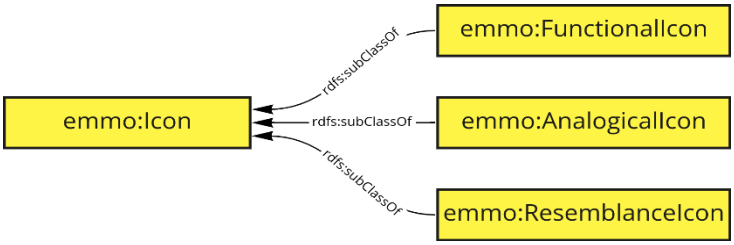


Figure 15 – Semiotic representation of the icon subclasses

2.3.2 ANALOGICAL ICON

The analogical icon is the subclass of icon inspired by the Peirceian diagram, whose internal relations represent by analogy the relations in the semiotic object. An analogical icon represents the internal

logic structure of the object and thus perfectly simulates the object it replaced, focusing on *how* the object works.

Examples of analogical icon are physics equations (as defined by RoMM) that replicates the mechanisms internal to the object, electrical diagrams, MODA, and CHADA.

In EMMO, all these comments and examples are available in OWL2 DL, through the new annotations implemented.

	Mandotory				
IRI	skos:prefLabel	emmo:elucidation	emmo:example	emmo:etymology	emmo:comment
AnalogicIcon	AnalogicIcon	An icon that represents the internal logical structure of the object.	A physics equation is replicating the mechanisms internal to the object. or Electrical diagram is diagrammatic and resemblance or MODA and CHADA are diagrammatic representation of a simulation or a characterisation workflow.	From Ancient Greek ἀναλογία (analogia), from ἀνά (aná) + λόγος (lógos, "speech, reckoning").	An icon that focus on HOW the object works. The subclass of icon inspired by Peirceian category (b) the diagram, whose internal relations, mainly dyadic or so taken, represent by analogy (with the same logic) the relations in something (e.g. math formula, geometric flowchart).

Figure 16 – Example of descriptive annotations for the analogic icon class.

2.3.3 FUNCTIONAL ICON

The functional icon is inspired by the Peirceian category of *metaphor,* which captures a parallelism in something else. It is an icon that imitates one representative character of the object sharing similarities with the object in terms of operativity, but not necessarily in terms of logical structure. It focuses on *what t*he object does.

For example, a data-based model is a functional icon, since it provides the same relations between the properties of the object (e.g., it can predict some properties as function of others) but is not considering the internal mechanisms (i.e., it can ignore the physics). A Turing machine, that makes use of language as a human being, is a functional icon since it does not elaborate language as a brain does. A simulation software is a functional icon of the process of observing a particular physical phenomenon.

2.3.4 RESEMBLANCE ICON

The resemblance icon is a subclass of icon inspired by Peirceian category of the image, which depends on a simple quality (e.g., picture, photograph). The resemblance icon resembles the object as it manifests itself in appearance. It may represent its object mainly by its similarity, no matter what its mode of being. Images partakes simple qualities of the semiotic object unlike those icons, described above, whose relations of own parts or functions are analogous of the object. The image inscribes immutable bodies in space and time. This icon mimics the spatial or temporal shape of the object. In this sense, a resemblance icon imitates the *where* and the *when* of an object, according to the four dimensional approach of EMMO.

Examples are a portrait of someone, or a replica, a geographical map that imitates the shape of the landscape and its properties at a specific historical time, a periodic plot (in space) that imitates the periodicity (in time) of a phenomena.

2.3.5 MODEL TYPES

The three icon subclasses enable the representation of the concepts usually associated with the term "model". The EMMO *model.ttl* module provides several types used by the OntoTrans applications. One of the main distinctions provided by this module is between mathematical models and simulations.

2.3.6 MATHEMATICAL MODEL

A mathematical model is an analogical icon expressed in mathematical language, in which the mathematical entity describes the way in which the object properties relate within each other, imitating the logical structure of the object. More precisely, a mathematical model can be defined as a description of a system using mathematical concepts and language to facilitate proper explanation of a system or to study the effects of different components and to make predictions on patterns of behaviour.

For example, physics-based models are mathematical entities based on a fundamental physics theory which defines the relations between physics quantities of an entity, that possess a physics equation as part. The second law of dynamics is a physics equation that expresses the relationship between the force and the acceleration of an object.

Materials models are a type of physics-based model that also includes material relations, according to the RoMM. Its subtypes are listed as electronic, atomistic, mesoscopic and continuum models, according to the entities that the model represents (see RoMM).

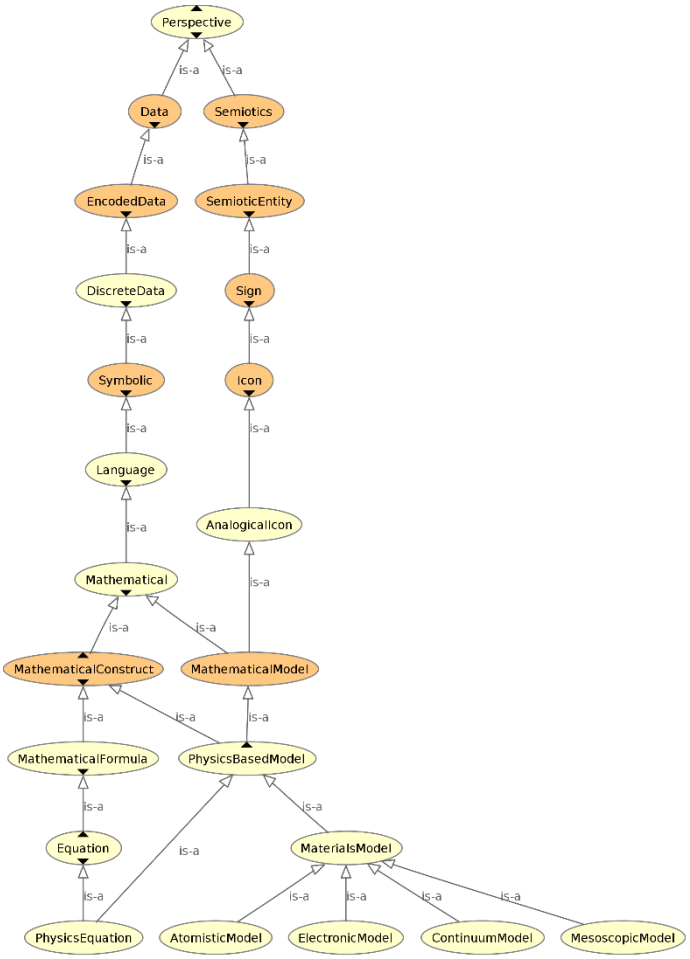


Figure 17 – Semiotic representation of the mathematical models

2.3.7 SIMULATION SOFTWARE

Simulation software is represented using the model and data perspectives. A simulation software is a functional icon, since it does not show the internal mechanisms of the objects, but simply provides a relation between their properties, just like a measurement process would do.

Figure 18 shows the taxonomy for the simulation software representation, distinguishing between different types of approaches to the software design.

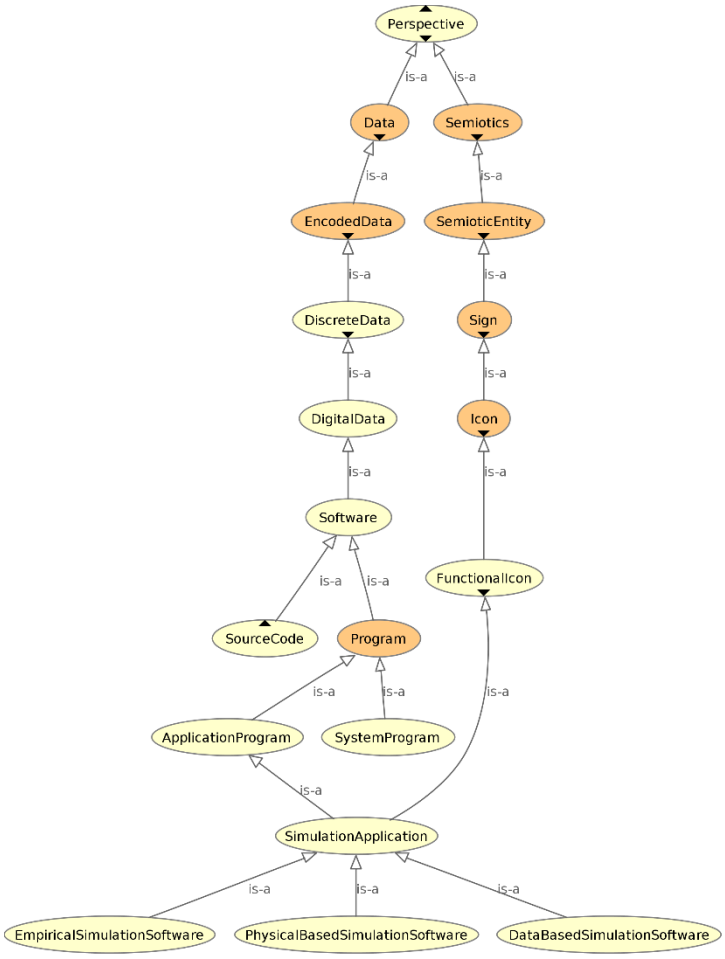


Figure 18 – Semiotic representation of the simulation software class

3 CONFORMITY ASSESSMENT MODULE

The conformity assessment module has been developed in collaboration with the OntoTrans project, and its structure is sketched in Figure 19. This module is mainly based on the ISO/IEC 17000 (Conformity assessment) and ISO 9000: 2015 (Quality system management) and strongly relies on the semiotic perspective to determine the successful validation or verification of a generic product (e.g., data, software) keeping track of the methodology used for its evaluation and of potential conflicting results between methods applied to the same entity.

We refer to the annex documentation for further information on the classes and relations involved in this module.

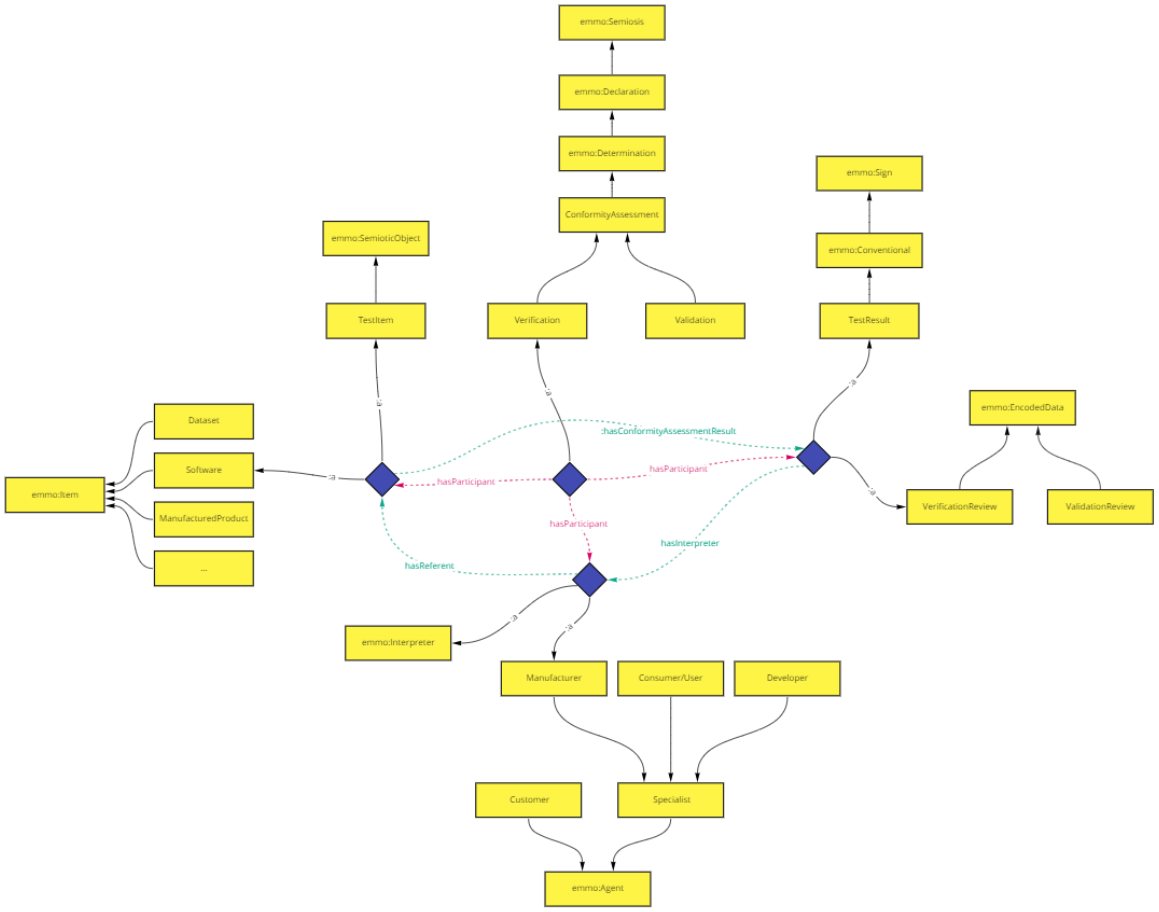


Figure 19 – Verification and Validation general schema

4 EXTENDED DOCUMENTATION

This document is a simple overview of the developed modules. The overall result of the T1.2 efforts, and the efforts of the networking projects SimDOME and OntoTrans, is extensively expressed in the attached documentation that collects all the annotations provided by the EMMO authors in the elucidation of classes and relations.

We refer to this document as the actual documentation for the T1.2.

5 CONCLUSION

The modules here presented are fully available in the GitHub EMMO page, in the 1.0.0-beta4 branch. While they represent a milestone, being usable modules for the OpenModel purposes, they nevertheless will be further expanded up to end of OpenModel and by companion projects (including the recently funded CoBRAIN Horizon Europe project).

6 ACKNOWLEDGMENT

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 953167.

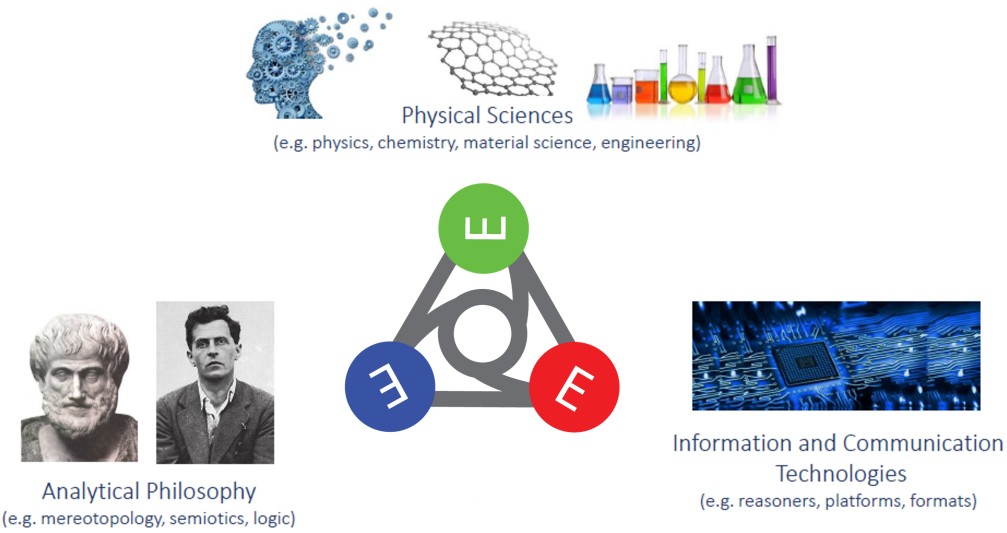
7 ANNEX: ONTOLOGY DOCUMENTATION

Elementary Multiperspective Material Ontology (EMMO)

Version 1.0.0-beta4

European Materials Modelling Council (EMMC)

January 30, 2023



Abstract:

EMMO is an ontology that is created by the European Materials Modelling Council (EMMC) to provide a formal way to describe the fundamental concepts of physics, chemistry and materials science. EMMO is designed to pave the road for semantic interoperability providing a generic common ground for describing materials, models and data that can be adapted by all domains.

It is a representational framework of predefined classes and axioms (ontology) provided by experts (EMMC) that enables end users (industry, research, academy) to represent real life physical entities (materials, devices), models and properties using ontological signs (individuals) in a standard way to facilitate interactions and exchanges (data, software, knowledge) between all involved material modelling and characterization communities and stakeholders.

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Georg Schmitz, ACCESS

Content

EMMO Relations

In the language of OWL, relations are called *properties*. However, since relations describe relations between classes and individuals and since properties has an other meaning in EMMO, we only call them *relations*.

Resource Description Framework (RDF) is a W3C standard that is widely used for describing information on the web and is one of the standards that OWL builds on. RDF expresses information in form of *subject-predicate-object* triplets. The subject and object are resources (aka items to describe) and the predicate expresses a relationship between the subject and the object.

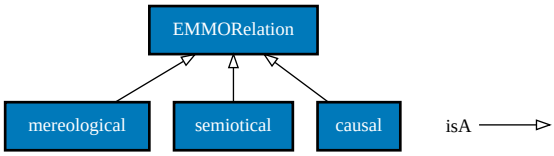
In OWL the subject and object are classes or individuals (or data) while the predicate is a relation. An example of a relationship is the statement *dog is_a animal*. Here `dog` is the subject, `is_a` the predicate and `animal` the object.

OWL distinguishes between *object properties*, that link classes or individuals to classes or individuals, and *data properties* that link individuals to data values. Since EMMO only deals with classes, we will only be discussing object properties. However, in actual simulations or characterisation applications build on EMMO, datatype properties will be important.

The characteristics of the different properties are described by the following *property axioms*:

- `rdf:subPropertyOf` is used to define that a property is a subproperty of some other property. For instance, in the figure below showing the relation branch, we see that `active_relation` is a subproperty or `relation`. The `rdf:subPropertyOf` axioms forms a taxonomy-like tree for relations.
- `owl:equivalentProperty` states that two properties have the same property extension.
- `owl:inverseOf` axioms relate active relations to their corresponding passive relations, and vice versa. The root relation `relation` is its own inverse.
- `owl:FunctionalProperty` is a property that can have only one (unique) value y for each instance x, i.e. there cannot be two distinct values y1 and y2 such that the pairs (x,y1) and (x,y2) are both instances of this property. Both object properties and datatype properties can be declared as “functional”.
- `owl:InverseFunctionalProperty`
- `owl:TransitiveProperty` states that if a pair (x,y) is an instance of P, and the pair (y,z) is instance of P, then we can infer that the pair (x,z) is also an instance of P.
- `owl:SymmetricProperty` states that if the pair (x,y) is an instance of P, then the pair (y,x) is also an instance of P. A popular example of a symmetric property is the `siblingOf` relation.
- `rdfs:domain` specifies which classes the property applies to. Or said differently, the valid values of the *subject* in a *subject-predicate-object* triplet.
- `rdfs:range` specifies the property extension, i.e. the valid values of the *object* in a *subject-predicate-object* triplet.

Root of EMMO relations



Top-level of the EMMO relation hierarchy.

EMMORelation

IRI: http://emmo:info/emmo#EMMO_ec2472ae_cf4a_46a5_8555_1556f5a6c3c5

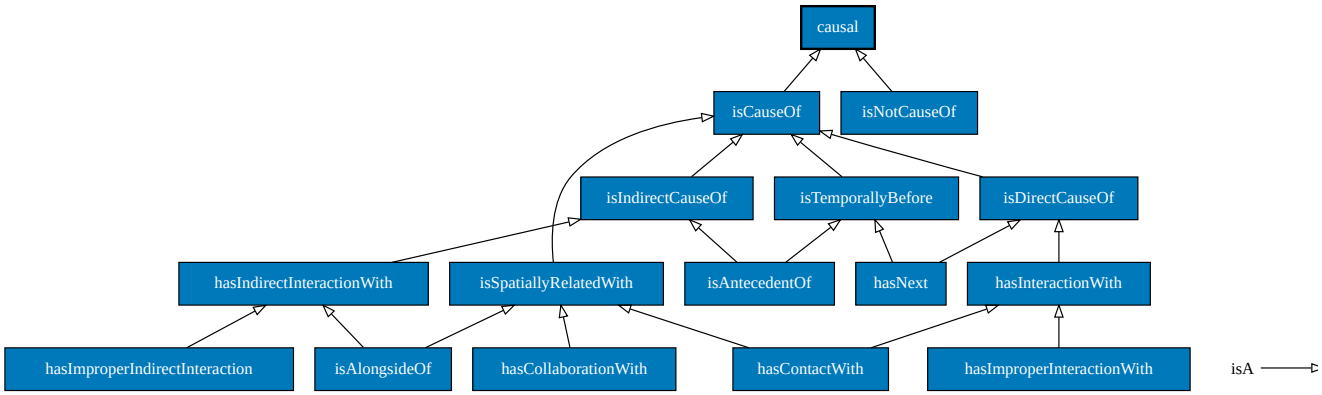
elucidation: The class for all relations used by the EMMO.

prefLabel: EMMORelation

Subclass of:

- is_a ObjectProperty
- is_a topObjectProperty
- domain EMMO
- range EMMO

CAUSAL BRANCH



Causal branch.

isAlongsideOf

IRI: http://emmo:info/emmo#EMMO_d01b3ee2_91a5_4ce2_95cd_f0d2c333c6d3

elucidation: The relation between two causally reachable entities through a path of hasContactWith relations (i.e. representing physical interactions).

altLabel: isSpatiallyReachableBy

prefLabel: isAlongsideOf

Subclass of:

- is_a ObjectProperty
- is_a ObjectProperty
- is_a hasIndirectInteractionWith
- is_a isSpatiallyRelatedWith

isTemporallyBefore

IRI: http://emmo:info/emmo#EMMO_ebc9e62c_5dc4_44db_9060_7923740bdf78

prefLabel: isTemporallyBefore

Subclass of:

- is_a ObjectProperty
- is_a ObjectProperty

- is_a isCauseOf

isNotCauseOf

IRI: http://emmo:info/emmo#EMMO_01e5766d_dac3_4574_8a78_310de92a5c9d

definition: x isNotCauseOf y iff not(x isCauseOf y)

prefLabel: isNotCauseOf

Subclass of:

- is_a causal

isIndirectCauseOf

IRI: http://emmo:info/emmo#EMMO_b85e4738_500c_4e1b_bbe8_9e84190485d6

elucidation: A causal relation between the effected and the causing entities with intermediaries.

prefLabel: isIndirectCauseOf

Subclass of:

- is_a ObjectProperty
- is_a isCauseOf

hasImproperInteractionWith

IRI: http://emmo:info/emmo#EMMO_ec90a8f0_16bf_4f76_b378_ef69b587b426

elucidation: An interaction that is the sum of direct causality relations between two entities that are not interpretable as fundamental physical interactions.

prefLabel: hasImproperInteractionWith

Subclass of:

- is_a ObjectProperty
- is_a hasInteractionWith

isAntecedentOf

IRI: http://emmo:info/emmo#EMMO_3733bd38_ca2b_4264_a92a_3075a1715598

elucidation: A causal relation between the y effected and the x causing entities with intermediaries, where x isCauseOf y and not(y isCauseOf x).

prefLabel: isAntecedentOf

Subclass of:

- is_a ObjectProperty
- is_a ObjectProperty
- is_a isIndirectCauseOf
- is_a isTemporallyBefore

causal

IRI: http://emmo:info/emmo#EMMO_ad0e72fc_dcaa_490d_8371_b4d814dcda2c

elucidation: The superclass of all causal EMMO relations.

comment: Each pair of entities is either in isCauseOf or isNotCauseOf relation. The two are mutually exclusive.

conceptualisation: Causality is the fundamental concept describing how entities affect each other, and occurs before time and space relations. Embracing a strong reductionistic view, causality originates at quantum entities level.

prefLabel: causal

Subclass of:

- is_a EMMORelation

hasNext

IRI: http://emmo:info/emmo#EMMO_499e24a5_5072_4c83_8625_fe3f96ae4a8d

elucidation: A time contact occurs when x isDirectCause y and not(y isDirectCause x).

altLabel: isBefore

comment: Each pair of entities in direct causality relation is either in hasNext or hasTwoWayCauseWith relation. The two are mutually exclusive.

comment: This relation is asymmetric and irreflexive.

conceptualisation: The temporal relation between two entities occurs when the two entities are in a one directional causality relation. The idea is that a temporal relation always implies a one-directional causality between two entities, leading to a asymmetric relation.

prefLabel: hasNext

Subclass of:

- is_a ObjectProperty
- is_a ObjectProperty
- is_a isDirectCauseOf
- is_a isTemporallyBefore

hasContactWith

IRI: http://emmo:info/emmo#EMMO_8785be5a_2493_4b12_8f39_31907ab11748

elucidation: An interaction that is the sum of direct causality relations between two entities that are interpretable as fundamental physical interactions.

altLabel: hasSpatiialnteractionWith

comment: Spatial contact is symmetric and irreflexive.

comment: The contact relation is not an ordering relation since is symmetric.

conceptualisation: A spatial contact between two entities occurs when the two entities are in an interaction relation whose causal structure is a representation of the fundamental interactions between elementary particles (Feynman diagrams).

prefLabel: hasContactWith

Subclass of:

- is_a ObjectProperty
- is_a ObjectProperty
- is_a isSpatiallyRelatedWith
- is_a hasInteractionWith

isCauseOf

IRI: http://emmo:info/emmo#EMMO_d67ee67e_4fac_4676_82c9_aec361dba698

elucidation: The relation between an individuals x and y, that holds if and only if: a) y having a part that is causing an effect on a part of x b) y and x non-overlapping

OWLDLRestrictedAxiom: (:isCauseOf owl:propertyDisjointWith :isOverlapping) due to the transitivity characteristic of :isOverlapping subclasses, that makes it a composite property.

comment: Cause is irreflexive.

comment: Each pair of entities is either in isDirectCauseOf or isIndirectCauseOf relation. The two are mutually exclusive.

comment: In EMMO FOL this relation is primitive. Cause provides the edges for the transitive closure of the causal direct acyclic graph whose nodes are the quantum entities. In this OWL 2 DL implementation of the theory, the isCauseOf relation applies to both quantums and macro-entities (entities made of more than one quantum), loosing transitivity and asymmetry.

comment: It is admissible for two entities to be one the cause of the other, excepts when they are both quantums.

conceptualisation: We say that an entity causes another if there is a quantum part of the first that is in causal relation with a quantum parts of the second. An entity cannot cause itself (causal loops are forbidden) or a part of itself. For this reasons causality between entities excludes reflexivity and prevents them to overlap.

prefLabel: isCauseOf

Subclass of:

- is_a ObjectProperty
- is_a causal

hasIndirectInteractionWith

IRI: http://emmo:info/emmo#EMMO_113087fa_8354_49d1_9625_5f36698d3298

elucidation: A causal relation between the y effected and the x causing entities with intermediaries, where x isCauseOf y and y isCauseOf x.

prefLabel: hasIndirectInteractionWith

Subclass of:

- is_a ObjectProperty
- is_a ObjectProperty
- is_a ObjectProperty
- is_a isIndirectCauseOf

hasCollaborationWith

IRI: http://emmo:info/emmo#EMMO_dbe39465_6cf4_4592_b0c5_b7446789a37b

prefLabel: hasCollaborationWith

Subclass of:

- is_a ObjectProperty
- is_a ObjectProperty
- is_a ObjectProperty
- is_a isSpatiallyRelatedWith

isDirectCauseOf

IRI: http://emmo:info/emmo#EMMO_555d0261_da5e_4301_b7f9_46f604a32e91

elucidation: A causal relation between the causing and the effected entities occurring without intermediaries.

comment: Direct cause is irreflexive.

comment: Direct cause provides the edges for the transitive restriction of the direct acyclic causal graph whose nodes are the quantum entities.

conceptualisation: Direct causality is a concept that capture the idea of contact between two entities, given the fact that there are no causal intermediaries between them.

prefLabel: isDirectCauseOf

Subclass of:

- is_a ObjectProperty
- is_a isCauseOf

hasInteractionWith

IRI: http://emmo:info/emmo#EMMO_a69a215c_4f4d_4729_a9c6_39302bbc5f77

elucidation: A symmetric relation occuring when x isDirectCause y and y isDirectCause x.

conceptualisation: An interaction between two entities is seen as an exchange of causality relations that goes both ways.

There are no requirements about their numbers (except that are minimun two) and their directions (except that there must be a two-way causality, e.g. from x to y and from y to x).

However, interactions can be categorised as: - representing a physical interaction (in this case we call it a contact, expression of a spatial relation) - or non representing a physical interaction, being simply an arbitrary sum of causality relations between entities.

The first case occurs when the causality relations between the quantums of the entities corresponds to the fundamental interactions as described by Feynman diagrams (Quantum Field Theory).

prefLabel: hasInteractionWith

Subclass of:

- is_a ObjectProperty
- is_a ObjectProperty
- is_a ObjectProperty
- is_a isDirectCauseOf

isSpatiallyRelatedWith

IRI: http://emmo:info/emmo#EMMO_54d0d0f4_d9fa_4179_a9b5_4110c49dafff

prefLabel: isSpatiallyRelatedWith

Subclass of:

- is_a ObjectProperty
- is_a ObjectProperty
- is_a ObjectProperty
- is_a isCauseOf

hasImproperIndirectInteraction

IRI: http://emmo:info/emmo#EMMO_febf1178_c74b_4d6d_816c_591ac2ee3530

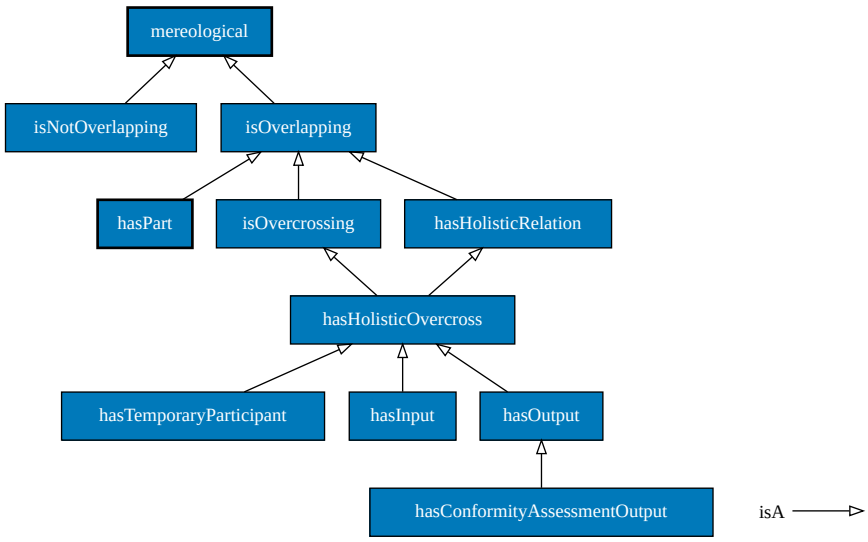
elucidation: The relation between two causally reachable entities through a path with at least one hasNonSpatialContactWith relation (i.e. non representing physical interactions).

prefLabel: hasImproperIndirectInteraction

Subclass of:

- is_a ObjectProperty
- is_a ObjectProperty
- is_a hasIndirectInteractionWith

MEREOLOGICAL BRANCH



Mereological branch.

hasHolisticOvercross

IRI: http://emmo:info/emmo#EMMO_53e5b1e1_6026_4ddc_8a4a_3aaaa5fdbdb7

elucidation: A relation between two holistic wholes that overcross, sharing one of their holistic parts.

example: A man and the process of building a house. The man is a whole that possesses an holistic temporal part which is an interval of six monts and represents a working period in his lifetime. The process of building a house is a whole that possesses an holistic spatial part which is a builder. The working period of the man and the builder participating the building process are the same individual, belonging both to a man lifetime and to a building holistic views. In this sense, the man and the building process overcrosses. and the overlapping individual is represented differently in both holistic views.

prefLabel: hasHolisticOvercross

Subclass of:

- is_a hasHolisticRelation
- is_a isOvercrossing
- domain Whole
- range Whole

hasOutput

IRI: http://emmo:info/emmo#EMMO_c4bace1d_4db0_4cd3_87e9_18122bae2840

elucidation: The outcome of a process.

prefLabel: hasOutput

Subclass of:

- is_a hasHolisticOvercross
- domain Process

hasInput

IRI: http://emmo:info/emmo/perspectives/manufacturing#EMMO_36e69413_8c59_4799_946c_10b05d266e22

elucidation: The input of a process.

prefLabel: hasInput

Subclass of:

- is_a hasHolisticOvercross
- domain Process

hasTemporaryParticipant

IRI: http://emmo:info/emmo#EMMO_35c29eb6_f57e_48d8_85af_854f9e926e77

prefLabel: hasTemporaryParticipant

Subclass of:

- is_a hasHolisticOvercross
- domain Process
- range Object

hasInterval

IRI: http://emmo:info/emmo#EMMO_2eb10b5b_900b_44d7_af85_4de9a3729474

elucidation: The relation between a process whole and a temporal part of the same type.

prefLabel: hasInterval

Subclass of:

- is_a hasRedundantPart
- is_a hasTemporalPart
- domain Process
- domain Redundant
- range Process

isOvercrossing

IRI: http://emmo:info/emmo#EMMO_9cb984ca_48ad_4864_b09e_50d3fff19420

elucidation: The relation between two distinct entities that overlaps.

prefLabel: isOvercrossing

Subclass of:

- is_a ObjectProperty
- is_a ObjectProperty
- is_a isOverlapping

hasHolisticRelation

IRI: http://emmo:info/emmo#EMMO_646cdc47_f955_4da3_9398_9aac0edf48a6

elucidation: The relation between a holistic whole and its related entities, being them parts or other overlapping entities.

prefLabel: hasHolisticRelation

Subclass of:

- is_a isOverlapping
- domain Whole
- range Holistic

mereological

IRI: http://emmo:info/emmo#EMMO_3f2e4ac2_8ef3_4a14_b826_60d37f15f8ee

elucidation: The superclass of all mereological EMMO relations.

comment: The EMMO adheres to Atomistic General Extensional Mereology (AGEM).

prefLabel: mereological

Subclass of:

- is_a EMMORelation

isOverlapping

IRI: http://emmo:info/emmo#EMMO_d893d373_b579_4867_841e_1c2b31a8d2c6

elucidation: The relation between two entities that share at least one of their parts.

prefLabel: isOverlapping

Subclass of:

- is_a ObjectProperty
- is_a ObjectProperty
- is_a mereological

isNotOverlapping

IRI: http://emmo:info/emmo#EMMO_aa987900_caf1_4ce2_82fa_6b1d6fbd2ead

prefLabel: isNotOverlapping

Subclass of:

- is_a ObjectProperty
- is_a ObjectProperty
- is_a mereological

hasPortion

IRI: http://emmo:info/emmo#EMMO_b1daa610_64c6_4935_94b8_a19db586a2f6

elucidation: The relation between a object whole and its spatial of the same type.

example: A volume of 1 cc of milk within a 1 litre can be considered still milk as a whole. If you scale down to a cluster of molecules, than the milk cannot be considered a fluid no more (and then no more a milk).

prefLabel: hasPortion

Subclass of:

- is_a hasRedundantPart
- domain Object
- domain Redundant
- range Object

hasRedundantPart

IRI: http://emmo:info/emmo#EMMO_6786b336_e982_4759_8dee_1905a4106591

elucidation: The relation between a whole and its mereological parts that are still holistic wholes.

example: A volume of water has redundand parts other volumes of water. All this volumes have holistic parts some water molecules.

prefLabel: hasRedundantPart

Subclass of:

- is_a hasHolisticRelation
- is_a hasSpatialPart
- domain Redundant
- range Whole

hasConformityAssessmentOutput

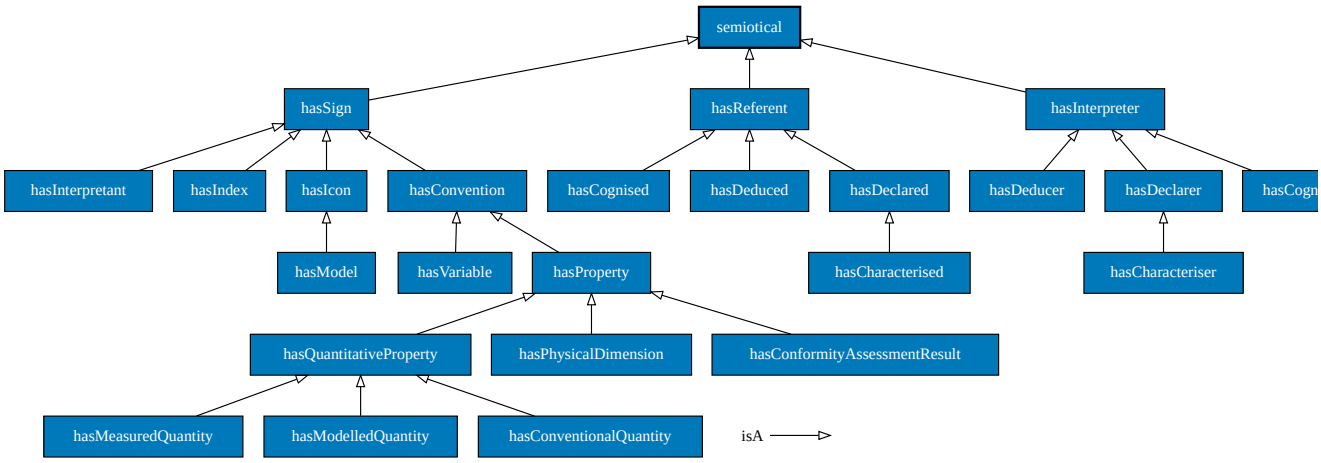
IRI: http://emmo:info/emmo#EMMO_514212c4_9861_47c2_8d4e_be1c65e06665

prefLabel: hasConformityAssessmentOutput

Subclass of:

- is_a hasOutput
- domain ConformityAssessment
- range TestResult

SEMIOTICAL BRANCH



Semiotical branch.

hasDeducer

IRI: http://emmo:info/emmo#EMMO_057d0573_6ac0_4c27_9e3f_3c29205fd104

prefLabel: hasDeducer

Subclass of:

- is_a hasInterpreter
- domain Index
- range Deducer

hasSign

IRI: http://emmo:info/emmo#EMMO_60577dea_9019_4537_ac41_80b0fb563d41

prefLabel: hasSign

Subclass of:

- is_a semiotical
- domain SemioticObject
- range Sign

hasDeclarer

IRI: http://emmo:info/emmo#EMMO_cc823237_398d_4c9a_b8fa_aa157ee3e3a5

prefLabel: hasDeclarer

Subclass of:

- is_a hasInterpreter
- domain Conventional
- range Declarer

hasInterpretant

IRI: http://emmo:info/emmo#EMMO_7fb7fe7e_bdf9_4eeb_adad_e384dd5285c6

prefLabel: hasInterpretant

Subclass of:

- is_a hasSign
- range Interpretant

hasCharacterised

IRI: http://emmo:info/emmo#EMMO_d271f202_4c1a_4d74_b86a_387c82034eb7

prefLabel: hasCharacterised

Subclass of:

- is_a hasDeclared
- domain Determiner
- range Determined

hasCognised

IRI: http://emmo:info/emmo#EMMO_51e72e5c_ab21_4d0e_ad9f_b168eca89cf4

prefLabel: hasCognised

Subclass of:

- is_a hasReferent
- domain Cogniser
- range Cognised

hasQuantitativeProperty

IRI: http://emmo:info/emmo#EMMO_0aa934ee_1ad4_4345_8a7f_bc73ec67c7e5

prefLabel: hasQuantitativeProperty

Subclass of:

- is_a hasProperty
- range QuantitativeProperty

semiotical

IRI: http://emmo:info/emmo#EMMO_2337e25c_3c60_43fc_a8f9_b11a3f974291

elucidation: The generic EMMO semiotical relation.

prefLabel: semiotical

Subclass of:

- is_a EMMORelation

hasCogniser

IRI: http://emmo:info/emmo#EMMO_5369d256_5866_4729_adc2_1498ee9a4959

prefLabel: hasCogniser

Subclass of:

- is_a hasInterpreter
- domain Icon
- range Cogniser

hasDeduced

IRI: http://emmo:info/emmo#EMMO_a0a2ded8_54e8_408d_a6b0_7fd1b4d7d16d

prefLabel: hasDeduced

Subclass of:

- is_a hasReferent
- domain Deducer
- range Deduced

hasVariable

IRI: http://emmo:info/emmo#EMMO_3446e167_c576_49d6_846c_215bb8878a55

prefLabel: hasVariable

Subclass of:

- is_a hasConvention
- domain Mathematical
- range Variable

hasIndex

IRI: http://emmo:info/emmo#EMMO_297999d6_c9e4_4262_9536_bd524d1c6e21

prefLabel: hasIndex

Subclass of:

- is_a hasSign
- domain Deduced
- range Index

hasInterpreter

IRI: http://emmo:info/emmo#EMMO_4832e353_6a2d_4deb_9a5b_96989afaff2d

prefLabel: hasInterpreter

Subclass of:

- is_a semiotical
- domain Sign
- range Interpreter

hasProperty

IRI: http://emmo:info/emmo#EMMO_e1097637_70d2_4895_973f_2396f04fa204

prefLabel: hasProperty

Subclass of:

- is_a hasConvention
- domain SemioticObject
- range Property

hasCharacteriser

IRI: http://emmo:info/emmo#EMMO_eeb8118c_b290_4f57_b0f8_bd65bb6d77ad

prefLabel: hasCharacteriser

Subclass of:

- is_a hasDeclarer
- domain Property
- range Determiner

hasIcon

IRI: http://emmo:info/emmo#EMMO_39c3815d_8cae_4c8f_b2ff_eeba24bec455

prefLabel: hasIcon

Subclass of:

- is_a hasSign
- domain Cognised
- range Icon

hasPhysicalDimension

IRI: http://emmo:info/emmo#EMMO_bed1d005_b04e_4a90_94cf_02bc678a8569

prefLabel: hasPhysicalDimension

Subclass of:

- is_a hasProperty
- range PhysicalDimension

hasModel

IRI: http://emmo:info/emmo#EMMO_24c71baf_6db6_48b9_86c8_8c70cf36db0c

prefLabel: hasModel

Subclass of:

- is_a hasIcon

hasDeclared

IRI: http://emmo:info/emmo#EMMO_0d829933_29e3_4e61_b3d3_88e6b9d0d0ce

prefLabel: hasDeclared

Subclass of:

- is_a hasReferent
- domain Declarer
- range Declared

hasConvention

IRI: http://emmo:info/emmo#EMMO_eb3518bf_f799_4f9e_8c3e_ce59af11453b

prefLabel: hasConvention

Subclass of:

- is_a hasSign
- domain Declared
- range Conventional

hasMeasuredQuantity

IRI: http://emmo:info/emmo#EMMO_fd689787_31b0_41cf_bf03_0d69af76469d

prefLabel: hasMeasuredQuantity

Subclass of:

- is_a hasQuantitativeProperty
- range MeasuredQuantitativeProperty

hasModelledQuantity

IRI: http://emmo:info/emmo#EMMO_b8f79e53_2ad4_441d_87ff_284a5c419e46

prefLabel: hasModelledQuantity

Subclass of:

- is_a hasQuantitativeProperty
- range ModelledQuantitativeProperty

hasConventionalQuantity

IRI: http://emmo:info/emmo#EMMO_16b510a6_0584_4134_bdb6_3bc185c17860

elucidation: Assigns a quantity to an object by convention.

example: An Hydrogen atom has the quantity atomic number Z = 1 as its conventional property.

prefLabel: hasConventionalQuantity

Subclass of:

- is_a hasQuantitativeProperty
- range ConventionalQuantitativeProperty

hasReferent

IRI: http://emmo:info/emmo#EMMO_f2fc1ce9_cc3b_4eb5_a112_3c85d1b1374a

altLabel: hasSemioticObject

prefLabel: hasReferent

Subclass of:

- is_a semiotical

- domain Interpreter
- range SemioticObject

hasConformityAssessmentResult

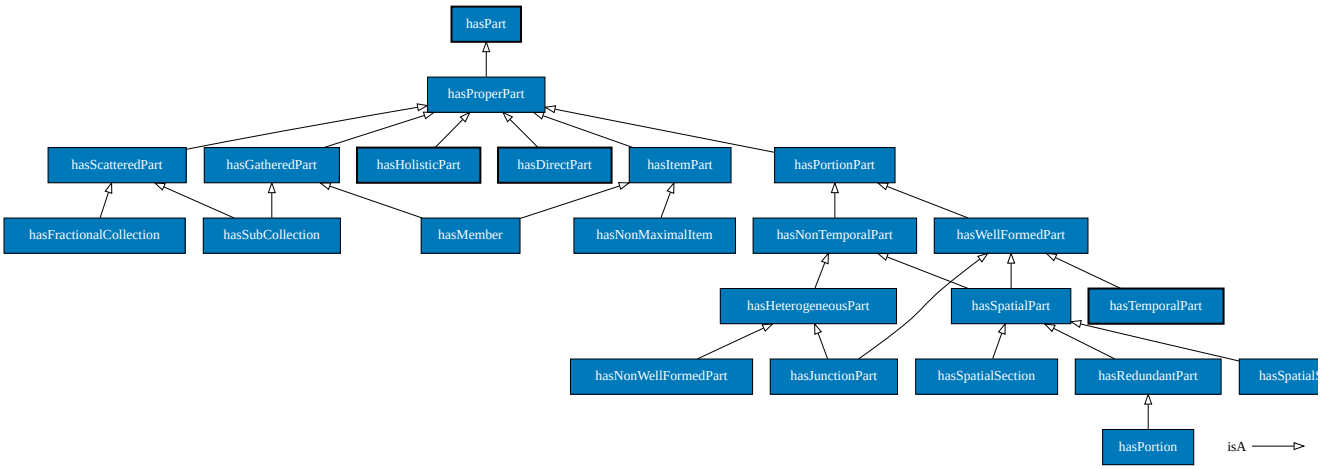
IRI: http://emmo:info/emmo#EMMO_cc677576_5bf4_4f11_9da4_f52556545320

prefLabel: hasConformityAssessmentResult

Subclass of:

- is_a hasProperty
- domain TestItem
- range TestResult

Has Part branch



Has Part branch.

hasTemporalCollectionSlice

IRI: http://emmo:info/emmo#EMMO_850b976f_0726_4408_b1b2_1f0ae367faf6

elucidation: A temporal part that is a collection.

prefLabel: hasTemporalCollectionSlice

Subclass of:

- is_a hasTemporalSlice
- is_a hasScatteredPart

hasSpatialPart

IRI: http://emmo:info/emmo#EMMO_dc57d998_23db_4d8e_b2cd_f346b195b846

elucidation: A proper part of a whole, whose parts always cover the full temporal extension of the whole within a spatial interval.

comment: In EMMO FOL this is a defined property. In OWL temporal relations are primitive.

prefLabel: hasSpatialPart

Subclass of:

- is_a hasWellFormedPart
- is_a hasNonTemporalPart
- domain CausalSystem
- range Item

hasSpatialSection

IRI: http://emmo:info/emmo#EMMO_6e046dd0_9634_4013_b2b1_9cc468087c83

elucidation: A proper part of the whole that is not Spatial or Temporal.

altLabel: hasSpatialPartialPart

comment: This relation identifies parts of a 4D object that do not fully cover the lifetime extent of the whole (spatial) nor the full spatial extent (temporal).

comment: This relation is a filler, to categorise the parts of an entity that are not covered by the other parthood relations. A proper part is then the disjoint union of: spatial part, temporal part and spatio temporal part relations.

prefLabel: hasSpatialSection

Subclass of:

- is_a hasSpatialPart

hasConstituent

IRI: http://emmo:info/emmo#EMMO_dba27ca1_33c9_4443_a912_1519ce4c39ec

elucidation: The relation between an object and one of its holistic part that contributes to the object under some spatial-based criteria.

prefLabel: hasConstituent

Subclass of:

- is_a hasHolisticNonTemporalPart
- domain Object
- range Constituent

hasItemPart

IRI: http://emmo:info/emmo#EMMO_8e742d6f_7fbb_40cf_949b_6806ab0d801f

definition: A proper part relation with range restricted to items.

prefLabel: hasItemPart

Subclass of:

- is_a hasProperPart
- range Item

hasProperPart

IRI: http://emmo:info/emmo#EMMO_9380ab64_0363_4804_b13f_3a8a94119a76

elucidation: The relation between an entity and one of its parts, when both entities are distinct.

prefLabel: hasProperPart

Subclass of:

- is_a ObjectProperty
- is_a hasPart

hasPart

IRI: http://emmo:info/emmo#EMMO_17e27c22_37e1_468c_9dd7_95e137f73e7f

elucidation: The primitive relation that express the concept of an entity being part of another one.

comment: All other mereology relations can be defined in FOL using hasPart as primitive.

prefLabel: hasPart

Subclass of:

- is_a isOverlapping

hasMember

IRI: http://emmo:info/emmo#EMMO_6b7276a4_4b9d_440a_b577_0277539c0fc4

elucidation: The relation between a collection and one of its item members.

prefLabel: hasMember

Subclass of:

- is_a ObjectProperty
- is_a hasItemPart
- is_a hasGatheredPart

hasTemporalItemSlice

IRI: http://emmo:info/emmo#EMMO_5022e4cb_125f_429d_8556_c3e635c561f2

elucidation: A temporal part that is an item.

prefLabel: hasTemporalItemSlice

Subclass of:

- is_a hasTemporalSlice
- is_a hasItemPart

hasHolisticNonTemporalPart

IRI: http://emmo:info/emmo#EMMO_5ceab41b_2aea_4041_9e9c_a243f7562cee

prefLabel: hasHolisticNonTemporalPart

Subclass of:

- is_a hasHolisticPart
- is_a hasNonTemporalPart
- range NonTemporalRole

hasComponent

IRI: http://emmo:info/emmo#EMMO_3c7f239f_e833_4a2b_98a1_c88831770c1b

prefLabel: hasComponent

Subclass of:

- is_a hasConstituent
- domain HolisticSystem
- range Component

hasJunctionPart

IRI: http://emmo:info/emmo#EMMO_408a46b2_3930_46da_b936_e9ce72ffdde9

elucidation: The part is connected with the rest item or members with hasNext (or its inverse) and hasContact relations only.

altLabel: hasSpatioTemporalPart

prefLabel: hasJunctionPart

Subclass of:

- is_a hasHeterogeneousPart
- is_a hasWellFormedPart

hasConstitutiveProcess

IRI: http://emmo:info/emmo#EMMO_e3850f08_8e79_454b_9d83_c517cab42857

prefLabel: hasConstitutiveProcess

Subclass of:

- is_a hasHolisticNonTemporalPart
- domain Object
- range ConstitutiveProcess

hasSubCollection

IRI: http://emmo:info/emmo#EMMO_49e17ba8_dd17_4c28_b8c8_c8c5d5a9aab9

prefLabel: hasSubCollection

Subclass of:

- is_a hasGatheredPart
- is_a hasScatteredPart

hasMeasurementUncertainty

IRI: http://emmo:info/emmo#EMMO_662c64e7_fc72_49b3_a161_f50fd42deafa

elucidation: The relation between a measurement result and the measurement uncertainty.

prefLabel: hasMeasurementUncertainty

Subclass of:

- is_a hasQuantity
- domain MeasurementResult
- range MeasurementUncertainty

hasPortion

IRI: http://emmo:info/emmo#EMMO_b1daa610_64c6_4935_94b8_a19db586a2f6

elucidation: The relation between a object whole and its spatial of the same type.

example: A volume of 1 cc of milk within a 1 litre can be considered still milk as a whole. If you scale down to a cluster of molecules, than the milk cannot be considered a fluid no more (and then no more a milk).

prefLabel: hasPortion

Subclass of:

- is_a hasRedundantPart
- domain Object
- domain Redundant
- range Object

hasFractionalCollection

IRI: http://emmo:info/emmo#EMMO_e1805abe_f5b7_4c40_810a_1a01950546be

prefLabel: hasFractionalCollection

Subclass of:

- is_a hasScatteredPart

hasRedundantPart

IRI: http://emmo:info/emmo#EMMO_6786b336_e982_4759_8dee_1905a4106591

elucidation: The relation between a whole and its mereological parts that are still holistic wholes.

example: A volume of water has redundand parts other volumes of water. All this volumes have holistic parts some water molecules.

prefLabel: hasRedundantPart

Subclass of:

- is_a hasHolisticRelation
- is_a hasSpatialPart
- domain Redundant
- range Whole

hasHeterogeneousPart

IRI: http://emmo:info/emmo#EMMO_0eb37d3d_b633_4ea4_a863_8b7a27c6fdb4

elucidation: The part is not connected with the rest item or members with hasNext (or its inverse) only or hasContact relations only.

prefLabel: hasHeterogeneousPart

Subclass of:

- is_a hasNonTemporalPart

hasScatteredPart

IRI: http://emmo:info/emmo#EMMO_cc0df52b_6211_4167_9e22_5cc3ba201bd9

definition: A proper part relation with range restricted to collections.

prefLabel: hasScatteredPart

Subclass of:

- is_a hasProperPart
- range Collection

hasNonMaximalItem

IRI: http://emmo:info/emmo#EMMO_fd821de4_1c1f_43dc_8ebd_57e7cc170ff9

prefLabel: hasNonMaximalItem

Subclass of:

- is_a hasItemPart

hasTemporalInternal

IRI: http://emmo:info/emmo#EMMO_8962933e_4bb0_4511_889a_9ea086a5a15a

prefLabel: hasTemporalInternal

Subclass of:

- is_a hasTemporalItemSlice

hasSubProcess

IRI: http://emmo:info/emmo#EMMO_d43af210_f854_4432_a891_ce3022e3b558

elucidation: The relation between a process and one of its process parts.

prefLabel: hasSubProcess

Subclass of:

- is_a hasHolisticNonTemporalPart
- domain Process
- range SubProcess

hasTemporalBegin

IRI: http://emmo:info/emmo#EMMO_4608bf9e_eeb9_4301_b0ab_d55b0f7da5e0

prefLabel: hasTemporalBegin

Subclass of:

- is_a hasTemporalItemSlice

hasQuantity

IRI: http://emmo:info/emmo#EMMO_5d73661e_e710_4844_ab9b_a85b7e68576a

elucidation: The relation between a whole and its holistic quantity parts.

prefLabel: hasQuantity

Subclass of:

- is_a hasConstituent
- range Quantity

hasNonTemporalPart

IRI: http://emmo:info/emmo#EMMO_9a50a0ae_841a_46fe_8b23_3df319b60611

elucidation: The part is not connected with the rest item or members with hasNext relation (or its inverse).

prefLabel: hasNonTemporalPart

Subclass of:

- is_a hasPortionPart

hasAgent

IRI: http://emmo:info/emmo#EMMO_cd24eb82_a11c_4a31_96ea_32f870c5580a

elucidation: The relation within a process and an agengt participant.

prefLabel: hasAgent

Subclass of:

- is_a hasParticipant
- range Agent

hasNonWellFormedPart

IRI: http://emmo:info/emmo#EMMO_ad6a320d_6c32_4e0b_9fb8_5a4bf771a6dd

elucidation: A part is connected with the rest item or a member with bi-directional causal relations that does not fall under hasNext (or its inverse) or hasContact.

prefLabel: hasNonWellFormedPart

Subclass of:

- is_a hasHeterogeneousPart

hasInterval

IRI: http://emmo:info/emmo#EMMO_2eb10b5b_900b_44d7_af85_4de9a3729474

elucidation: The relation between a process whole and a temporal part of the same type.

prefLabel: hasInterval

Subclass of:

- is_a hasRedundantPart
- is_a hasTemporalPart
- domain Process
- domain Redundant
- range Process

hasParticipant

IRI: http://emmo:info/emmo#EMMO_ae2d1a96_bfa1_409a_a7d2_03d69e8a125a

elucidation: The relation between a process and an object participating to it, i.e. that is relevant to the process itself.

prefLabel: hasParticipant

Subclass of:

- is_a hasHolisticNonTemporalPart
- domain Process
- range Participant

hasSpatialSlice

IRI: http://emmo:info/emmo#EMMO_f68030be_94b8_4c61_a161_886468558054

elucidation: A relation that identify a proper part of the whole that extends itself in time along the overall lifetime of the whole, and whose parts never cover the full spatial extension of the 4D whole.

altLabel: hasSpatialIntegralPart

comment: In EMMO FOL this is a defined property. In OWL spatial relations are primitive.

prefLabel: hasSpatialSlice

Subclass of:

- is_a hasSpatialPart

hasGatheredPart

IRI: http://emmo:info/emmo#EMMO_c37d451b_e245_439f_bd94_9050e04ec9f7

definition: A proper part relation with domain restricted to collections.

prefLabel: hasGatheredPart

Subclass of:

- is_a hasProperPart
- domain Collection

hasPortionPart

IRI: http://emmo:info/emmo#EMMO_55354438_7000_4284_b1b9_59d60c2261b9

definition: A proper part relation with domain restricted to items.

prefLabel: hasPortionPart

Subclass of:

- is_a hasProperPart
- domain Item

hasWellFormedPart

IRI: http://emmo:info/emmo#EMMO_22c91e99_61f8_4433_8853_432d44a2a46a

elucidation: The part is connected to the rest item or members only with hasNext or hasContact relations or their inverse.

prefLabel: hasWellFormedPart

Subclass of:

- is_a hasPortionPart

hasTemporalEnd

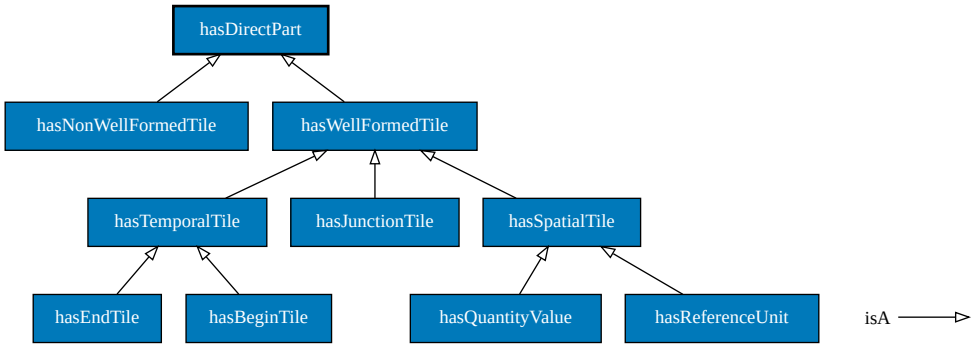
IRI: http://emmo:info/emmo#EMMO_f9df1503_6ecf_427e_b127_742536601562

prefLabel: hasTemporalEnd

Subclass of:

- is_a hasTemporalItemSlice

Has Direct Part branch



Has Direct Part branch.

hasSpatialTile

IRI: http://emmo:info/emmo#EMMO_b2282816_b7a3_44c6_b2cb_3feff1ceb7fe

elucidation: A relation that establishes for the whole a univocal tessellation in spatial parts.

prefLabel: hasSpatialTile

Subclass of:

- is_a ObjectProperty
- is_a ObjectProperty
- is_a hasWellFormedTile
- domain Tessellation
- range SpatialTile

hasEndTile

IRI: http://emmo:info/emmo#EMMO_c0f48dc6_4a32_4d9a_a956_d68415954a8e

elucidation: The relation between the whole and the last direct temporal part of a sequence.

altLabel: hasTemporalLast

prefLabel: hasEndTile

Subclass of:

- is_a FunctionalProperty
- is_a ObjectProperty

- is_a ObjectProperty
- is_a hasTemporalTile

hasTemporalTile

IRI: http://emmo:info/emmo#EMMO_65a2c5b8_e4d8_4a51_b2f8_e55effc0547d

elucidation: A relation that establishes for the whole a univocal tessellation in temporal parts.

prefLabel: hasTemporalTile

Subclass of:

- is_a ObjectProperty
- is_a ObjectProperty
- is_a hasWellFormedTile
- domain Tessellation
- range TemporalTile

hasBeginTile

IRI: http://emmo:info/emmo#EMMO_fe63194f_7c04_4dbd_a244_524b38b6699b

elucidation: The relation between the whole and the first direct temporal part of a sequence.

altLabel: hasTemporalFirst

prefLabel: hasBeginTile

Subclass of:

- is_a FunctionalProperty
- is_a ObjectProperty
- is_a ObjectProperty
- is_a hasTemporalTile

hasQuantityValue

IRI: http://emmo:info/emmo#EMMO_8ef3cd6d_ae58_4a8d_9fc0_ad8f49015cd0

prefLabel: hasQuantityValue

Subclass of:

- is_a ObjectProperty
- is_a ObjectProperty
- is_a hasSpatialTile
- domain Quantity

hasDirectPart

IRI: http://emmo:info/emmo#EMMO_74a75cf1_3418_4244_b43c_b5db94635d42

elucidation: The relation grouping all direct parthood relations used in the reductionistic perspective.

comment: This relation is not antitransitive, to enable partitioning of a causal object with more than one tiling scheme (e.g. time and space partitioning).

prefLabel: hasDirectPart

Subclass of:

- is_a hasProperPart
- domain Tessellation
- range Tile

hasWellFormedTile

IRI: http://emmo:info/emmo#EMMO_7efab93d_c8fe_49c7_ba8e_d21d13b38c85

elucidation: A tile that is connected with other tiles with bi-directional causal relations that fall under hasNext (or its inverse) or hasContact.

prefLabel: hasWellFormedTile

Subclass of:

- is_a InverseFunctionalProperty
- is_a ObjectProperty

- is_a ObjectProperty
- is_a hasDirectPart

hasReferenceUnit

IRI: http://emmo:info/emmo#EMMO_67fc0a36_8dcb_4ffa_9a43_31074efa3296

prefLabel: hasReferenceUnit

Subclass of:

- is_a ObjectProperty
- is_a ObjectProperty
- is_a hasSpatialTile
- domain Quantity
- range ReferenceUnit

hasNonWellFormedTile

IRI: http://emmo:info/emmo#EMMO_ea55b233_f47b_4bcf_98a0_ec1abeb82b81

elucidation: A tile that is connected with other tiles with bi-directional causal relations that does not fall under hasNext (or its inverse) or hasContact.

prefLabel: hasNonWellFormedTile

Subclass of:

- is_a hasDirectPart

hasJunctionTile

IRI: http://emmo:info/emmo#EMMO_663859e5_add3_4c9e_96fb_c99399de278d

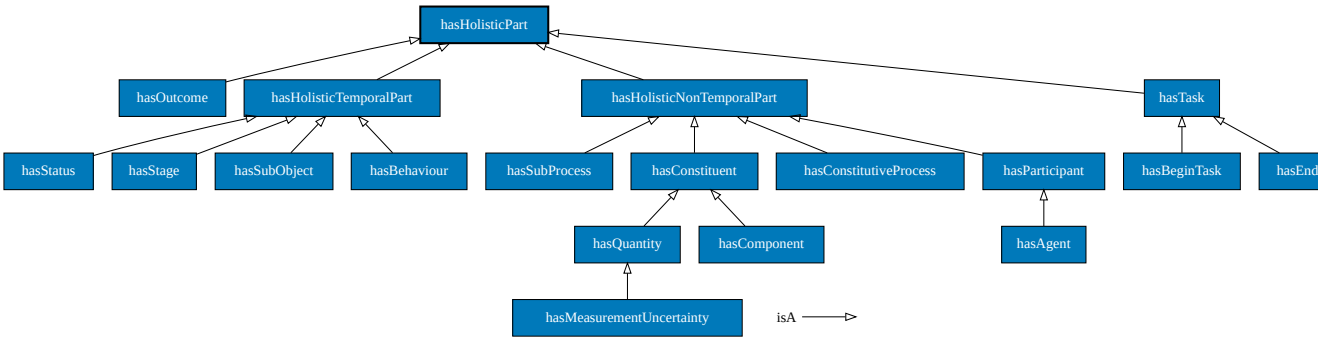
elucidation: A relation that establishes for the whole a univocal tessellation in spatio temporal parts.

prefLabel: hasJunctionTile

Subclass of:

- is_a ObjectProperty
- is_a ObjectProperty
- is_a hasWellFormedTile
- domain Tessellation
- range JunctionTile

Has Holistic Part branch



Has Holistic Part branch.

hasOutcome

IRI: http://emmo:info/emmo#EMMO_0b1502e2_d12f_4ff3_83b1_eeedf9382954

elucidation: The relation between a process and the entity that represents how things have turned out.

prefLabel: hasOutcome

Subclass of:

- is_a hasHolisticPart

- domain Process

hasSubProcess

IRI: http://emmo:info/emmo#EMMO_d43af210_f854_4432_a891_ce3022e3b558

elucidation: The relation between a process and one of its process parts.

prefLabel: hasSubProcess

Subclass of:

- is_a hasHolisticNonTemporalPart
- domain Process
- range SubProcess

hasConstituent

IRI: http://emmo:info/emmo#EMMO_dba27ca1_33c9_4443_a912_1519ce4c39ec

elucidation: The relation between an object and one of its holistic part that contributes to the object under some spatial-based criteria.

prefLabel: hasConstituent

Subclass of:

- is_a hasHolisticNonTemporalPart
- domain Object
- range Constituent

hasQuantity

IRI: http://emmo:info/emmo#EMMO_5d73661e_e710_4844_ab9b_a85b7e68576a

elucidation: The relation between a whole and its holistic quantity parts.

prefLabel: hasQuantity

Subclass of:

- is_a hasConstituent
- range Quantity

hasBeginTask

IRI: http://emmo:info/emmo#EMMO_4ab7fb52_cec3_4c00_90c0_5648f01e3296

prefLabel: hasBeginTask

Subclass of:

- is_a hasTask

hasStatus

IRI: http://emmo:info/emmo#EMMO_1440d010_e4c5_4597_8858_1d58cb1fb28f

prefLabel: hasStatus

Subclass of:

- is_a hasHolisticTemporalPart
- domain Process
- range Status

hasHolisticTemporalPart

IRI: http://emmo:info/emmo#EMMO_9ee42d6b_7242_4a8d_967e_79f8f1c7fe29

prefLabel: hasHolisticTemporalPart

Subclass of:

- is_a hasTemporalPart
- is_a hasHolisticPart
- range TemporalRole

hasHolisticNonTemporalPart

IRI: http://emmo:info/emmo#EMMO_5ceab41b_2aea_4041_9e9c_a243f7562cee

prefLabel: hasHolisticNonTemporalPart

Subclass of:

- is_a hasHolisticPart
- is_a hasNonTemporalPart
- range NonTemporalRole

hasStage

IRI: http://emmo:info/emmo#EMMO_f22abf74_4538_4f50_ab85_09908cdda707

prefLabel: hasStage

Subclass of:

- is_a hasHolisticTemporalPart
- domain Process
- range Stage

hasComponent

IRI: http://emmo:info/emmo#EMMO_3c7f239f_e833_4a2b_98a1_c88831770c1b

prefLabel: hasComponent

Subclass of:

- is_a hasConstituent
- domain HolisticSystem
- range Component

hasHolisticPart

IRI: http://emmo:info/emmo#EMMO_8e52c42b_e879_4473_9fa1_4b23428b392b

elucidation: The relation between the whole and a proper part of the whole that scale down to the point which it lose the characteristics of the whole and become something else.

example: An holistic part of water fluid is a water molecule.

prefLabel: hasHolisticPart

Subclass of:

- is_a hasHolisticRelation
- is_a hasProperPart
- range Role

hasAgent

IRI: http://emmo:info/emmo#EMMO_cd24eb82_a11c_4a31_96ea_32f870c5580a

elucidation: The relation within a process and an agengt participant.

prefLabel: hasAgent

Subclass of:

- is_a hasParticipant
- range Agent

hasConstitutiveProcess

IRI: http://emmo:info/emmo#EMMO_e3850f08_8e79_454b_9d83_c517cab42857

prefLabel: hasConstitutiveProcess

Subclass of:

- is_a hasHolisticNonTemporalPart
- domain Object
- range ConstitutiveProcess

hasEndTask

IRI: http://emmo:info/emmo#EMMO_92227f7f_22e9_4b19_a011_920eac3c7b75

prefLabel: hasEndTask

Subclass of:

- is_a hasTask

hasParticipant

IRI: http://emmo:info/emmo#EMMO_ae2d1a96_bfa1_409a_a7d2_03d69e8a125a

elucidation: The relation between a process and an object participating to it, i.e. that is relevant to the process itself.

prefLabel: hasParticipant

Subclass of:

- is_a hasHolisticNonTemporalPart
- domain Process
- range Participant

hasSubObject

IRI: http://emmo:info/emmo#EMMO_7329967c_3972_4c99_b478_84f66436620d

prefLabel: hasSubObject

Subclass of:

- is_a hasHolisticTemporalPart
- domain Object
- range SubObject

hasMeasurementUncertainty

IRI: http://emmo:info/emmo#EMMO_662c64e7_fc72_49b3_a161_f50fd42deafa

elucidation: The relation between a measurement result and the measurement uncertainty.

prefLabel: hasMeasurementUncertainty

Subclass of:

- is_a hasQuantity
- domain MeasurementResult
- range MeasurementUncertainty

hasTask

IRI: http://emmo:info/emmo#EMMO_70da982d_1810_4b01_9630_a28e216ecd9a

prefLabel: hasTask

Subclass of:

- is_a hasHolisticPart
- domain Workflow
- range Task

hasBehaviour

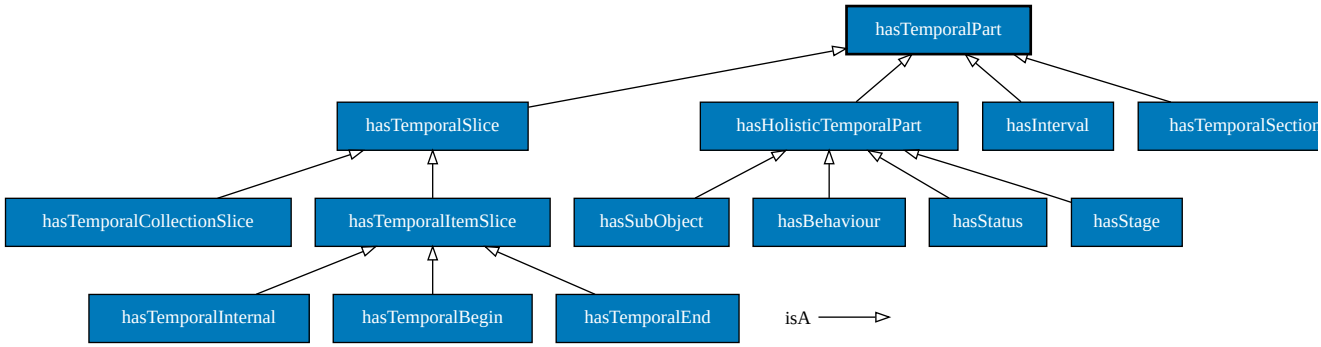
IRI: http://emmo:info/emmo#EMMO_ebc8c324_8e7a_4b09_bcb5_306e0c461d24

prefLabel: hasBehaviour

Subclass of:

- is_a hasHolisticTemporalPart
- domain Object
- range Behaviour

Has Temporal Part branch



Has Temporal Part branch.

hasTemporalCollectionSlice

IRI: http://emmo:info/emmo#EMMO_850b976f_0726_4408_b1b2_1f0ae367faf6

elucidation: A temporal part that is a collection.

prefLabel: hasTemporalCollectionSlice

Subclass of:

- is_a hasTemporalSlice
- is_a hasScatteredPart

hasTemporalInternal

IRI: http://emmo:info/emmo#EMMO_8962933e_4bb0_4511_889a_9ea086a5a15a

prefLabel: hasTemporalInternal

Subclass of:

- is_a hasTemporalItemSlice

hasHolisticTemporalPart

IRI: http://emmo:info/emmo#EMMO_9ee42d6b_7242_4a8d_967e_79f8f1c7fe29

prefLabel: hasHolisticTemporalPart

Subclass of:

- is_a hasTemporalPart
- is_a hasHolisticPart
- range TemporalRole

hasInterval

IRI: http://emmo:info/emmo#EMMO_2eb10b5b_900b_44d7_af85_4de9a3729474

elucidation: The relation between a process whole and a temporal part of the same type.

prefLabel: hasInterval

Subclass of:

- is_a hasRedundantPart
- is_a hasTemporalPart
- domain Process
- domain Redundant
- range Process

hasSubObject

IRI: http://emmo:info/emmo#EMMO_7329967c_3972_4c99_b478_84f66436620d

prefLabel: hasSubObject

Subclass of:

- is_a hasHolisticTemporalPart

- domain Object
- range SubObject

hasTemporalBegin

IRI: http://emmo:info/emmo#EMMO_4608bf9e_eeb9_4301_b0ab_d55b0f7da5e0

prefLabel: hasTemporalBegin

Subclass of:

- is_a hasTemporalItemSlice

hasBehaviour

IRI: http://emmo:info/emmo#EMMO_ebc8c324_8e7a_4b09_bcb5_306e0c461d24

prefLabel: hasBehaviour

Subclass of:

- is_a hasHolisticTemporalPart
- domain Object
- range Behaviour

hasStatus

IRI: http://emmo:info/emmo#EMMO_1440d010_e4c5_4597_8858_1d58cb1fb28f

prefLabel: hasStatus

Subclass of:

- is_a hasHolisticTemporalPart
- domain Process
- range Status

hasTemporalPart

IRI: http://emmo:info/emmo#EMMO_7afbed84_7593_4a23_bd88_9d9c6b04e8f6

elucidation: A relation that identify a proper item part of the whole, whose parts always cover the full spatial extension of the whole within a time interval.

comment: A temporal part of an item cannot both cause and be caused by any other proper part of the item.

A temporal part is not constraint to be causally self-connected, i.e. it can be either an item or a collection. We therefore introduce two subproperties in order to distinguish between both cases.

comment: In EMMO FOL this is a defined property. In OWL temporal relations are primitive.

prefLabel: hasTemporalPart

Subclass of:

- is_a hasWellFormedPart

hasStage

IRI: http://emmo:info/emmo#EMMO_f22abf74_4538_4f50_ab85_09908cdda707

prefLabel: hasStage

Subclass of:

- is_a hasHolisticTemporalPart
- domain Process
- range Stage

hasTemporalItemSlice

IRI: http://emmo:info/emmo#EMMO_5022e4cb_125f_429d_8556_c3e635c561f2

elucidation: A temporal part that is an item.

prefLabel: hasTemporalItemSlice

Subclass of:

- is_a hasTemporalSlice
- is_a hasItemPart

hasTemporalSlice

IRI: http://emmo:info/emmo#EMMO_2a33ee61_8235_4da4_b9a1_ca62cb87a016

elucidation: A temporal part that capture the overall spatial extension of the causal object.

prefLabel: hasTemporalSlice

Subclass of:

- is_a hasTemporalPart

hasTemporalEnd

IRI: http://emmo:info/emmo#EMMO_f9df1503_6ecf_427e_b127_742536601562

prefLabel: hasTemporalEnd

Subclass of:

- is_a hasTemporalItemSlice

hasTemporalSection

IRI: http://emmo:info/emmo#EMMO_aef8af39_0a22_4be8_a523_4e47ca36e035

elucidation: A temporal part that is not a slice.

prefLabel: hasTemporalSection

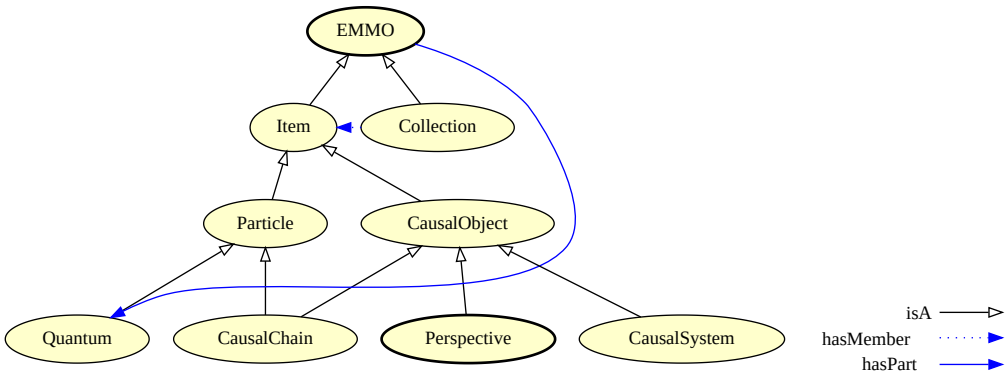
Subclass of:

- is_a hasTemporalPart

EMMO Classes

emmo is a class representing the collection of all the individuals (signs) that are used in the ontology. Individuals are declared by the EMMO users when they want to apply the EMMO to represent the world.

EMMO BRANCH



EMMO branch.

The root of all classes used to represent the world. It has two children; *collection* and *item*.

collection is the class representing the collection of all the individuals (signs) that represents a collection of non-connected real world objects.

item Is the class that collects all the individuals that are members of a set (it's the most comprehensive set individual). It is the branch of mereotopology.

Homonuclear

IRI: http://emmo:info/emmo#EMMO_e024544d_e374_45b7_9340_1982040bc6b7

elucidation: A molecule with only one nucleus.

example: A helium molecule in a gas.

altLabel: ElementalMolecule

prefLabel: Homonuclear

Subclass of:

- is_a Molecule

PhysicsBasedModel

IRI: http://emmo:info/emmo#EMMO_b29fd350_39aa_4af7_9459_3faa0544cba6

elucidation: A mathematical entity based on a fundamental physics theory which defines the relations between physics quantities of an entity.

prefLabel: PhysicsBasedModel

Subclass of:

- is_a MathematicalModel
- hasSpatialSlice some PhysicsEquation
- is_a MathematicalConstruct
- is_a CausalSystem

Collection

IRI: http://emmo:info/emmo#EMMO_2d2ecd97_067f_4d0e_950c_d746b7700a31

elucidation: The class of not direct causally self-connected world entities.

example: The collection of users of a particular software, the collection of atoms that have been part of that just dissociated molecule.

conceptualisation: A collection is the concept that complements the item concept, being an entity that possesses at least one part non directly causally connected with the rest. A collection can be partitioned in maximally connected items called members. The members are self-connected entities and there is no direct causality relation between them. The combination of collection and item concepts is the EMMO mereocausality alternative to set theory. However, two items can be members only if they are non direct causally connected, giving some constraints to a collection definition. For example, two entities which are directly connected cannot be two distinct members, while their interiors (i.e. the entities obtained by removing the layer of parts that provides the causal contact between them) can be.

prefLabel: Collection

Subclass of:

- hasMember min 2 Item
- is_a EMMO

MesoscopicModel

IRI: http://emmo:info/emmo#EMMO_53935db0_af45_4426_b9e9_244a0d77db00

elucidation: A physics-based model based on a physics equation describing the behaviour of mesoscopic entities, i.e. a set of bounded atoms like a molecule, bead or nanoparticle.

prefLabel: MesoscopicModel

Subclass of:

- is_a MaterialsModel

Particle

IRI: http://emmo:info/emmo#EMMO_6c03574f_6daa_4488_a970_ee355cca2530

definition: The union of Elementary and Quantum classes.

elucidation: The class of entities that have no spatial structure.

conceptualisation: The concept is based on the common usage of the word “particle”, that is used to identify both a specific state of an elementary particle (a quantum) and both the chain of quantums that expresses the evolution of the particle in time.

prefLabel: Particle

Subclass of:

- is_a Item
- disjoint_union_of CausalChain, Quantum

Quantum

IRI: http://emmo:info/emmo#EMMO_3f9ae00e_810c_4518_aec2_7200e424cf68

definition: The class of entities without proper parts.

elucidation: The class of the mereological and causal fundamental entities.

example: From a physics perspective a quantum can be related to smallest identifiable entities, according to the limits imposed by the uncertainty principle in space and time measurements. However, the quantum mereotopology approach is not restricted only to physics. For example, in a manpower management ontology, a quantum can stand for an hour (time) of a worker (space) activity.

comment: A quantum is the EMMO mereological atomistic and causal reductionistic entity. To avoid confusion with the concept of atom coming from physics and to underline the causal reductionistic approach, we will use the expression quantum mereology, instead of atomistic mereology.

conceptualisation: A quantum is the most fundamental item (both mereologically and causally) and is considered causally self-connected by definition. The quantum concept recalls the fact that there is lower epistemological limit to our knowledge of the universe, related to the uncertainity principle. Space and time emerge following the network of causal connections between quantum objects. So quantum objects are adimensional objects, that precede space and time dimensions. Using physics concepts, we can think the quantum as an elementary particle (e.g. an electron) in a specific state between two causal interactions.

prefLabel: Quantum

Subclass of:

- hasProperPart only Nothing
- is_a Particle

ElectronicModel

IRI: http://emmo:info/emmo#EMMO_6eca09be_17e9_445e_abc9_000aa61b7a11

elucidation: A physics-based model based on a physics equation describing the behaviour of electrons.

example: Density functional theory. Hartree-Fock.

prefLabel: ElectronicModel

Subclass of:

- is_a MaterialsModel

MaterialsModel

IRI: http://emmo:info/emmo#EMMO_90f18cf0_1225_4c64_b5f8_f65cd7f992c5

elucidation: A solvable set of one Physics Equation and one or more Materials Relations.

prefLabel: MaterialsModel

Subclass of:

- is_a PhysicsBasedModel
- hasSpatialSlice some MaterialRelation
- disjoint_union_of ContinuumModel, MesoscopicModel, ElectronicModel, AtomisticModel

CausalObject

IRI: http://emmo:info/emmo#EMMO_c5ddfdba_c074_4aa4_ad6b_1ac4942d300d

definition: The union of Elementary and CausalSystem classes.

elucidation: A self-connected composition of more than one quantum object.

altLabel: PhysicalObject

comment: A causal object expresses itself in time and space thanks to the underlying causality relations between its constituent quantum entities. It must at least provide two temporal parts.

The unity criterion beyond the definition of a causal object (the most general concept of object) is the existence of a causal path between each of its parts.

conceptualisation: The most fundamental unity criterion for the definition of an object is that: - is made of at least two quantums (an object is not a simple entity) - all quantum parts form a causally coonected graph

prefLabel: CausalObject

Subclass of:

- is_a Item
- disjoint_union_of CausalChain, CausalSystem

Individuals:

- universe

Molecule

IRI: http://emmo:info/emmo#EMMO_3397f270_dfc1_4500_8f6f_4d0d85ac5f71

elucidation: An atom_based state defined by an exact number of e-bonded atomic species and an electron cloud made of the shared electrons.

example: H20, C6H12O6, CH4

prefLabel: Molecule

Subclass of:

- is_a MolecularEntity
- hasSpatialPart some Electron
- hasSpatialPart some AtomicNucleus
- is_a CompositeParticle
- is_a CausalSystem
- disjoint_union_of Heteronuclear, Homonuclear

AtomisticModel

IRI: http://emmo:info/emmo#EMMO_84cadc45_6758_46f2_ba2a_5ead65c70213

elucidation: A physics-based model based on a physics equation describing the behaviour of atoms.

prefLabel: AtomisticModel

Subclass of:

- is_a MaterialsModel

PhysicsEquation

IRI: http://emmo:info/emmo#EMMO_27c5d8c6_8af7_4d63_beb1_ec37cd8b3fa3

elucidation: An ‘equation’ that stands for a ‘physical_law’ by mathematically defining the relations between physics_quantities.

example: The Newton’s equation of motion. The Schrödinger equation. The Navier-Stokes equation.

prefLabel: PhysicsEquation

Subclass of:

- is_a PhysicsBasedModel
- is_a Equation

Heteronuclear

IRI: http://emmo:info/emmo#EMMO_50967f46_51f9_462a_b1e4_e63365b4a184

elucidation: A molecule with more than one nucleus.

example: Hydrogen molecule (H2).

prefLabel: Heteronuclear

Subclass of:

- is_a Molecule

CausalSystem

IRI: http://emmo:info/emmo#EMMO_e7aac247_31d6_4b2e_9fd2_e842b1b7ccac

elucidation: A non-elementary causal object.

example: A electron binded by a nucleus.

conceptualisation: A causal system provides the most general concept of system, being a union of causal objects causally interacting together.
In its most simple form, a causal system is an interlacement of elementaries (the most simple object).

prefLabel: CausalSystem

Subclass of:

- is_a CausalObject

Atom

IRI: http://emmo:info/emmo#EMMO_eb77076b_a104_42ac_a065_798b2d2809ad

elucidation: A standalone atom has direct part one ‘nucleus’ and one ‘electron_cloud’.

An O ‘atom’ within an O2 ‘molecule’ is an ‘e-bonded_atom’.

In this material branch, H atom is a particular case, with respect to higher atomic number atoms, since as soon as it shares its electron it has no nucleus entangled electron cloud.

We cannot say that H2 molecule has direct part two H atoms, but has direct part two H nucleus.

altLabel: ChemicalElement

prefLabel: Atom

Subclass of:

- is_a MolecularEntity
- hasSpatialPart some Electron
- hasSpatialSlice some AtomicNucleus
- is_a CompositeParticle
- is_a CausalSystem

ContinuumModel

IRI: http://emmo:info/emmo#EMMO_4456a5d2_16a6_4ee1_9a8e_5c75956b28ea

elucidation: A physics-based model based on a physics equation describing the behaviour of continuum volume.

prefLabel: ContinuumModel

Subclass of:

- is_a MaterialsModel

Item

IRI: http://emmo:info/emmo#EMMO_eb3a768e_d53e_4be9_a23b_0714833c36de

definition: The disjoint union of Elementary, Quantum and CausalSystem classes.

elucidation: The class of individuals standing for direct causally self-connected world entities.

conceptualisation: A world entity is direct causally self-connected if any two parts that make up the whole are direct causally connected to each other. In the EMMO, topological connectivity is based on causality. All physical objects, i.e. entities whose behaviour is explained by physics laws, are represented only by items. In other words, a physical object part is embedded in a direct causal graph that provides always a path between two of its parts. Members of a collection lack such direct causality connection, i.e. they do not constitute a physical object.

Following graph theory concepts, the quantums of an item are all connected together within a network of causal relations, forming a connected causal graph. A collection is then a set of disconnected graphs.

prefLabel: Item

Subclass of:

- is_a EMMO
- disjoint_union_of CausalChain, Quantum, CausalSystem

EMMO

IRI: http://emmo:info/emmo#EMMO_802d3e92_8770_4f98_a289_ccaaab7fdddf

definition: The disjoint union of the Item and Collection classes.

elucidation: The class of all the OWL individuals declared by EMMO as standing for world entities.

comment: EMMO entities dimensionality is related to their mereocausal structures. From the no-dimensional quantum entity, we introduce time dimension with the elementary concept, and the spacetime with the causal system concept. The EMMO conceptualisation does not allow the existence of space without a temporal dimension, the latter coming from a causal relation between entities. For this reason, the EMMO entities that are not quantum or elementaries, may be considered to be always spatiotemporal. The EMMO poses no constraints to the number of spatial dimensions for a causal system (except being higher than one).

conceptualisation: The EMMO conceptualises the world using the primitive concepts of causality and parthood. Parthood is about the composition of world entities starting from other more fundamental entities. Causality is about the interactions between world entities.

The quantum is the smallest indivisible part of any world entity. Quantum individuals are the fundamental causal constituents of the universe, since it is implied that causality originates from quantum-to-quantum interactions. Quantums are no-dimensional, and their aggregation makes spacetime emerge from their causal structure. Causality between macro entities (i.e. entities made of more than one quantum) is explained as the sum of the causality relations between their quantum constituents.

The fundamental distinction between world entities is direct causality self-connectedness: a world entity can be self-connected xor not self-connected depending on the causality network of its fundamental components.

There is no concept for void region, or in other worlds of spacetime without entities, since space and time are measured quantities following a causality relation between entities (spacetime emerges as relational property).

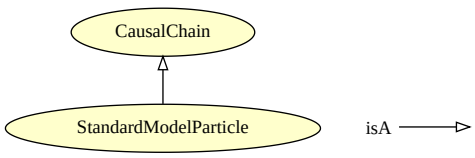
Entities are not placed in space or time: space and time are always relative between entities and are measured. In other words, space and time relations originates from causality interactions.

prefLabel: EMMO

Subclass of:

- is_a Thing
- hasPart some Quantum
- Inverse(hasPart) value universe
- disjoint_union_of Collection, Item

Elementary branch



Elementary branch.

CausalChain

IRI: http://emmo:info/emmo#EMMO_0f795e3e_c602_4577_9a43_d5a231aa1360

elucidation: The class of entities that possess a temporal structure but no spatial structure.

example: An electron with at least one causal interaction with another particle.

OWLDLRestrictedAxiom: hasTemporalPart min 2 (Elementary or Quantum)

altLabel: Elementary

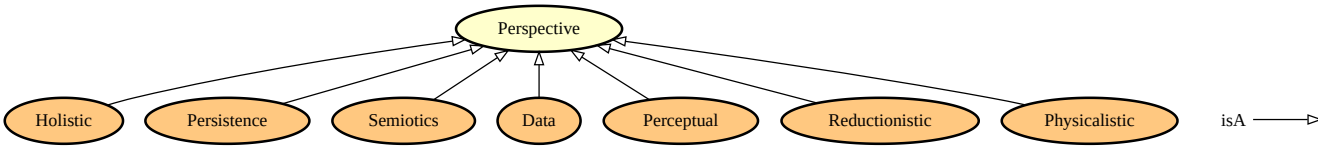
conceptualisation: A causal chain is an ordered causal sequence of entities that does not host any bifurcation within itself (a chain). A chain can only be partitioned in time.

prefLabel: CausalChain

Subclass of:

- hasTemporalPart some (CausalChain or Quantum)
- hasTemporalPart only (CausalChain or Quantum)
- is_a CausalObject
- is_a Particle

Perspective branch



Perspective branch.

Perspective

IRI: http://emmo:info/emmo#EMMO_49267eba_5548_4163_8f36_518d65b583f9

elucidation: The class of individuals that stand for real world objects according to a specific representational perspective.

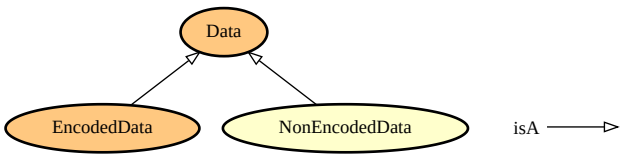
comment: This class is the practical implementation of the EMMO pluralistic approach for which the only objective categorization is provided by the Universe individual and all the Quantum individuals. Between these two extremes, there are several subjective ways to categorize real world objects, each one provide under a ‘Perspective’ subclass.

prefLabel: Perspective

Subclass of:

- is_a CausalObject

Data branch



Data branch.

Data

IRI: http://emmo:info/emmo#EMMO_1e877c70_3b01_45a8_a8f6_8ce4f6a24660

elucidation: A perspective in which entities are represented according to the variation of their properties.

altLabel: Contrast

altLabel: Dedomena

altLabel: Pattern

comment: A data is a causal object whose variations (non-uniformity) can be recognised and eventually interpreted. A data can be of different physical types (e.g., matter, wave, atomic excited states). How the variations are recognised and eventually decoded depends on the interpreting rules that characterise that type of data. Variations are pure physical variations and do not necessarily possess semantic meaning.

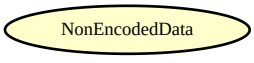
comment: The covering axiom that defines the data class discriminates within all the possible causal objects between encoded or non encoded.

prefLabel: Data

Subclass of:

- is_a Perspective
- equivalent_to EncodedData or NonEncodedData

Non Encoded Data branch



Non Encoded Data branch.

NonEncodedData

IRI: http://emmo:info/emmo#EMMO_5a10e288_c6a5_409a_a16a_98a2fb8be4f3

elucidation: Data that occurs naturally without an encoding agent producing it.

example: A cloud in the sky. The radiative spectrum of a star.

altLabel: EnvironmentalData

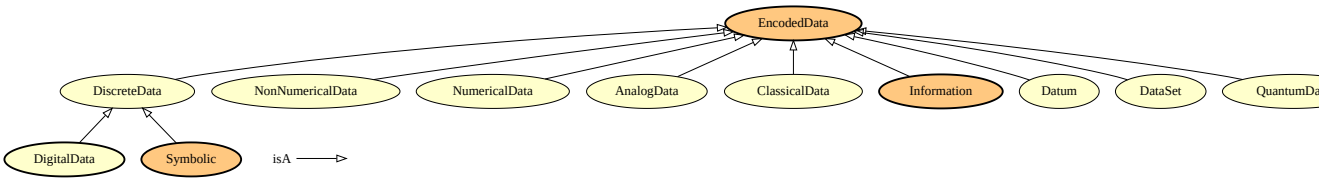
comment: This is a really broad class that gathers all physical phenomena in which a variation occurs naturally.

prefLabel: NonEncodedData

Subclass of:

- is_a Data

Encoded Data branch



Encoded Data branch.

EncodedData

IRI: http://emmo:info/emmo#EMMO_3e7add3d_e6ed_489a_a796_8e31fef9b490

elucidation: A causal object whose properties variation are encoded by an agent and that can be decoded by another agent according to a specific rule.

example: A Radio Morse Code transmission can be addressed by combination of perspectives.

Physicalistic: the electromagnetic pulses can be defined as individual A (of type Field) and the strip of paper coming out a printer receiver can be defined as individual B (of type Matter). Data: both A and B are also DiscreteData class individuals. In particular they may belong to a MorseData class, subclass of DiscreteData. Perceptual: B is an individual belonging to the graphical entities expressing symbols. In particular is a formula under the MorseLanguage class, made of a combination of . and - symbols. Semiotics: A and B can be signs if they refers to something else (e.g. a report about a fact, names).

example: A signal through a cable. A sound wave. Words on a page. The pattern of excited states within a computer RAM.

altLabel: EncodedVariation

comment: We call “decoding” the act of recognise the variation according to a particular rule and generate another equivalent schema (e.g. in the agent’s cognitive apparatus, as another form of data). We call “interpreting” the act of providing semantic meaning to data, which is covered by the semiotic perspective.

prefLabel: EncodedData

wikipediaReference: https://no:wikipedia:org/wiki/Data

Subclass of:

- is_a Data
- equivalent_to AnalogData or DiscreteData
- equivalent_to DataSet or Datum
- equivalent_to QuantumData or ClassicalData
- equivalent_to NumericalData or NonNumericalData

NonNumericalData

IRI: http://emmo:info/emmo#EMMO_ac1a05c5_0c17_4387_bac0_683f2a86f3ed

elucidation: Data that are non-quantitatively interpreted (e.g., qualitative data, types).

prefLabel: NonNumericalData

Subclass of:

- is_a EncodedData

NumericalData

IRI: http://emmo:info/emmo#EMMO_888a5dea_3b7d_4dc0_93f2_d4e345a1f903

elucidation: Data that can be decoded under a quantitative schema and also associated with a graphical number symbols.

prefLabel: NumericalData

Subclass of:

- is_a EncodedData

AnalogData

IRI: http://emmo:info/emmo#EMMO_0d1c0018_42e2_4506_bc3d_f53c117c1ad3

elucidation: Data that are decoded retaining its continuous variations characteristic.

example: A vynil contain continuous information about the recorded sound.

comment: The fact that there may be a finite granularity in the variations of the material basis (e.g. the smallest peak in a vynil that can be recognized by the piezo-electric transducer) does not prevent a data to be analog. It means only that the focus on such data encoding is on a scale that makes such variations negligible, making them practically a continuum.

prefLabel: AnalogData

Subclass of:

- is_a EncodedData

DiscreteData

IRI: http://emmo:info/emmo#EMMO_be8592a7_68d1_4a06_ad23_82f2b56ef926

elucidation: Data whose variations are decoded according to a discrete schema.

example: A text is a collection of discrete symbols. A compact disc is designed to host discrete states in the form of pits and lands.

comment: A discrete schema may be based on a continuum material basis that is filtered according to its variations. For example, a continuous voltage based signal can be considered 1 or 0 according to some threshold. Discrete does not mean tha the material basis is discrete, but that the data are encoded according to such step-based rules.

prefLabel: DiscreteData

Subclass of:

- is_a EncodedData

ClassicalData

IRI: http://emmo:info/emmo#EMMO_ed257e78_8b59_44c3_9d61_06c261184f55

elucidation: Data that are expressed through classical physics mechanisms, having one value and one state, and being in the same place at the same time.

prefLabel: ClassicalData

Subclass of:

- is_a EncodedData

Datum

IRI: http://emmo:info/emmo#EMMO_50d6236a_7667_4883_8ae1_9bb5d190423a

elucidation: A self-consistent encoded data entity.

example: A character, a bit, a song in a CD.

prefLabel: Datum

Subclass of:

- is_a EncodedData

DataSet

IRI: http://emmo:info/emmo#EMMO_194e367c_9783_4bf5_96d0_9ad597d48d9a

elucidation: Encoded data made of more than one datum.

prefLabel: DataSet

Subclass of:

- is_a EncodedData

QuantumData

IRI: http://emmo:info/emmo#EMMO_6fa1feac_c388_44cc_a721_283499d5addc

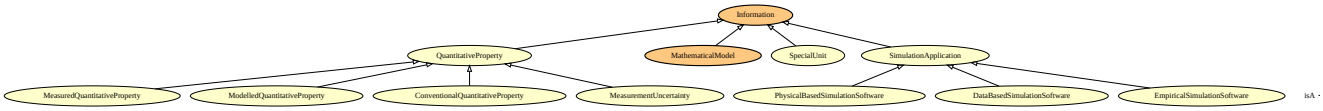
elucidation: Data that are expressed through quantum mechanical principles, and that can have several values / be in several states in the same place at the same time (quantum superposition), each of them with a certain probability.

prefLabel: QuantumData

Subclass of:

- is_a EncodedData

INFORMATION BRANCH



Information branch.

SimulationApplication

IRI: http://emmo:info/emmo#EMMO_8b66ada5_510c_44bd_a8d8_3c64d301a5e9

elucidation: An application aimed to functionally reproduce an object.

example: An application that predicts the pressure drop of a fluid in a pipe segment is aimed to functionally reproduce the outcome of a measurement of pressure before and after the segment.

prefLabel: SimulationApplication

Subclass of:

- is_a ApplicationProgram
- is_a FunctionalIcon
- is_a Information

QuantitativeProperty

IRI: http://emmo:info/emmo#EMMO_dd4a7f3e_ef56_466c_ac1a_d2716b5f87ec

definition: A property of a phenomenon, body, or substance, where the property has a magnitude that can be expressed by means of a number and a reference. – ISO 80000-1

A reference can be a measurement unit, a measurement procedure, a reference material, or a combination of such. – International vocabulary of metrology (VIM)

elucidation: A quantity that can be quantified with respect to a standardized reference physical instance (e.g. the prototype meter bar, the kg prototype) or method (e.g. resilience) through a measurement process.

VIMTerm: quantity

prefLabel: QuantitativeProperty

Subclass of:

- is_a Objective
- is_a Quantity
- is_a Information

PhysicalBasedSimulationSoftware

IRI: http://emmo:info/emmo#EMMO_8d4962d7_9608_44f7_a2f1_82a4bb173f4a

elucidation: A computational application that uses a physical model to predict the behaviour of a system, providing a identifiable analogy with the original object.

prefLabel: PhysicalBasedSimulationSoftware

Subclass of:

- is_a SimulationApplication

DataBasedSimulationSoftware

IRI: http://emmo:info/emmo#EMMO_a4b14b83_9392_4a5f_a2e8_b2b58793f59b

elucidation: A computational application that uses existing data to predict the behaviour of a system without providing a identifiable analogy with the original object.

prefLabel: DataBasedSimulationSoftware

Subclass of:

- is_a SimulationApplication

MeasuredQuantitativeProperty

IRI: http://emmo:info/emmo#EMMO_873b0ab3_88e6_4054_b901_5531e01f14a4

elucidation: Quantitative property intended to be measured.

– VIM

VIMTerm: measurand

altLabel: Measurand

prefLabel: MeasuredQuantitativeProperty

Subclass of:

- is_a QuantitativeProperty

EmpiricalSimulationSoftware

IRI: http://emmo:info/emmo#EMMO_67c70dcd_2adf_4e6c_b3f8_f33dd1512487

elucidation: A computational application that uses an empiric equation to predict the behaviour of a system without relying on the knowledge of the actual physical phenomena occurring in the object.

prefLabel: EmpiricalSimulationSoftware

Subclass of:

- is_a SimulationApplication

ModelledQuantitativeProperty

IRI: http://emmo:info/emmo#EMMO_d0200cf1_e4f4_45ae_873f_b9359daea3cd

prefLabel: ModelledQuantitativeProperty

Subclass of:

- is_a QuantitativeProperty

ConventionalQuantitativeProperty

IRI: http://emmo:info/emmo#EMMO_d8aa8e1f_b650_416d_88a0_5118de945456

elucidation: A quantitative property attributed by agreement to a quantity for a given purpose.

example: The thermal conductivity of a copper sample in my laboratory can be assumed to be the conductivity that appears in the vendor specification. This value has been obtained by measurement of a sample which is not the one I have in my laboratory. This conductivity value is then a conventional quantitiative property assigned to my sample through a semiotic process in which no actual measurement is done by my laboratory.

If I don’t believe the vendor, then I can measure the actual thermal conductivity. I then perform a measurement process that semiotically assign another value for the conductivity, which is a measured property, since is part of a measurement process.

Then I have two different physical quantities that are properties thanks to two different semiotic processes.

prefLabel: ConventionalQuantitativeProperty

Subclass of:

- is_a QuantitativeProperty

Information

IRI: http://emmo:info/emmo#EMMO_64c72d00_7582_44ea_a0b5_3a14e50acc36

elucidation: Information is encoded data with a meaning (semiotic sign).

prefLabel: Information

Subclass of:

- is_a Sign
- is_a EncodedData
- equivalent_to EncodedData and Sign

MeasurementUncertainty

IRI: http://emmo:info/emmo#EMMO_847724b7_acef_490e_9f0d_67da967f2812

elucidation: A non-negative parameter characterising the dispersion of the quantity being measured.

example: - Standard deviation

- Half-width of an interval with a stated coverage probability

VIMTerm: measurement uncertainty

prefLabel: MeasurementUncertainty

Subclass of:

- is_a QuantitativeProperty

SpecialUnit

IRI: http://emmo:info/emmo#EMMO_3ee80521_3c23_4dd1_935d_9d522614a3e2

elucidation: A unit symbol that stands for a derived unit.

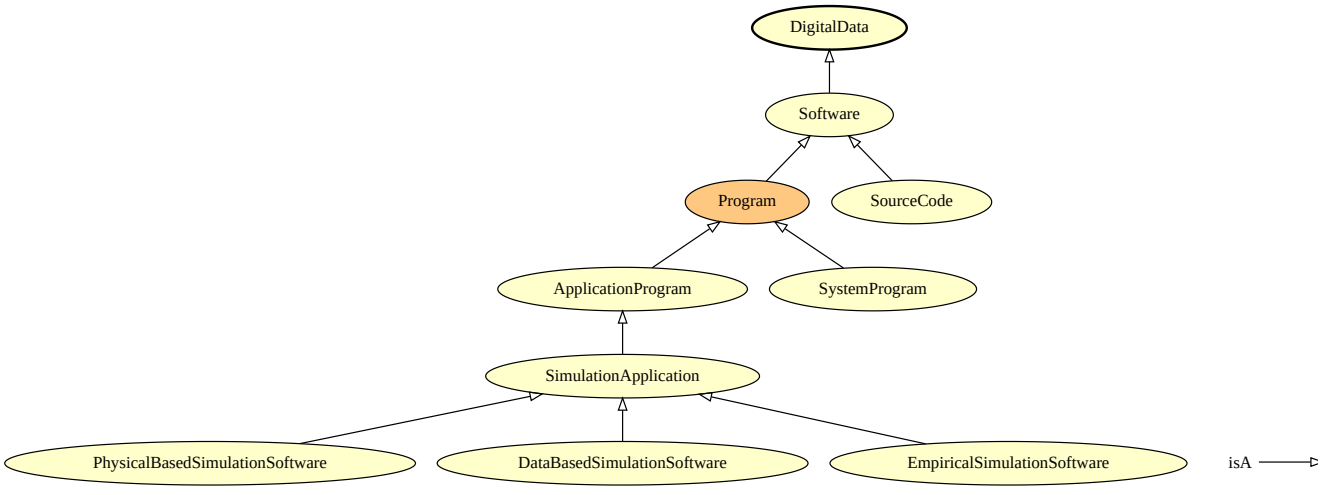
example: Pa stands for N/m2 J stands for N m

prefLabel: SpecialUnit

Subclass of:

- is_a DerivedUnit
- Inverse(hasSign) some DerivedUnit
- is_a Information
- is_a UnitSymbol

Digital Data branch



Digital Data branch.

DigitalData

IRI: http://emmo:info/emmo#EMMO_4db96fb7_e9e0_466d_942b_f6f17bfdc145

elucidation: Discrete data that can be interpreted symbolically as sequence of 1/0, or true/false, or on/off.

altLabel: BinaryData

prefLabel: DigitalData

Subclass of:

- is_a DiscreteData

Program

IRI: http://emmo:info/emmo#EMMO_65411b3d_c8d3_4111_86a9_a2ce0a64c647

elucidation: A set of instructions that tell a computer what to do.

altLabel: Executable

comment: A program is a sequence of instructions understandable by a computer's central processing unit (CPU) that indicates which operations the computer should perform on a set of data.

prefLabel: Program

Subclass of:

- is_a Software
- equivalent_to ApplicationProgram or SystemProgram

SimulationApplication

IRI: http://emmo:info/emmo#EMMO_8b66ada5_510c_44bd_a8d8_3c64d301a5e9

elucidation: An application aimed to functionally reproduce an object.

example: An application that predicts the pressure drop of a fluid in a pipe segment is aimed to functionally reproduce the outcome of a measurement of pressure before and after the segment.

prefLabel: SimulationApplication

Subclass of:

- is_a ApplicationProgram
- is_a FunctionalIcon
- is_a Information

PhysicalBasedSimulationSoftware

IRI: http://emmo:info/emmo#EMMO_8d4962d7_9608_44f7_a2f1_82a4bb173f4a

elucidation: A computational application that uses a physical model to predict the behaviour of a system, providing a identifiable analogy with the original object.

prefLabel: PhysicalBasedSimulationSoftware

Subclass of:

- is_a SimulationApplication

ApplicationProgram

IRI: http://emmo:info/emmo#EMMO_3b031fa9_8623_4ea5_8b57_bcafb70c5c8b

elucidation: A program aimed to provide a specific high level function to the user, usually hiding lower level procedures.

example: Word processors, graphic image processing programs, database management systems, numerical simulation software and games.

altLabel: App

altLabel: Application

prefLabel: ApplicationProgram

Subclass of:

- is_a Program

Software

IRI: http://emmo:info/emmo#EMMO_8681074a_e225_4e38_b586_e85b0f43ce38

elucidation: All or part of the programs, procedures, rules, and associated documentation of an information processing system.

comment: Software is usually used as a generic term for programs. However, in its broadest sense it can refer to all information (i.e., both programs and data) in electronic form and can provide a distinction from hardware, which refers to computers or other electronic systems on which software can exist and be use. Here we explicitly include in the definition also all the data (e.g. source code, script files) that takes part to the building of the executable, are necessary to the execution of a program or that document it for the users.

prefLabel: Software

Subclass of:

- is_a DigitalData

DataBasedSimulationSoftware

IRI: http://emmo:info/emmo#EMMO_a4b14b83_9392_4a5f_a2e8_b2b58793f59b

elucidation: A computational application that uses existing data to predict the behaviour of a system without providing a identifiable analogy with the original object.

prefLabel: DataBasedSimulationSoftware

Subclass of:

- is_a SimulationApplication

SourceCode

IRI: http://emmo:info/emmo#EMMO_348d39f7_6a17_49d1_9860_9b33b69b51de

elucidation: A programming language entity expressing a formal detailed plan of what a software is intended to do.

comment: A source code is the companion of an application, being it the entity used to generate the application list of CPU executable instructions.

comment: Source code (also referred to as source or code) is the version of software as it is originally written (i.e., typed into a computer) by a human in plain text (i.e., human readable alphanumeric characters).

prefLabel: SourceCode

Subclass of:

- is_a Software
- is_a ProgrammingLanguage

EmpiricalSimulationSoftware

IRI: http://emmo:info/emmo#EMMO_67c70dcd_2adf_4e6c_b3f8_f33dd1512487

elucidation: A computational application that uses an empiric equation to predict the behaviour of a system without relying on the knowledge of the actual physical phenomena occurring in the object.

prefLabel: EmpiricalSimulationSoftware

Subclass of:

- is_a SimulationApplication

SystemProgram

IRI: http://emmo:info/emmo#EMMO_58b17cac_3125_4486_9b9c_8c45ac254040

elucidation: System program refers to operating systems and utility programs that manage computer resources at a low level enabling a computer to function.

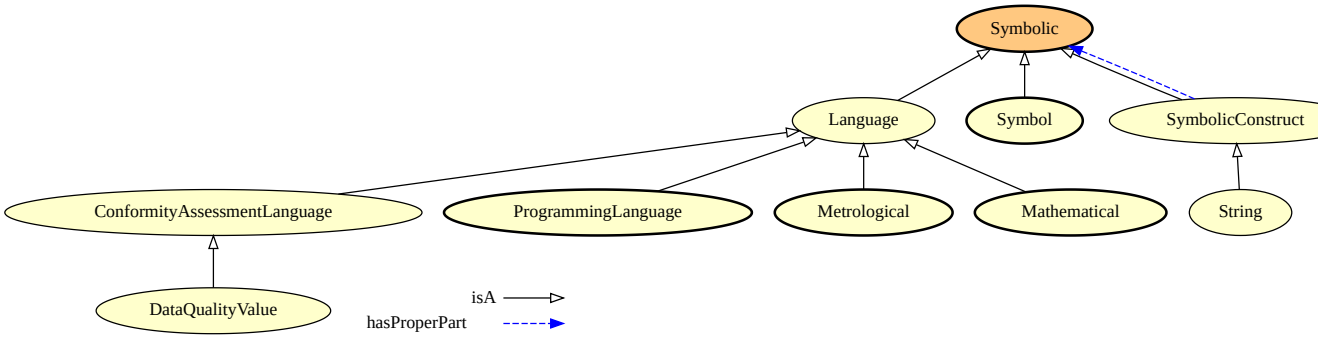
example: An operating system. A graphic driver.

prefLabel: SystemProgram

Subclass of:

- is_a Program

SYMBOLIC BRANCH



Symbolic branch.

Shape4x3Matrix

IRI: http://emmo:info/emmo#EMMO_24b30ba4_90f4_423d_93d2_fd0fde349087

elucidation: A real matrix with shape 4x3.

prefLabel: Shape4x3Matrix

Subclass of:

- is_a Matrix

PhysicsBasedModel

IRI: http://emmo:info/emmo#EMMO_b29fd350_39aa_4af7_9459_3faa0544cba6

elucidation: A mathematical entity based on a fundamental physics theory which defines the relations between physics quantities of an entity.

prefLabel: PhysicsBasedModel

Subclass of:

- is_a MathematicalModel
- hasSpatialSlice some PhysicsEquation
- is_a MathematicalConstruct
- is_a CausalSystem

MesoscopicModel

IRI: http://emmo:info/emmo#EMMO_53935db0_af45_4426_b9e9_244a0d77db00

elucidation: A physics-based model based on a physics equation describing the behaviour of mesoscopic entities, i.e. a set of bounded atoms like a molecule, bead or nanoparticle.

prefLabel: MesoscopicModel

Subclass of:

- is_a MaterialsModel

Polynomial

IRI: http://emmo:info/emmo#EMMO_91447ec0_fb55_49f2_85a5_3172dff6482c

example: 2 * x^2 + x + 3

prefLabel: Polynomial

Subclass of:

- is_a AlgebricExpression

Inequality

IRI: http://emmo:info/emmo#EMMO_0b6ebe5a_0026_4bef_a1c1_5be00df9f98e

elucidation: A relation which makes a non-equal comparison between two numbers or other mathematical expressions.

example: f(x) > 0

prefLabel: Inequality

Subclass of:

- is_a MathematicalFormula

AlgebricExpression

IRI: http://emmo:info/emmo#EMMO_1aed91a3_d00c_48af_8f43_a0c958b2512a

example: 2x+3

prefLabel: AlgebricExpression

Subclass of:

- is_a Expression

ElectronicModel

IRI: http://emmo:info/emmo#EMMO_6eca09be_17e9_445e_abc9_000aa61b7a11

elucidation: A physics-based model based on a physics equation describing the behaviour of electrons.

example: Density functional theory. Hartree-Fock.

prefLabel: ElectronicModel

Subclass of:

- is_a MaterialsModel

MaterialsModel

IRI: http://emmo:info/emmo#EMMO_90f18cf0_1225_4c64_b5f8_f65cd7f992c5

elucidation: A solvable set of one Physics Equation and one or more Materials Relations.

prefLabel: MaterialsModel

Subclass of:

- is_a PhysicsBasedModel
- hasSpatialSlice some MaterialRelation
- disjoint_union_of ContinuumModel, MesoscopicModel, ElectronicModel, AtomisticModel

Shape3Vector

IRI: http://emmo:info/emmo#EMMO_2ff07b07_c447_490f_903a_f6a72a12d7bf

elucidation: A real vector with 3 elements.

example: The quantity value of physical quantities if real space is a Shape3Vector.

prefLabel: Shape3Vector

Subclass of:

- is_a Vector

Vector

IRI: http://emmo:info/emmo#EMMO_06658d8d_dcde_4fc9_aae1_17f71c0bcdec

elucidation: 1-dimensional array who’s spatial direct parts are numbers.

altLabel: 1DArray

altLabel: LinearArray

prefLabel: Vector

Subclass of:

- is_a Array
- hasSpatialTile some Number
- is_a MathematicalConstruct
- is_a Tessellation

MathematicalFormula

IRI: http://emmo:info/emmo#EMMO_88470739_03d3_4c47_a03e_b30a1288d50c

elucidation: A mathematical string that express a relation between the elements in one set X to elements in another set Y.

prefLabel: MathematicalFormula

Subclass of:

- is_a MathematicalConstruct

AtomisticModel

IRI: http://emmo:info/emmo#EMMO_84cadc45_6758_46f2_ba2a_5ead65c70213

elucidation: A physics-based model based on a physics equation describing the behaviour of atoms.

prefLabel: AtomisticModel

Subclass of:

- is_a MaterialsModel

PhysicsEquation

IRI: http://emmo:info/emmo#EMMO_27c5d8c6_8af7_4d63_beb1_ec37cd8b3fa3

elucidation: An ‘equation’ that stands for a ‘physical_law’ by mathematically defining the relations between physics_quantities.

example: The Newton’s equation of motion. The Schrödinger equation. The Navier-Stokes equation.

prefLabel: PhysicsEquation

Subclass of:

- is_a PhysicsBasedModel
- is_a Equation

Language

IRI: http://emmo:info/emmo#EMMO_d8d2144e_5c8d_455d_a643_5caf4d8d9df8

elucidation: A language object is a discrete data entity respecting a specific language syntactic rules (a well-formed formula).

prefLabel: Language

Subclass of:

- is_a Symbolic

DataQualityValue

IRI: http://emmo:info/emmo#EMMO_f41e958d_a115_442f_8766_8a280444b0ec

prefLabel: DataQualityValue

Subclass of:

- is_a ConformityAssessmentLanguage

Matrix

IRI: http://emmo:info/emmo#EMMO_1cba0b27_15d0_4326_933f_379d0b3565b6

elucidation: 2-dimensional array who’s spatial direct parts are vectors.

altLabel: 2DArray

prefLabel: Matrix

Subclass of:

- is_a Array
- hasSpatialTile some Vector
- is_a MathematicalConstruct
- is_a Tessellation

ConformityAssessmentLanguage

IRI: http://emmo:info/emmo#EMMO_0077e933_10c4_4030_ac9a_37a03cc8b41f

prefLabel: ConformityAssessmentLanguage

Subclass of:

- is_a Language

Array3D

IRI: http://emmo:info/emmo#EMMO_20ff3b34_c864_4936_8955_9345fc0a3b3c

elucidation: 3-dimensional array who's spatial direct parts are matrices.

altLabel: 3DArray

prefLabel: Array3D

Subclass of:

- is_a Array
- hasSpatialTile some Matrix
- is_a MathematicalConstruct
- is_a Tessellation

ContinuumModel

IRI: http://emmo:info/emmo#EMMO_4456a5d2_16a6_4ee1_9a8e_5c75956b28ea

elucidation: A physics-based model based on a physics equation describing the behaviour of continuum volume.

prefLabel: ContinuumModel

Subclass of:

- is_a MaterialsModel

SymbolicConstruct

IRI: http://emmo:info/emmo#EMMO_89a0c87c_0804_4013_937a_6fe234d9499c

elucidation: A symbolic entity made of other symbolic entities according to a specific spatial configuration.

comment: This class collects individuals that represents arrangements of strings, or other symbolic compositions, without any particular predifined arrangement schema.

prefLabel: SymbolicConstruct

Subclass of:

- is_a Symbolic
- hasProperPart some Symbolic

ArithmeticExpression

IRI: http://emmo:info/emmo#EMMO_89083bab_f69c_4d06_bf6d_62973b56cdc7

example: 2+2

prefLabel: ArithmeticExpression

Subclass of:

- is_a AlgebricExpression
- is_a not hasSpatialTile some Variable

String

IRI: http://emmo:info/emmo#EMMO_50ea1ec5_f157_41b0_b46b_a9032f17ca10

elucidation: A physical made of more than one symbol sequentially arranged.

example: The word "cat" considered as a collection of 'symbol'-s respecting the rules of english language.

In this example the 'symbolic' entity "cat" is not related to the real cat, but it is only a word (like it would be to an italian person that ignores the meaning of this english word).

If an 'interpreter' skilled in english language is involved in a 'semiotic' process with this word, that "cat" became also a 'sign' i.e. it became for the 'interpreter' a representation for a real cat.

comment: A string is made of concatenated symbols whose arrangement is one-dimensional. Each symbol can have only one previous and one next neighborhood (bidirectional list).

comment: A string is not requested to respect any syntactic rule: it's simply directly made of symbols.

prefLabel: String

Subclass of:

- is_a SymbolicConstruct

MathematicalConstruct

IRI: http://emmo:info/emmo#EMMO_ffe760a2_9d1f_4aef_8bee_1f450f9cb00d

prefLabel: MathematicalConstruct

Subclass of:

- is_a SymbolicConstruct
- is_a Mathematical
- equivalent_to Mathematical and SymbolicConstruct

Symbolic

IRI: http://emmo:info/emmo#EMMO_057e7d57_aff0_49de_911a_8861d85cef40

elucidation: A discrete data whose elements can be decoded as tokens from one or more alphabets, without necessarily respecting syntactic rules.

example: fe780 emmo !5*a cat for(i=0;i<N;++i)

comment: A symbolic entity is not necessarily graphical (e.g. it doesn't necessarily have the physical shape of a letter), but its elements can be decoded and put in relation with an alphabet. In other words, a sequence of bit "1000010" in a RAM (a non-graphical entity) is a valid symbol since it can be decoded through ASCII rules as the letter "B". The same holds for an entity standing for the sound of a voice saying: "Hello", since it can be decomposed in discrete parts, each of them being associated to a letter of an alphabet.

comment: A symbolic object possesses a reductionistic oriented structure. For example, text is made of words, spaces and punctuations. Words are made of characters (i.e. atomic symbols).

prefLabel: Symbolic

Subclass of:

- is_a DiscreteData
- equivalent_to SymbolicConstruct or Symbol

Expression

IRI: http://emmo:info/emmo#EMMO_f9bc8b52_85e9_4b53_b969_dd7724d5b8e4

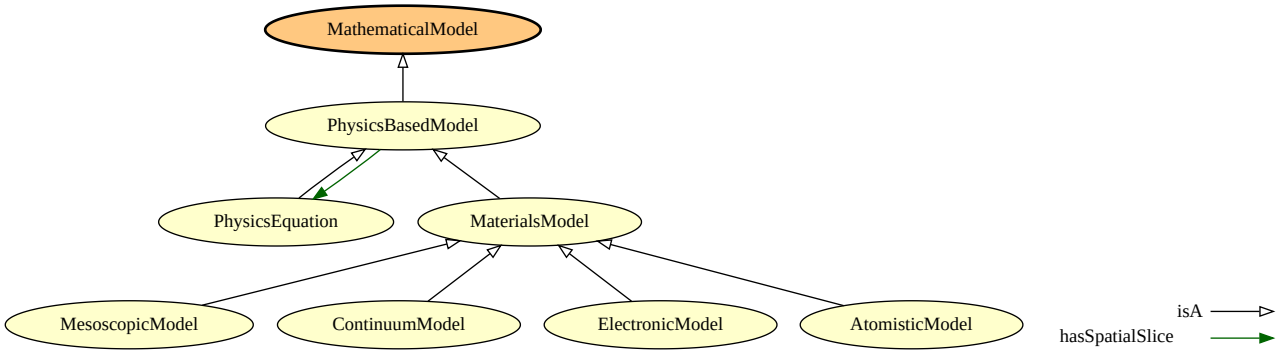
elucidation: A well-formed finite combination of mathematical symbols according to some specific rules.

prefLabel: Expression

Subclass of:

- is_a MathematicalConstruct

Mathematical Model branch



Mathematical Model branch.

PhysicsBasedModel

IRI: http://emmo:info/emmo#EMMO_b29fd350_39aa_4af7_9459_3faa0544cba6

elucidation: A mathematical entity based on a fundamental physics theory which defines the relations between physics quantities of an entity.

prefLabel: PhysicsBasedModel

Subclass of:

- is_a MathematicalModel
- hasSpatialSlice some PhysicsEquation
- is_a MathematicalConstruct
- is_a CausalSystem

MesoscopicModel

IRI: http://emmo:info/emmo#EMMO_53935db0_af45_4426_b9e9_244a0d77db00

elucidation: A physics-based model based on a physics equation describing the behaviour of mesoscopic entities, i.e. a set of bounded atoms like a molecule, bead or nanoparticle.

prefLabel: MesoscopicModel

Subclass of:

- is_a MaterialsModel

ContinuumModel

IRI: http://emmo:info/emmo#EMMO_4456a5d2_16a6_4ee1_9a8e_5c75956b28ea

elucidation: A physics-based model based on a physics equation describing the behaviour of continuum volume.

prefLabel: ContinuumModel

Subclass of:

- is_a MaterialsModel

MathematicalModel

IRI: http://emmo:info/emmo#EMMO_f7ed665b_c2e1_42bc_889b_6b42ed3a36f0

elucidation: An analogical icon expressed in mathematical language.

prefLabel: MathematicalModel

Subclass of:

- is_a AnalogicalIcon
- is_a Information
- is_a Mathematical
- equivalent_to AnalogicalIcon and Mathematical

ElectronicModel

IRI: http://emmo:info/emmo#EMMO_6eca09be_17e9_445e_abc9_000aa61b7a11

elucidation: A physics-based model based on a physics equation describing the behaviour of electrons.

example: Density functional theory. Hartree-Fock.

prefLabel: ElectronicModel

Subclass of:

- is_a MaterialsModel

MaterialsModel

IRI: http://emmo:info/emmo#EMMO_90f18cf0_1225_4c64_b5f8_f65cd7f992c5

elucidation: A solvable set of one Physics Equation and one or more Materials Relations.

prefLabel: MaterialsModel

Subclass of:

- is_a PhysicsBasedModel
- hasSpatialSlice some MaterialRelation
- disjoint_union_of ContinuumModel, MesoscopicModel, ElectronicModel, AtomisticModel

AtomisticModel

IRI: http://emmo:info/emmo#EMMO_84cadc45_6758_46f2_ba2a_5ead65c70213

elucidation: A physics-based model based on a physics equation describing the behaviour of atoms.

prefLabel: AtomisticModel

Subclass of:

- is_a MaterialsModel

PhysicsEquation

IRI: http://emmo:info/emmo#EMMO_27c5d8c6_8af7_4d63_beb1_ec37cd8b3fa3

elucidation: An ‘equation’ that stands for a ‘physical_law’ by mathematically defining the relations between physics_quantities.

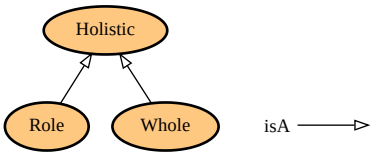
example: The Newton’s equation of motion. The Schrödinger equation. The Navier-Stokes equation.

prefLabel: PhysicsEquation

Subclass of:

- is_a PhysicsBasedModel
- is_a Equation

HOLISTIC BRANCH



Holistic branch.

Holistic

IRI: http://emmo:info/emmo#EMMO_0277f24a_ea7f_4917_81b7_fb0406c8fc62

definition: The union of classes whole and part.

elucidation: A perspective characterized by the belief that some mereological parts of a whole (holistic parts) are intimately interconnected and explicable only by reference to the whole and vice versa.

example: A molecule of a body can have role in the body evolution, without caring if its part of a specific organ and without specifying the time interval in which this role occurred.

example: A product is a role that can be fulfilled by many objects, but always requires a process to which the product participates and from which it is generated.

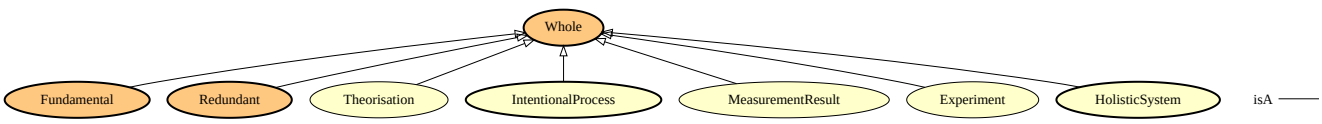
altLabel: Wholistic

prefLabel: Holistic

Subclass of:

- is_a Perspective
- equivalent_to Whole or Role

WHOLE BRANCH



Whole branch.

Whole

IRI: http://emmo:info/emmo#EMMO_1efe8b96_e006_4a33_bc9a_421406cbb9f0

elucidation: An entity which is defined according to a unity criteria that relates holistically its parts to form a whole.

prefLabel: Whole

Subclass of:

- is_a Holistic
- equivalent_to Fundamental or Redundant

Theorisation

IRI: http://emmo:info/emmo#EMMO_6c739b1a_a774_4416_bb31_1961486fa9ed

elucidation: The ‘semiosis’ process of interpreting a ‘physical’ and provide a complec sign, ‘theory’ that stands for it and explain it to another interpreter.

altLabel: Theorization

prefLabel: Theorisation

Subclass of:

- is_a Determination
- hasTemporaryParticipant some Theory
- is_a Whole
- is_a Process

MeasurementResult

IRI: http://emmo:info/emmo#EMMO_0f6f0120_c079_4d95_bb11_4ddee05e530e

elucidation: Result of a measurement.

A set of quantites being attributed to a measurand (measured quantitative property) together with any other available relevant information, like measurement uncertainty.

– VIM

VIMTerm: measurement result

comment: A measurement result has the measured quantity, measurement uncertainty and other relevant attributes as holistic parts.

prefLabel: MeasurementResult

Subclass of:

- is_a Objective
- hasQuantity some Quantity
- is_a Whole
- is_a Object

Experiment

IRI: http://emmo:info/emmo#EMMO_22522299_4091_4d1f_82a2_3890492df6db

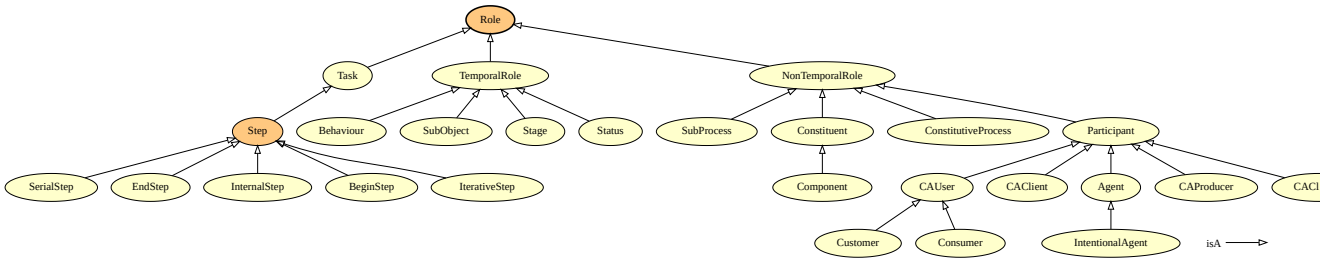
elucidation: An experiment is a process that is intended to replicate a physical phenomenon in a controlled environment.

prefLabel: Experiment

Subclass of:

- is_a Observation
- hasTemporaryParticipant some PhysicalPhenomenon
- is_a Whole
- is_a Process

Role branch



Role branch.

SerialStep

IRI: http://emmo:info/emmo#EMMO_2666a7e3_2ad4_49a0_899e_329607231f4b

prefLabel: SerialStep

Subclass of:

- is_a TemporalTile
- is_a Step

Customer

IRI: http://emmo:info/emmo#EMMO_a1e306e9_cabf_4fcb_84bb_21fc95c8df2c

comment: organization or person that receives a product Note 1 to entry: The customer may be the user or a distributor.

prefLabel: Customer

Subclass of:

- is_a CAUser

SubProcess

IRI: http://emmo:info/emmo#EMMO_49804605_c0fe_4538_abda_f70ba1dc8a5d

elucidation: A process which is an holistic spatial part of a process.

example: Breathing is a subprocess of living for a human being.

comment: In the EMMO the relation of participation to a process falls under mereotopology.

Since topological connection means causality, then the only way for a real world object to participate to a process is to be a part of it.

prefLabel: SubProcess

Subclass of:

- is_a Process
- is_a NonTemporalRole

EndStep

IRI: http://emmo:info/emmo#EMMO_8a2a1cbc_dfc3_4e6c_b337_00ee56fd438a

elucidation: The final step of a workflow.

comment: There may be more than one end task, if they run in parallel leading to more than one output.

prefLabel: EndStep

Subclass of:

- is_a Step
- is_a EndTile

CAUser

IRI: http://emmo:info/emmo#EMMO_972a6b9c_6dbc_4e60_8953_1dd54946005c

comment: user is organization or person that purchases or otherwise acquires fasteners and installs them for purposes of assembly or overhaul and maintenance

prefLabel: CAUser

Subclass of:

- Inverse(hasParticipant) some ConformityAssessment
- is_a Participant

Behaviour

IRI: http://emmo:info/emmo#EMMO_210e7e99_c1cf_44cc_87c7_310a10ff068b

elucidation: A process which is an holistic temporal part of an object.

example: Accelerating is a behaviour of a car.

prefLabel: Behaviour

Subclass of:

- is_a TemporalRole
- is_a Process

SubObject

IRI: http://emmo:info/emmo#EMMO_2553c342_fc28_47d8_8e19_7a98fa08f150

elucidation: An object which is an holistic temporal part of another object.

example: If an inhabited house is considered as an house that is occupied by some people in its majority of time, then an interval of inhabited house in which occasionally nobody is in there is no more an inhabited house, but an unhinabited house, since this temporal part does not satisfy the criteria of the whole.

prefLabel: SubObject

Subclass of:

- is_a TemporalRole
- is_a Object

TemporalRole

IRI: http://emmo:info/emmo#EMMO_0e1f2009_bf12_49d1_99f3_1422e5287d82

elucidation: An holistic temporal part of a whole.

altLabel: HolisticTemporalPart

prefLabel: TemporalRole

Subclass of:

- is_a Role

Stage

IRI: http://emmo:info/emmo#EMMO_a633c6f8_4269_4870_9b28_f5ca1783fd54

elucidation: A process which is an holistic temporal part of a process.

example: Moving a leg is a stage of the process of running.

prefLabel: Stage

Subclass of:

- is_a TemporalRole
- is_a Process

CAClient

IRI: http://emmo:info/emmo#EMMO_8d954278_8789_4e8f_84a1_a35a04af4e0c

elucidation: Client is individual, organization, department or division, internal or external, that requests or commissions an objective to be realised, that is called claim

comment: individual, organization, department or division, internal or external, that requests or commissions a research project

prefLabel: CAClient

Subclass of:

- Inverse(hasParticipant) some ConformityAssessment

- is_a Participant

Constituent

IRI: http://emmo:info/emmo#EMMO_ceaaf9f7_fd11_424b_8fda_9afa186af186

elucidation: An object which is an holistic spatial part of a object.

example: A tire is a constituent of a car.

altLabel: ObjectPart

prefLabel: Constituent

Subclass of:

- is_a Object
- is_a NonTemporalRole

IntentionalAgent

IRI: http://emmo:info/emmo#EMMO_c130614a_2985_476d_a7ed_8a137847703c

elucidation: An agent that is driven by the intention to reach a defined objective in driving a process.

comment: Intentionality is not limited to human agents, but in general to all agents that have the capacity to decide to act in driving a process according to a motivation.

prefLabel: IntentionalAgent

Subclass of:

- is_a Agent

ConstitutiveProcess

IRI: http://emmo:info/emmo#EMMO_f68858dd_64f4_4877_b7fb_70d04fbe5bab

elucidation: A process which is an holistic spatial part of an object.

example: Blood circulation in a human body.

comment: A constitutive process is a process that is holistically relevant for the definition of the whole.

prefLabel: ConstitutiveProcess

Subclass of:

- is_a Process
- is_a NonTemporalRole

InternalStep

IRI: http://emmo:info/emmo#EMMO_322ce14e_9ede_4841_ad70_302b4d6c5f28

elucidation: A generic step in a workflow, that is not the begin or the end.

prefLabel: InternalStep

Subclass of:

- is_a Step
- is_a ThroughTile

NonTemporalRole

IRI: http://emmo:info/emmo#EMMO_fcae603e_aa6e_4940_9fa1_9f0909cabf3b

elucidation: An holistic spatial part of a whole.

altLabel: HolisticSpatialPart

prefLabel: NonTemporalRole

Subclass of:

- is_a Role

Component

IRI: http://emmo:info/emmo#EMMO_f76884f7_964e_488e_9bb7_1b2453e9e817

elucidation: A constituent of a system.

prefLabel: Component

Subclass of:

- Inverse(hasConstituent) some HolisticSystem
- is_a Constituent

BeginStep

IRI: http://emmo:info/emmo#EMMO_b941e455_2cb1_4c11_93e3_17caa06086b4

elucidation: An initial step of a workflow.

comment: There may be more than one begin task, if they run in parallel.

prefLabel: BeginStep

Subclass of:

- is_a Step
- is_a BeginTile

Step

IRI: http://emmo:info/emmo#EMMO_9f6ec830_c59f_46aa_8a22_945ba20b6ea3

elucidation: A task that is a well formed tile of a workflow, according to a reductionistic description.

comment: A step is part of a specific granularity level for the workflow description, as composition of tasks.

prefLabel: Step

Subclass of:

- is_a Task
- is_a WellFormedTile
- equivalent_to InternalStep or EndStep or BeginStep

Agent

IRI: http://emmo:info/emmo#EMMO_2480b72b_db8d_460f_9a5f_c2912f979046

elucidation: A participant that is the driver of the process.

example: A catalyst. A bus driver. A substance that is initiating a reaction that would not occur without its presence.

comment: An agent is not necessarily human. An agent plays an active role within the process. An agent is a participant of a process that would not occur without it.

prefLabel: Agent

Subclass of:

- is_a Participant

Participant

IRI: http://emmo:info/emmo#EMMO_13191289_6c2b_4741_93e1_82d53bd0e703

elucidation: An object which is an holistic spatial part of a process.

example: A student during an examination.

prefLabel: Participant

Subclass of:

- is_a Object
- is_a NonTemporalRole

Status

IRI: http://emmo:info/emmo#EMMO_d9589ed2_5304_48b3_9795_11bf44e64e9b

elucidation: An object which is an holistic temporal part of a process.

example: A semi-naked man is a status in the process of a man’s dressing.

altLabel: State

prefLabel: Status

Subclass of:

- is_a TemporalRole
- is_a Object

Task

IRI: http://emmo:info/emmo#EMMO_4299e344_a321_4ef2_a744_bacfcce80afc

elucidation: A procedure that is an hoilistic part of a workflow.

altLabel: Job

comment: A task is a generic part of a workflow, without taking care of the task granularities. It means that you can declare that e.g. tightening a bolt is a task of building an airplane, without caring of the coarser tasks to which this tightening belongs.

prefLabel: Task

Subclass of:

- is_a Procedure
- Inverse(hasTask) some Workflow
- is_a Role

Role

IRI: http://emmo:info/emmo#EMMO_4f226cf3_6d02_4d35_8566_a9e641bc6ff3

elucidation: An entity that is categorized according to its relation with a whole through a parthood relation and that contributes to it according to an holistic criterion.

altLabel: HolisticPart

altLabel: Part

prefLabel: Role

Subclass of:

- is_a Holistic
- equivalent_to TemporalRole or NonTemporalRole

CAProducer

IRI: http://emmo:info/emmo#EMMO_354e79ba_13d8_44d4_a2b8_e113370275ad

comment: organization or individual that carries out an experiment or measurement, funded by a payer (3.11), and producing a data set Note 1 to entry: In the research domain producer is typically a researcher, in the commercial domain the producer can be a contract laboratory.

comment: producer creator or provider of a tool (3.17), including anyone who modifies or customises a tool Note 1 to entry: The person(s) or organization(s) responsible for the creation or maintenance of a tool or customisation of a tool is the producer. Note 2 to entry: Providing scripts to automate common functions modifies or customises a tool.

prefLabel: CAProducer

Subclass of:

- Inverse(hasParticipant) some ConformityAssessment
- is_a Participant

CAClaimer

IRI: http://emmo:info/emmo#EMMO_63f95f1f_8b6f_433c_88b9_a14b63b43f2f

elucidation: The CAClaimer, in a Conformity Assessment, is the one who commissions the target to be achieved and against which the comparison with the test item is made, prior to awarding the Test Result.

example: Stakeholder, Company, Market

altLabel: ConformityAssessmentBody

comment: individual, organization, department or division, internal or external, that requests or commissions a research project

prefLabel: CAClaimer

Subclass of:

- Inverse(hasParticipant) some ConformityAssessment
- is_a Participant

Consumer

IRI: http://emmo:info/emmo#EMMO_55700226_edfa_44f3_960b_eae91e498aab

comment: consumer individual member of the general public purchasing or using goods, property or services for private purposes

prefLabel: Consumer

Subclass of:

- is_a CAUser

IterativeStep

IRI: http://emmo:info/emmo#EMMO_9ac10a20_63d0_4bbd_a5d3_f00a0ad4682c

elucidation: A workflow whose output ca be used as input for another workflow of the same type, iteratively, within the framework of a larger workflow.

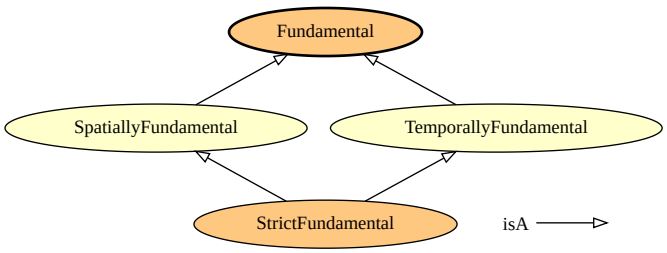
example: Jacobi method numerical step, involving the multiplication between a matrix A and a vector x, whose result is used to update the vector x.

prefLabel: IterativeStep

Subclass of:

- is_a Workflow
- is_a Step

FUNDAMENTAL BRANCH



Fundamental branch.

Fundamental

IRI: http://emmo:info/emmo#EMMO_57c75ca1_bf8a_42bc_85d9_58cfe38c7df2

elucidation: A whole that represent the overall lifetime of the world object that represents according to some holistic criteria.

example: A marathon is an example of class whose individuals are always maximal since the criteria satisfied by a marathon 4D entity poses some constraints on its temporal and spatial extent.

On the contrary, the class for a generic running process does not necessarily impose maximality to its individuals. A running individual is maximal only when it extends in time for the minimum amount required to identify a running act, so every possible temporal part is always a non-running.

Following the two examples, a marathon individual is a maximal that can be decomposed into running intervals. The marathon class is a subclass of running.

altLabel: Lifetime

altLabel: Maximal

prefLabel: Fundamental

Subclass of:

- is_a Whole
- equivalent_to TemporallyFundamental or SpatiallyFundamental

SpatiallyFundamental

IRI: http://emmo:info/emmo#EMMO_f055e217_0b1b_4e7e_b8be_7340211b0c5e

elucidation: The class of individuals that satisfy a whole defining criteria (i.e. belongs to a subclass of whole) and have no spatial parts that satisfy that same criteria (no parts that are of the same type of the whole).

prefLabel: SpatiallyFundamental

Subclass of:

- is_a Fundamental

TemporallyFundamental

IRI: http://emmo:info/emmo#EMMO_aaad78a9_abaf_4f97_9c1a_d763a94c4ba3

elucidation: The class of individuals that satisfy a whole defining criteria (i.e. belongs to a subclass of whole) and have no temporal parts that satisfy that same criteria (no parts that are of the same type of the whole).

prefLabel: TemporallyFundamental

Subclass of:

- is_a Fundamental

StrictFundamental

IRI: http://emmo:info/emmo#EMMO_4b32fc1e_5293_4247_9e8d_1175df9f1c0b

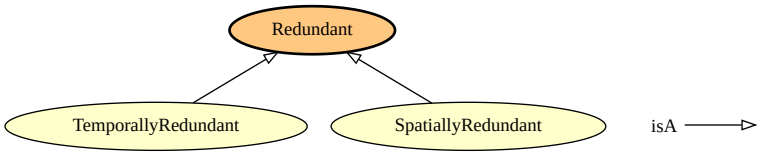
elucidation: The class of individuals that satisfy a whole defining criteria (i.e. belongs to a subclass of whole) and have no proper parts that satisfy that same criteria (no parts that are of the same type of the whole).

prefLabel: StrictFundamental

Subclass of:

- is_a TemporallyFundamental
- is_a SpatiallyFundamental
- equivalent_to TemporallyFundamental and SpatiallyFundamental

REDUNDANT BRANCH



Redundant branch.

Redundant

IRI: http://emmo:info/emmo#EMMO_bbca6dfa_7463_4e8d_8280_35862ff50ce0

elucidation: A whole possessing some proper parts of its same type.

example: An object A which is classified as water-fluid possesses a proper part B which is water itself if the lenght scale of the B is larger than the water intermolecular distance keeping it in the continuum range. In this sense, A is redundant.

If A is a water-fluid so small that its every proper part is no more a continuum object (i.e. no more a fluid), then A is fundamental.

altLabel: NonMaximal

prefLabel: Redundant

Subclass of:

- is_a Whole
- equivalent_to SpatiallyRedundant or TemporallyRedundant

TemporallyRedundant

IRI: http://emmo:info/emmo#EMMO_808566db_b810_448d_8a54_48e7f6d30f36

elucidation: A whole with temporal parts of its same type.

prefLabel: TemporallyRedundant

Subclass of:

- is_a Redundant

SpatiallyRedundant

IRI: http://emmo:info/emmo#EMMO_2469e4c6_ac2e_4c8f_b49f_7b2d2e277215

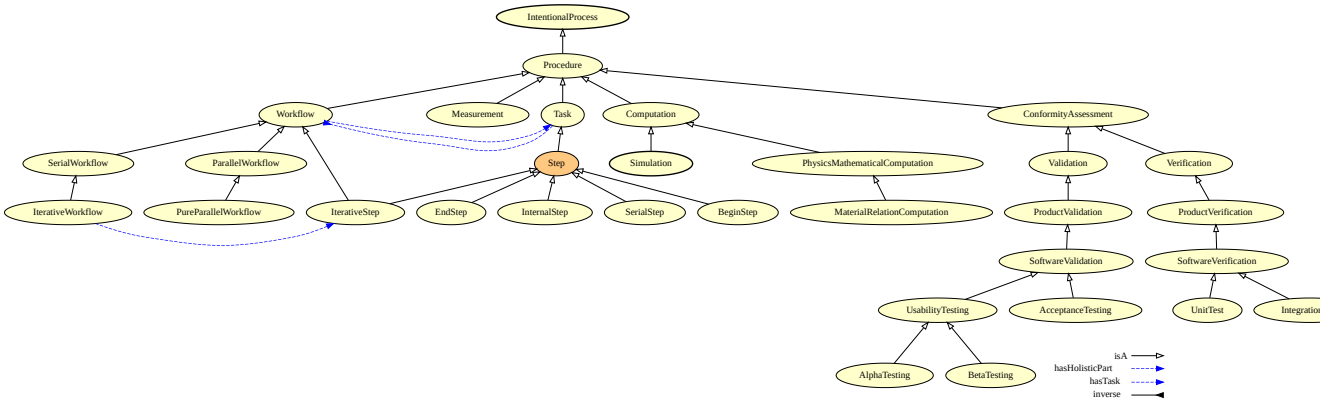
elucidation: A whole with spatial parts of its same type.

prefLabel: SpatiallyRedundant

Subclass of:

- is_a Redundant

Intentional Process branch



Intentional Process branch.

BetaTesting

IRI: http://emmo:info/emmo#EMMO_321eb37b_e9d7_4319_bf43_8981ee2d2e43

prefLabel: BetaTesting

Subclass of:

- is_a UsabilityTesting

UsabilityTesting

IRI: http://emmo:info/emmo#EMMO_551f93c7_7e76_4994_8293_fe2c8ebda450

prefLabel: UsabilityTesting

Subclass of:

- is_a SoftwareValidation

SerialStep

IRI: http://emmo:info/emmo#EMMO_2666a7e3_2ad4_49a0_899e_329607231f4b

prefLabel: SerialStep

Subclass of:

- is_a TemporalTile
- is_a Step

IntentionalProcess

IRI: http://emmo:info/emmo#EMMO_bafc17b5_9be4_4823_8bbe_ab4e90b6738c

elucidation: A process occurring with the active participation of an agent that drives the process according to a specific objective (intention).

prefLabel: IntentionalProcess

Subclass of:

- is_a Process
- hasAgent some IntentionalAgent
- is_a Whole

Verification

IRI: http://emmo:info/emmo#EMMO_433eac85_e5ae_4a88_8fd5_27299d76c8c7

elucidation: A Verification is a process where the interpreter attributes a sign, specifically a property, to the way the product is made following test procedures, depending on the fulfillment of specified requirements. The interpreter is the producer. The Verification can be executed either on the entire process or on parts of it.(e in qualsiasi momento) The Verification can be executed during the initial stages of the product realisation, or during the final stages of that.

comment: Confirmation, through the provision of objective evidence (3.8.3), that specified requirements (3.6.4) have been fulfilled. NOTE 1 : The objective evidence needed for a verification can be the result of an inspection (3.11.7) or of other forms of determination (3.11.1) such as performing alternative calculations or reviewing documents (3.8.5). Note 2 to entry: The activities carried out for verification are sometimes called a qualification process (3.4.1). Note 3 to entry: The word “verified” is used to designate the corresponding status.

comment: The process of evaluating a system or component to determine whether the products of a given development phase satisfy the conditions imposed at the start of that phase.

comment: The process of evaluating a system or component to determine whether the products of a given development phase satisfy the conditions imposed at the start of that phase. (B) The process of providing objective evidence that the system, software, or hardware and its associated products conform to requirements (e.g., for correctness, completeness, consistency, and accuracy) for all life cycle activities during each life cycle process (acquisition, supply, development, operation, and maintenance); satisfy standards, practices, and conventions during life cycle processes; and successfully complete each life cycle activity and satisfy all the criteria for initiating succeeding life cycle activities. Verification of interim work products is essential for proper understanding and assessment of the life cycle phase product(s).

comment: Verification is a strictly paper-based exercise. It begins by acquiring all design inputs: characteristics, government and industry standards, knowledge gained from previous projects, and any other information required for proper operation. Once you have these requirements, you compare them with the outputs of your design: schematics, assembly instructions, test instructions and electronic design files.

comment: it answers to the question “Am I doing the thing right?”

prefLabel: Verification

Subclass of:

- is_a Observation
- is_a ConformityAssessment

Measurement

IRI: http://emmo:info/emmo#EMMO_463bcfda_867b_41d9_a967_211d4d437cfb

elucidation: An ‘observation’ that results in a quantitative comparison of a ‘property’ of an ‘object’ with a standard reference based on a well defined mesurement procedure.

VIMTerm: measurement

prefLabel: Measurement

Subclass of:

- is_a Observation
- is_a Procedure
- hasTemporaryParticipant some MeasurementResult
- hasTemporaryParticipant some MeasuringSystem
- hasOutput some MeasurementResult

EndStep

IRI: http://emmo:info/emmo#EMMO_8a2a1cbc_dfc3_4e6c_b337_00ee56fd438a

elucidation: The final step of a workflow.

comment: There may be more than one end task, if they run in parallel leading to more than one output.

prefLabel: EndStep

Subclass of:

- is_a Step
- is_a EndTile

Validation

IRI: http://emmo:info/emmo#EMMO_3ecefbaf_f06b_4ea3_9e50_a798cf25a879

elucidation: A Validation is a process where the interpreter attributes a sign, specifically a property, to the end product or to a product in its final stages of realisation, following test procedures, or on the basis of certain criteria. It can been done on a first end unit produced, but also on a prototype of the product. The interpreter can be either producer or the customer.(If the interpreters are the producers, they conduct the process simulating the use conditions of the end product so they are estimators, if the use conditions are real they are observers). If the interpreters are the customers, they are observers. The validaton process can be executed both on products and data. The Validation may require the cooperation of the two interpreter, making a comparison between the two processes of determination done by the customer and by the producer.

comment: Answer to the question “Am I doing the right thing?”

comment: The process of evaluating a system or component during or at the end of the development process to determine whether it satisfies specified requirements

comment: The process of evaluating a system or component during or at the end of the development process to determine whether it satisfies specified requirements. (B) The process of providing evidence that the system, software, or hardware and its associated products satisfy requirements allocated to it at the end of each life cycle activity, solve the right problem (e.g., correctly model physical laws, implement business rules, and use the proper system assumptions), and satisfy intended use and user needs.

comment: confirmation, through the provision of objective evidence (3.8.3), that the requirements (3.6.4) for a specific intended use or application have been fulfilled Note 1 to entry: The objective evidence needed for a validation is the result of a test (3.11.8) or other form of determination (3.11.1) such as performing alternative calculations or reviewing documents (3.8.5). Note 2 to entry: The word “validated” is used to designate the corresponding status. Note 3 to entry: The use conditions for validation can be real or simulated.

prefLabel: Validation

Subclass of:

- is_a ConformityAssessment

Workflow

IRI: http://emmo:info/emmo#EMMO_64963ed6_39c9_4258_85e0_6466c4b5420c

elucidation: A procedure that has at least two procedures (tasks) as proper parts.

prefLabel: Workflow

Subclass of:

- is_a Procedure
- hasHolisticPart some Task
- disjoint_union_of SerialWorkflow, ParallelWorkflow

Computation

IRI: http://emmo:info/emmo#EMMO_eff42cb3_208e_4768_9a39_f8b6b3c3d7a2

elucidation: A procedure that deals with quantitative symbols (i.e. symbols associated with a quantitative oriented language).

example: A matematician that calculates 2+2. A computation machine that calculate the average value of a dataset.

prefLabel: Computation

Subclass of:

- is_a Procedure

IterativeWorkflow

IRI: http://emmo:info/emmo#EMMO_ddecfff6_d3a1_4972_b9e9_3d0ca11a3a0b

elucidation: A workflow whose steps (iterative steps) are the repetition of the same workflow type.

prefLabel: IterativeWorkflow

Subclass of:

- is_a SerialWorkflow
- hasTask some IterativeStep

ConformityAssessment

IRI: http://emmo:info/emmo#EMMO_508f7b78_b67a_4cbf_bab0_a5afd5eb0134

elucidation: A Conformity assessment is a process where the interpreter attributes a sign, specifically a property, to a process or a product, considering the fullfillment or not fullfillment of requiremnts estimated or defined.

altLabel: AssertionTesting

comment: any activity concerned with determining directly or indirectly that relevant requirements are fulfilled

comment: confirmation through the provision of objective evidence (3.4.32), that specified requirements (3.1.15) have been fulfilled

comment: demonstration that specified requirements relating to a product, process, system, person or body are fulfilled

prefLabel: ConformityAssessment

Subclass of:

- is_a Determination
- is_a Procedure

AlphaTesting

IRI: http://emmo:info/emmo#EMMO_1d4d1a1a_1366_4d2f_82b1_55fd27de14e1

prefLabel: AlphaTesting

Subclass of:

- is_a UsabilityTesting

SerialWorkflow

IRI: http://emmo:info/emmo#EMMO_57ba1bf0_4314_432c_a9bb_6a6720c8dab5

elucidation: A workflow whose tasks are tiles of a sequence.

prefLabel: SerialWorkflow

Subclass of:

- is_a Workflow
- is_a Sequence

InternalStep

IRI: http://emmo:info/emmo#EMMO_322ce14e_9ede_4841_ad70_302b4d6c5f28

elucidation: A generic step in a workflow, that is not the begin or the end.

prefLabel: InternalStep

Subclass of:

- is_a Step
- is_a ThroughTile

PhysicsMathematicalComputation

IRI: http://emmo:info/emmo#EMMO_5dd63d84_57f5_4b79_b760_fe940c06680d

elucidation: A functional icon that imitates the behaviour of the object through mathematical evaluations of some mathematical construct.

comment: The equation that describes the velocity of a uniform accelerated body v = v0 + a*t is a functional icon. In general every analitical solution of a mathematical model can be considered an icon. A functional icon expresses its similarity with the object when is part of a process the makes it imitate the behavior of the object. In the case of v = v0 + a*t, plotting the velocity over time or listing their values at certain instants is when the icon expresses it functionality.

prefLabel: PhysicsMathematicalComputation

Subclass of:

- is_a FunctionalIcon
- is_a Computation

BeginStep

IRI: http://emmo:info/emmo#EMMO_b941e455_2cb1_4c11_93e3_17caa06086b4

elucidation: An initial step of a workflow.

comment: There may be more than one begin task, if they run in parallel.

prefLabel: BeginStep

Subclass of:

- is_a Step
- is_a BeginTile

Step

IRI: http://emmo:info/emmo#EMMO_9f6ec830_c59f_46aa_8a22_945ba20b6ea3

elucidation: A task that is a well formed tile of a workflow, according to a reductionistic description.

comment: A step is part of a specific granularity level for the workflow description, as composition of tasks.

prefLabel: Step

Subclass of:

- is_a Task
- is_a WellFormedTile
- equivalent_to InternalStep or EndStep or BeginStep

PureParallelWorkflow

IRI: http://emmo:info/emmo#EMMO_83a460aa_5826_4fbb_93e8_d73d0df25757

elucidation: A workflow that is the concurrent evolution of two or more tasks, not communicacting between themselves.

altLabel: EmbarassinglyParallelWorkflow

prefLabel: PureParallelWorkflow

Subclass of:

- is_a Arrangement
- is_a ParallelWorkflow

Procedure

IRI: http://emmo:info/emmo#EMMO_472a0ca2_58bf_4618_b561_6fe68bd9fd49

elucidation: The process in which an agent works with some entities according to some operative rules.

example: The process in which a control unit of a CPU (the agent) orchestrates some cached binary data according to a list of instructions (e.g. a program). The process in which a librarian order books alphabetically on a shelf. The execution of an algorithm.

altLabel: Elaboration

altLabel: Work

comment: A procedure can be considered as an intentional process with a plan.

conceptualisation: The set of established forms or methods of an organized body for accomplishing a certain task or tasks (Wiktionary).

prefLabel: Procedure

Subclass of:

- is_a IntentionalProcess

IntegrationTest

IRI: http://emmo:info/emmo#EMMO_3ec60cca_870d_4e47_8efd_7c2f3a995d4c

elucidation: progressive linking and testing of programs or modules in order to ensure their proper functioning in the complete system

prefLabel: IntegrationTest

Subclass of:

- is_a SoftwareVerification

AcceptanceTesting

IRI: http://emmo:info/emmo#EMMO_b5215e42_33fb_4bdd_917b_6f6f36b14755

prefLabel: AcceptanceTesting

Subclass of:

- is_a SoftwareValidation

Task

IRI: http://emmo:info/emmo#EMMO_4299e344_a321_4ef2_a744_bacfcce80afc

elucidation: A procedure that is an hoilistic part of a workflow.

altLabel: Job

comment: A task is a generic part of a workflow, without taking care of the task granularities. It means that you can declare that e.g. tightening a bolt is a task of building an airplane, without caring of the coarser tasks to which this tightening belongs.

prefLabel: Task

Subclass of:

- is_a Procedure
- Inverse(hasTask) some Workflow
- is_a Role

SoftwareValidation

IRI: http://emmo:info/emmo#EMMO_78807d14_82c4_44e6_867c_142b338c27d1

elucidation: The software Validation is a validation process where the interprer can be the program or a human.

prefLabel: SoftwareValidation

Subclass of:

- is_a ProductValidation

ProductVerification

IRI: http://emmo:info/emmo#EMMO_5f2f0d99_c958_489c_a373_522eb07c5f40

elucidation: inspection, test or examination to ensure that materials, products or services conform to specified requirements

altLabel: QualityControl

prefLabel: ProductVerification

Subclass of:

- is_a Verification

ParallelWorkflow

IRI: http://emmo:info/emmo#EMMO_5848e476_2768_4988_98f9_9053c532307b

prefLabel: ParallelWorkflow

Subclass of:

- is_a Workflow

ProductValidation

IRI: http://emmo:info/emmo#EMMO_e4ece4ad_41fc_4af5_9014_1afdbf722436

elucidation: The Product Validation is a validation process that can be realise by a human interpreter.

prefLabel: ProductValidation

Subclass of:

- is_a Validation

MaterialRelationComputation

IRI: http://emmo:info/emmo#EMMO_084b4f77_6df7_4c6a_b705_2528aba5cdda

prefLabel: MaterialRelationComputation

Subclass of:

- is_a PhysicsMathematicalComputation

SoftwareVerification

IRI: http://emmo:info/emmo#EMMO_87d19dcd_9fdb_4d89_b168_894e2490b46d

elucidation: testing that takes into account the internal mechanism of a system or component cf. functional testing (1), structure-based testing Note 1 to entry: Types include branch testing, path testing, statement testing.

example: WhiteBoxTesting

altLabel: StructureTesting

prefLabel: SoftwareVerification

Subclass of:

- is_a ProductVerification

UnitTest

IRI: http://emmo:info/emmo#EMMO_886b5675_5339_45b4_bcf3_7be7f70d93fe

elucidation: In software engineering, unit testing, unit test[1] or unit testing refers to the activity of testing individual units of a piece of software. A unit is normally understood to be the smallest component of a programme with autonomous operation; depending on the programming paradigm or programming language, this may correspond, for example, to a single function in procedural programming, or a single class or method in object-oriented programming.

altLabel: UnitTesting

comment: test of individual programs or modules in order to ensure that there are no analysis or programming errors Note 1 to entry: unit test: term and definition standardized by ISO/IEC [ISO/IEC 2382-20:1990]. Note 2 to entry: 20.05.05 (2382)

prefLabel: UnitTest

Subclass of:

- is_a SoftwareVerification

IterativeStep

IRI: http://emmo:info/emmo#EMMO_9ac10a20_63d0_4bbd_a5d3_f00a0ad4682c

elucidation: A workflow whose output ca be used as input for another workflow of the same type, iteratively, within the framework of a larger workflow.

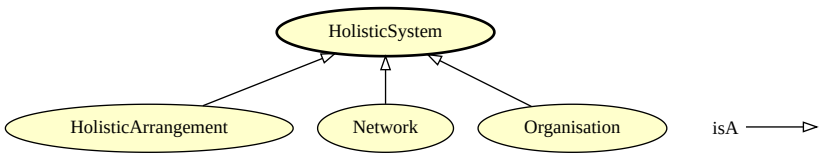
example: Jacobi method numerical step, involving the multiplication between a matrix A and a vector x, whose result is used to update the vector x.

prefLabel: IterativeStep

Subclass of:

- is_a Workflow
- is_a Step

Holistic System branch



Holistic System branch.

HolisticArrangement

IRI: http://emmo:info/emmo#EMMO_b9522e56_1fac_4766_97e6_428605fabd3e

elucidation: A system which is mainly characterised by the spatial configuration of its elements.

prefLabel: HolisticArrangement

Subclass of:

- is_a HolisticSystem

Network

IRI: http://emmo:info/emmo#EMMO_f93fe78b_9646_4a15_b88b_1c93686a764d

elucidation: A system whose is mainly characterised by the way in which elements are interconnected.

prefLabel: Network

Subclass of:

- is_a HolisticSystem

Organisation

IRI: http://emmo:info/emmo#EMMO_c0f72631_d7c2_434c_9c26_5c44123df682

elucidation: A system driven by group of people to address a particular purpose in an organised way .

prefLabel: Organisation

Subclass of:

- is_a HolisticSystem

HolisticSystem

IRI: http://emmo:info/emmo#EMMO_65a007dc_2550_46b0_b394_3346c67fbb69

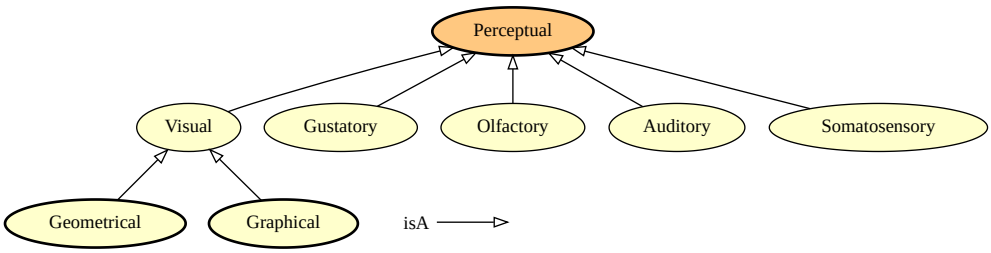
elucidation: An object that is made of a set of sub objects working together as parts of a mechanism or an interconnecting network (natural or artificial); a complex whole.

prefLabel: HolisticSystem

Subclass of:

- is_a Object
- hasConstituent some Component
- is_a Whole

PERCEPTUAL BRANCH



Perceptual branch.

Perceptual

IRI: http://emmo:info/emmo#EMMO_649bf97b_4397_4005_90d9_219755d92e34

elucidation: The class of ‘Physical’ individuals which stand for real world objects that can stimulate a perception (e.g. a retina impression) into the ontologist and that are categorized accordingly to human perception mechanisms.

example: A line scratched on a surface. A sound. A smell. The word ‘cat’ and the sound of the word ‘cat’ (the first one is graphical and the second acoustical).

example: The meta-semiotic process: I see a cloud in the sky. Since I’m an EMMO ontologist, I create an individual named Cloud under the ‘Perceptual’ class, meaning that I recognize the cloud as an object thanks to a specific perceptual channel (e.g. through my eyes). This semiotic process occurs at meta-level: it’s how I use the EMMO as tool for a direct representation of the world, understandable by others ontologists.

The semiotic process within EMMO: My friend looks at the same cloud and says: “It is an elephant”. I use the EMMO to record this experience by declaring: - my friend as MyFriend individual, belonging to ‘Interpreter’ classes - the sound of the word “elephant” as an acoustical perception individual named ElephantWord, belonging to ‘Perceptual’ - a relation hasSign between Cloud and ElephantWord, that makes ElephantWord also belonging to ‘Sign’ class and Cloud belonging also to ‘Object’ class - a ‘Semiosis’ individual called MyFriendElephantCloud that hasParticipant: Cloud, ElephantWord and MyFriend, respectively as object, sign and interpreter.

So, the Perceptual class is here to categorized real-world objects at meta-level using common perceptual channels, for practical ontology usage.

We could have represented the word “elephant” within a physicalistic approach, by identifying it as a pressure wave in the air.

prefLabel: Perceptual

Subclass of:

- is_a Perspective
- equivalent_to Auditory or Somatosensory or Visual or Gustatory or Olfactory

Visual

IRI: http://emmo:info/emmo#EMMO_c5ae6d8e_6b39_431f_8de4_ae4e357abc04

elucidation: A ‘Perceptual’ which stands for a real world object whose spatiotemporal pattern makes it identifiable by an observer through an optical perception employing the visible part of the electromagnetic spectrum.

example: A cloud. A picture. A colour gradient on a wall. A stain. A mail.

prefLabel: Visual

Subclass of:

- is_a Perceptual

Gustatory

IRI: http://emmo:info/emmo#EMMO_dd14d055_2db0_4b81_bc97_ef6c2f72b8a0

prefLabel: Gustatory

Subclass of:

- is_a Perceptual

Auditory

IRI: http://emmo:info/emmo#EMMO_4b3afb22_27cf_4ce3_88bc_492bfccb546b

elucidation: A ‘Perceptual’ which stands for a real world object whose spatiotemporal pattern makes it identifiable by an observer as a sound.

example: When we use the term ‘sound’ what are we referring to? The EMMO identifis a sound as the physical object that can be heard by the observer (more exactly, by the sensor of the observer).

In this sense, a sound (which is an acoustical object) is to be identified as the air region that manifests the sound wave and is able to be perceived by an observer. In case the wave is travelling through water or steel, then these other media regions are the sounds.

If the waveform is travelling through a cable as electronic signal (analog or digital) it is no more a sound, since it cannot be perceived by an observer as an acoustical object. This electrical waveform (or digital packet) is another physical that may stand for a sound if interpreted by a device (e.g. an amplifier, a DA converter).

altLabel: Sound

prefLabel: Auditory

Subclass of:

- is_a Perceptual

Olfactory

IRI: http://emmo:info/emmo#EMMO_e1021593_06da_4237_8a02_29d8f6fef76d

prefLabel: Olfactory

Subclass of:

- is_a Perceptual

Somatosensory

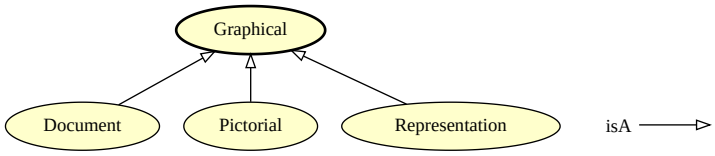
IRI: http://emmo:info/emmo#EMMO_8f207971_aaab_48dc_a10d_55a6b4331410

prefLabel: Somatosensory

Subclass of:

- is_a Perceptual

GRAPHICAL BRANCH



Graphical branch.

Document

IRI: http://emmo:info/emmo#EMMO_ccdc1a41_6e96_416b_92ec_efe67917434a

elucidation: An heterogenous object made of different graphical object parts.

prefLabel: Document

Subclass of:

- is_a Graphical

Pictorial

IRI: http://emmo:info/emmo#EMMO_1da53c06_9577_4008_8652_272fa3b62be7

elucidation: A ‘Graphical’ that stands for a real world object that shows a recognizable pictorial pattern without being necessarily associated to a symbolic language.

example: A drawing of a cat. A circle on a paper sheet. The Mona Lisa.

prefLabel: Pictorial

Subclass of:

- is_a Graphical

Graphical

IRI: http://emmo:info/emmo#EMMO_c74da218_9147_4f03_92d1_8894abca55f3

elucidation: A ‘Perceptual’ which stands for a real world object whose spatial configuration is due to an explicit graphical procedure and shows an identifiable pattern.

example: ‘Graphical’ objects include writings, pictures, sketches …

prefLabel: Graphical

Subclass of:

- is_a Visual

Representation

IRI: http://emmo:info/emmo#EMMO_eb7de1a1_c30e_4f0d_94c6_fe70414d7e61

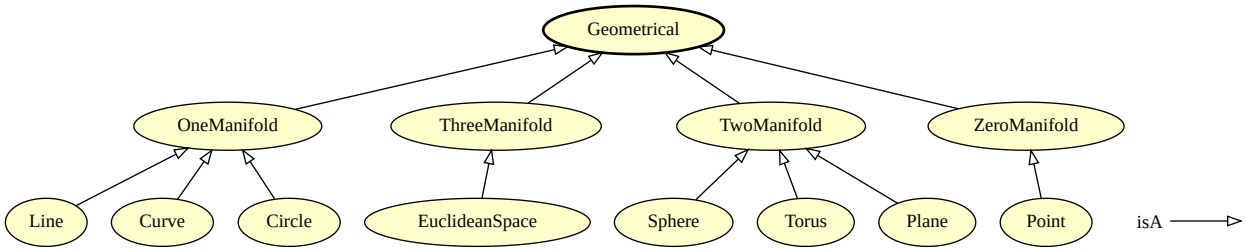
elucidation: A graphical object aimed to represent schematically the conceptual, tempral or spatial structure of another object.

prefLabel: Representation

Subclass of:

- is_a Graphical

GEOMETRICAL BRANCH



Geometrical branch.

Geometrical

IRI: http://emmo:info/emmo#EMMO_b5957cef_a287_442d_a3ce_fd39f20ba1cd

elucidation: A ‘graphical’ aimed to represent a geometrical concept.

example: A geometrical object can be expressed in many different forms.

For example, a line can be expressed by: a) an equation like y=mx+q, which is both an ‘equation’ and a ‘geometrical’ b) a line drawn with a pencil on a paper, which is simply a ‘graphical’ object c) a set of axioms, when the properties of a line are inferred by the interpreter reading them, that are both ‘graphical’ and also ‘formula’

The case a) is a geometrical and mathematical, b) is geometrical and pictorial, while c) is geometrical and a composition of idiomatic strings.

prefLabel: Geometrical

Subclass of:

- is_a Visual

Point

IRI: http://emmo:info/emmo#EMMO_39362460_2a97_4367_8f93_0418c2ac9a08

prefLabel: Point

Subclass of:

- is_a ZeroManifold

Sphere

IRI: http://emmo:info/emmo#EMMO_d7bf784a_db94_4dd9_861c_54f262846fbf

prefLabel: Sphere

Subclass of:

- is_a TwoManifold

OneManifold

IRI: http://emmo:info/emmo#EMMO_0c576e13_4ee7_4f3d_bfe9_1614243df018

altLabel: 1-manifold

prefLabel: OneManifold

Subclass of:

- is_a Geometrical

Torus

IRI: http://emmo:info/emmo#EMMO_86060335_31c2_4820_b433_27c64aea0366

prefLabel: Torus

Subclass of:

- is_a TwoManifold

EuclideanSpace

IRI: http://emmo:info/emmo#EMMO_5f278af9_8593_4e27_a717_ccc9e07a0ddf

prefLabel: EuclideanSpace

Subclass of:

- is_a ThreeManifold

Line

IRI: http://emmo:info/emmo#EMMO_3e309118_e8b7_4021_80f4_642d2df65d94

prefLabel: Line

Subclass of:

- is_a OneManifold

Curve

IRI: http://emmo:info/emmo#EMMO_0ef4ff4a_5458_4f2a_b51f_4689d472a3f2

prefLabel: Curve

Subclass of:

- is_a OneManifold

ThreeManifold

IRI: http://emmo:info/emmo#EMMO_46f0f8df_4dc6_418f_8036_10427a3a288e

altLabel: 3-manifold

prefLabel: ThreeManifold

Subclass of:

- is_a Geometrical

Plane

IRI: http://emmo:info/emmo#EMMO_25f5ca8e_8f7f_44d8_a392_bd3fe8894458

prefLabel: Plane

Subclass of:

- is_a TwoManifold

TwoManifold

IRI: http://emmo:info/emmo#EMMO_9268958f_7f54_48ab_a693_febe2645892b

altLabel: 2-manifold

prefLabel: TwoManifold

Subclass of:

- is_a Geometrical

Circle

IRI: http://emmo:info/emmo#EMMO_b2a234a8_579a_422c_9305_b8f7e72c76cd

prefLabel: Circle

Subclass of:

- is_a OneManifold

ZeroManifold

IRI: http://emmo:info/emmo#EMMO_0ab0485c_9e5b_4257_a679_90a2dfba5c7c

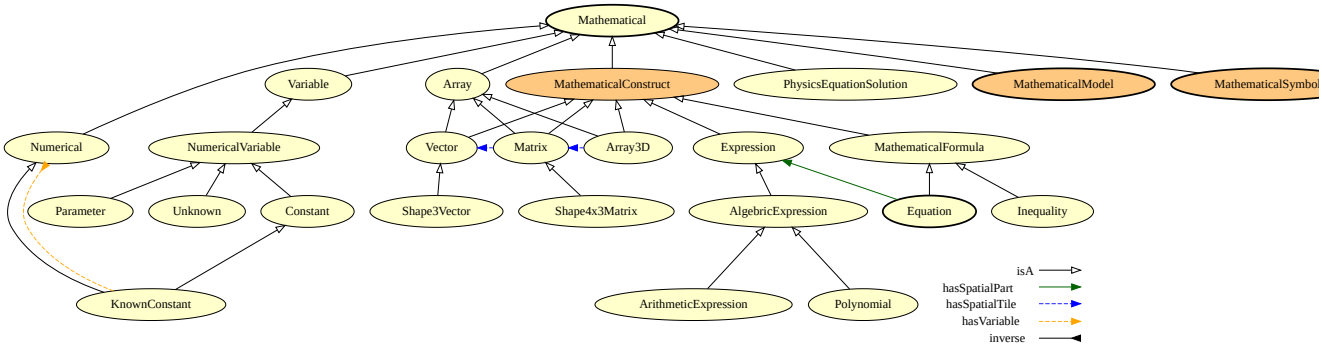
altLabel: 0-manifold

prefLabel: ZeroManifold

Subclass of:

- is_a Geometrical

MATHEMATICAL BRANCH



Mathematical branch.

Shape4x3Matrix

IRI: http://emmo:info/emmo#EMMO_24b30ba4_90f4_423d_93d2_fd0fde349087

elucidation: A real matrix with shape 4x3.

prefLabel: Shape4x3Matrix

Subclass of:

- is_a Matrix

PhysicsBasedModel

IRI: http://emmo:info/emmo#EMMO_b29fd350_39aa_4af7_9459_3faa0544cba6

elucidation: A mathematical entity based on a fundamental physics theory which defines the relations between physics quantities of an entity.

prefLabel: PhysicsBasedModel

Subclass of:

- is_a MathematicalModel
- hasSpatialSlice some PhysicsEquation
- is_a MathematicalConstruct
- is_a CausalSystem

Numerical

IRI: http://emmo:info/emmo#EMMO_4ce76d7f_03f8_45b6_9003_90052a79bfaa

elucidation: A ‘Mathematical’ that has no unknown value, i.e. all its ‘Variable”-s parts refers to a ’Number’ (for scalars that have a built-in datatype) or to another ‘Numerical’ (for complex numerical data structures that should rely on external implementations).

prefLabel: Numerical

Subclass of:

- is_a Mathematical

Inequality

IRI: http://emmo:info/emmo#EMMO_0b6ebe5a_0026_4bef_a1c1_5be00df9f98e

elucidation: A relation which makes a non-equal comparison between two numbers or other mathematical expressions.

example: f(x) > 0

prefLabel: Inequality

Subclass of:

- is_a MathematicalFormula

PhysicsEquationSolution

IRI: http://emmo:info/emmo#EMMO_6e0664f2_4d4d_4407_bf60_e1b3c07198d7

elucidation: A function solution of a physics equation that provides a methods for the prediction of some quantitiative properties of an object.

example: A parabolic function is a prediction of the trajectory of a falling object in a gravitational field. While it has predictive capabilities it lacks of an analogical character, since it does not show the law behind that trajectory.

prefLabel: PhysicsEquationSolution

Subclass of:

- is_a Mathematical

AlgebricExpression

IRI: http://emmo:info/emmo#EMMO_1aed91a3_d00c_48af_8f43_a0c958b2512a

example: 2x+3

prefLabel: AlgebricExpression

Subclass of:

- is_a Expression

Shape3Vector

IRI: http://emmo:info/emmo#EMMO_2ff07b07_c447_490f_903a_f6a72a12d7bf

elucidation: A real vector with 3 elements.

example: The quantity value of physical quantities if real space is a Shape3Vector.

prefLabel: Shape3Vector

Subclass of:

- is_a Vector

MathematicalFormula

IRI: http://emmo:info/emmo#EMMO_88470739_03d3_4c47_a03e_b30a1288d50c

elucidation: A mathematical string that express a relation between the elements in one set X to elements in another set Y.

prefLabel: MathematicalFormula

Subclass of:

- is_a MathematicalConstruct

Real

IRI: http://emmo:info/emmo#EMMO_18d180e4_5e3e_42f7_820c_e08951223486

elucidation: A real number.

prefLabel: Real

Subclass of:

- is_a Number
- hasNumericalData only type
- hasNumericalData exactly 1 type
- equivalent_to hasNumericalData some type

PhysicsEquation

IRI: http://emmo:info/emmo#EMMO_27c5d8c6_8af7_4d63_beb1_ec37cd8b3fa3

elucidation: An ‘equation’ that stands for a ‘physical_law’ by mathematically defining the relations between physics_quantities.

example: The Newton’s equation of motion. The Schrödinger equation. The Navier-Stokes equation.

prefLabel: PhysicsEquation

Subclass of:

- is_a PhysicsBasedModel
- is_a Equation

Matrix

IRI: http://emmo:info/emmo#EMMO_1cba0b27_15d0_4326_933f_379d0b3565b6

elucidation: 2-dimensional array who's spatial direct parts are vectors.

altLabel: 2DArray

prefLabel: Matrix

Subclass of:

- is_a Array
- hasSpatialTile some Vector
- is_a MathematicalConstruct
- is_a Tessellation

Array3D

IRI: http://emmo:info/emmo#EMMO_20ff3b34_c864_4936_8955_9345fc0a3b3c

elucidation: 3-dimensional array who's spatial direct parts are matrices.

altLabel: 3DArray

prefLabel: Array3D

Subclass of:

- is_a Array
- hasSpatialTile some Matrix
- is_a MathematicalConstruct
- is_a Tessellation

KnownConstant

IRI: http://emmo:info/emmo#EMMO_ae15fb4f_8e4d_41de_a0f9_3997f89ba6a2

elucidation: A variable that stand for a well known numerical constant (a known number).

example: π refers to the constant number ~3.14

prefLabel: KnownConstant

Subclass of:

- is_a Numerical
- is_a Constant
- Inverse(hasVariable) only Numerical

ContinuumModel

IRI: http://emmo:info/emmo#EMMO_4456a5d2_16a6_4ee1_9a8e_5c75956b28ea

elucidation: A physics-based model based on a physics equation describing the behaviour of continuum volume.

prefLabel: ContinuumModel

Subclass of:

- is_a MaterialsModel

NumericalVariable

IRI: http://emmo:info/emmo#EMMO_9e029526_79a2_47a8_a151_dd0545db471b

elucidation: A variable standing for a numerical defined mathematical object like e.g. a number, a vector of numbers, a matrix of numbers.

prefLabel: NumericalVariable

Subclass of:

- is_a Variable

ArithmeticExpression

IRI: http://emmo:info/emmo#EMMO_89083bab_f69c_4d06_bf6d_62973b56cdc7

example: 2+2

prefLabel: ArithmeticExpression

Subclass of:

- is_a AlgebricExpression
- is_a not hasSpatialTile some Variable

Number

IRI: http://emmo:info/emmo#EMMO_21f56795_ee72_4858_b571_11cfaa59c1a8

elucidation: A numerical data value.

altLabel: Numeral

prefLabel: Number

Subclass of:

- is_a Numerical
- is_a MathematicalSymbol

MesoscopicModel

IRI: http://emmo:info/emmo#EMMO_53935db0_af45_4426_b9e9_244a0d77db00

elucidation: A physics-based model based on a physics equation describing the behaviour of mesoscopic entities, i.e. a set of bounded atoms like a molecule, bead or nanoparticle.

prefLabel: MesoscopicModel

Subclass of:

- is_a MaterialsModel

Polynomial

IRI: http://emmo:info/emmo#EMMO_91447ec0_fb55_49f2_85a5_3172dff6482c

example: 2 * x^2 + x + 3

prefLabel: Polynomial

Subclass of:

- is_a AlgebricExpression

Unknown

IRI: http://emmo:info/emmo#EMMO_fe7e56ce_118b_4243_9aad_20eb9f4f31f6

elucidation: The dependent variable for which an equation has been written.

example: Velocity, for the Navier-Stokes equation.

prefLabel: Unknown

Subclass of:

- is_a NumericalVariable

ElectronicModel

IRI: http://emmo:info/emmo#EMMO_6eca09be_17e9_445e_abc9_000aa61b7a11

elucidation: A physics-based model based on a physics equation describing the behaviour of electrons.

example: Density functional theory. Hartree-Fock.

prefLabel: ElectronicModel

Subclass of:

- is_a MaterialsModel

MaterialsModel

IRI: http://emmo:info/emmo#EMMO_90f18cf0_1225_4c64_b5f8_f65cd7f992c5

elucidation: A solvable set of one Physics Equation and one or more Materials Relations.

prefLabel: MaterialsModel

Subclass of:

- is_a PhysicsBasedModel
- hasSpatialSlice some MaterialRelation
- disjoint_union_of ContinuumModel, MesoscopicModel, ElectronicModel, AtomisticModel

Vector

IRI: http://emmo:info/emmo#EMMO_06658d8d_dcde_4fc9_aae1_17f71c0bcdec

elucidation: 1-dimensional array who's spatial direct parts are numbers.

altLabel: 1DArray

altLabel: LinearArray

prefLabel: Vector

Subclass of:

- is_a Array
- hasSpatialTile some Number
- is_a MathematicalConstruct
- is_a Tessellation

AtomisticModel

IRI: http://emmo:info/emmo#EMMO_84cadc45_6758_46f2_ba2a_5ead65c70213

elucidation: A physics-based model based on a physics equation describing the behaviour of atoms.

prefLabel: AtomisticModel

Subclass of:

- is_a MaterialsModel

Mathematical

IRI: http://emmo:info/emmo#EMMO_54ee6b5e_5261_44a8_86eb_5717e7fdb9d0

elucidation: The class of general mathematical symbolic objects respecting mathematical syntactic rules.

prefLabel: Mathematical

Subclass of:

- is_a Language

Array

IRI: http://emmo:info/emmo#EMMO_28fbea28_2204_4613_87ff_6d877b855fcd

elucidation: Arrays are ordered mathematical objects who's elementary spatial parts are numbers. Their dimensionality is constructed with spatial direct parthood, where 1-dimensional arrays have spatial direct parts Number and n-dimensional array have spatial direct parts (n-1)-dimensional arrays.

example: A Vector is a 1-dimensional Array with Number as spatial direct parts, a Matrix is a 2-dimensional Array with Vector as spatial direct parts, an Array3D is a 3-dimensional Array with Matrix as spatial direct parts, and so forth…

prefLabel: Array

Subclass of:

- is_a Mathematical

Parameter

IRI: http://emmo:info/emmo#EMMO_d1d436e7_72fc_49cd_863b_7bfb4ba5276a

example: Viscosity in the Navier-Stokes equation

prefLabel: Parameter

Subclass of:

- is_a NumericalVariable

Constant

IRI: http://emmo:info/emmo#EMMO_8c64fcfa_23aa_45f8_9e58_bdfd065fab8f

elucidation: A variable that stand for a numerical constant, even if it is unknown.

prefLabel: Constant

Subclass of:

- is_a NumericalVariable

Boolean

IRI: http://emmo:info/emmo#EMMO_54dc83cb_06e1_4739_9e45_bc09cead7f48

elucidation: A boolean number.

prefLabel: Boolean

Subclass of:

- is_a Number
- hasNumericalData only type
- hasNumericalData exactly 1 type
- equivalent_to hasNumericalData some type

MathematicalConstruct

IRI: http://emmo:info/emmo#EMMO_ffe760a2_9d1f_4aef_8bee_1f450f9cb00d

prefLabel: MathematicalConstruct

Subclass of:

- is_a SymbolicConstruct
- is_a Mathematical
- equivalent_to Mathematical and SymbolicConstruct

Integer

IRI: http://emmo:info/emmo#EMMO_f8bd64d5_5d3e_4ad4_a46e_c30714fecb7f

elucidation: An integer number.

prefLabel: Integer

Subclass of:

- is_a Number
- hasNumericalData only type
- hasNumericalData exactly 1 type
- equivalent_to hasNumericalData some type

Variable

IRI: http://emmo:info/emmo#EMMO_1eed0732_e3f1_4b2c_a9c4_b4e75eeb5895

elucidation: A variable is a symbolic object that stands for any other mathematical object, such as number, a vector, a matrix, a function, the argument of a function, a set, an element of a set.

example: x k

prefLabel: Variable

Subclass of:

- is_a Mathematical

Expression

IRI: http://emmo:info/emmo#EMMO_f9bc8b52_85e9_4b53_b969_dd7724d5b8e4

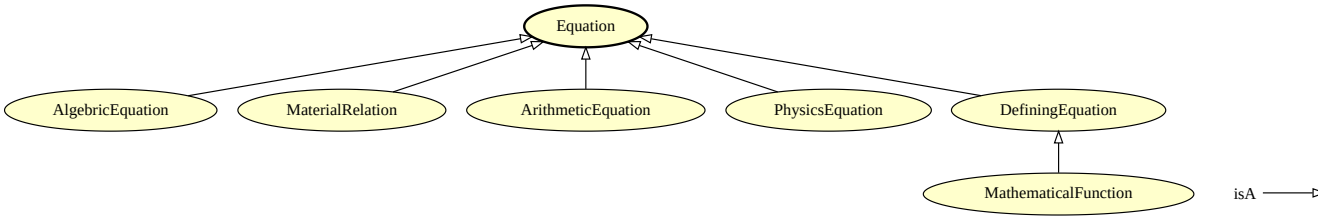
elucidation: A well-formed finite combination of mathematical symbols according to some specific rules.

prefLabel: Expression

Subclass of:

- is_a MathematicalConstruct

EQUATION BRANCH



Equation branch.

AlgebricEquation

IRI: http://emmo:info/emmo#EMMO_98d65021_4574_4890_b2fb_46430841077f

example: 2 * a - b = c

prefLabel: AlgebricEquation

Subclass of:

- is_a Equation
- hasSpatialPart some AlgebricExpression

MaterialRelation

IRI: http://emmo:info/emmo#EMMO_e5438930_04e7_4d42_ade5_3700d4a52ab7

elucidation: An ‘equation’ that stands for a physical assumption specific to a material, and provides an expression for a ‘physics_quantity’ (the dependent variable) as function of other variables, physics_quantity or data (independent variables).

example: The Lennard-Jones potential. A force field. An Hamiltonian.

prefLabel: MaterialRelation

Subclass of:

- is_a Equation

ArithmeticEquation

IRI: http://emmo:info/emmo#EMMO_a6138ba7_e365_4f2d_b6b4_fe5a5918d403

example: 1 + 1 = 2

prefLabel: ArithmeticEquation

Subclass of:

- is_a Equation

Equation

IRI: http://emmo:info/emmo#EMMO_e56ee3eb_7609_4ae1_8bed_51974f0960a6

elucidation: The class of ‘mathematical’-s that stand for a statement of equality between two mathematical expressions.

example: 2+3 = 5 x^2 +3x = 5x dv/dt = a sin(x) = y

prefLabel: Equation

Subclass of:

- is_a MathematicalFormula
- hasSpatialPart some Expression
- is_a CausalSystem

PhysicsEquation

IRI: http://emmo:info/emmo#EMMO_27c5d8c6_8af7_4d63_beb1_ec37cd8b3fa3

elucidation: An ‘equation’ that stands for a ‘physical_law’ by mathematically defining the relations between physics_quantities.

example: The Newton’s equation of motion. The Schrödinger equation. The Navier-Stokes equation.

prefLabel: PhysicsEquation

Subclass of:

- is_a PhysicsBasedModel
- is_a Equation

MathematicalFunction

IRI: http://emmo:info/emmo#EMMO_4bc29b0f_8fcc_4026_a291_f9774a66d9b8

elucidation: A function defined using functional notation.

example: y = f(x)

altLabel: FunctionDefinition

prefLabel: MathematicalFunction

Subclass of:

- is_a DefiningEquation

DefiningEquation

IRI: http://emmo:info/emmo#EMMO_29afdf54_90ae_4c98_8845_fa9ea3f143a8

elucidation: An equation that define a new variable in terms of other mathematical entities.

example: The definition of velocity as v = dx/dt.

The definition of density as mass/volume.

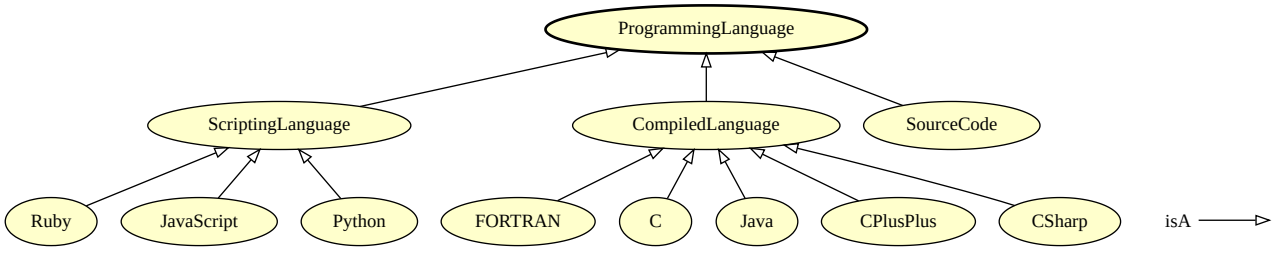
y = f(x)

prefLabel: DefiningEquation

Subclass of:

- is_a Equation

Programming Language branch



Programming Language branch.

FORTRAN

IRI: http://emmo:info/emmo#EMMO_aab6a0cc_2fbd_43ac_ac5a_b7b7b75331dc

prefLabel: FORTRAN

Subclass of:

- is_a CompiledLanguage

ScriptingLanguage

IRI: http://emmo:info/emmo#EMMO_f84b1b92_1dc8_4146_99f0_b03cd53e455b

elucidation: A programming language that is executed through runtime interpretation.

prefLabel: ScriptingLanguage

Subclass of:

- is_a ProgrammingLanguage

Ruby

IRI: http://emmo:info/emmo#EMMO_53dd6f2a_f9de_4f83_b925_1bf39a4ab9a6

prefLabel: Ruby

Subclass of:

- is_a ScriptingLanguage

JavaScript

IRI: http://emmo:info/emmo#EMMO_161bef57_cc59_4246_8249_19dbdae96e7b

prefLabel: JavaScript

Subclass of:

- is_a ScriptingLanguage

ProgrammingLanguage

IRI: http://emmo:info/emmo#EMMO_9ffffb55_3496_4307_82b8_a0d78fe1fcd8

elucidation: A language object that follows syntactic rules of a programming language.

altLabel: Code

altLabel: SoftwareCode

comment: A programming language object can also be a fragment (e.g. a C function) not suitable for exectution.

comment: Entities are not necessarily digital data, but can be code fragments printed on paper.

prefLabel: ProgrammingLanguage

Subclass of:

- is_a Language

C

IRI: http://emmo:info/emmo#EMMO_36a9bf69_483b_42fd_8a0c_7ac9206320bc

prefLabel: C

Subclass of:

- is_a CompiledLanguage

SourceCode

IRI: http://emmo:info/emmo#EMMO_348d39f7_6a17_49d1_9860_9b33b69b51de

elucidation: A programming language entity expressing a formal detailed plan of what a software is intended to do.

comment: A source code is the companion of an application, being it the entity used to generate the application list of CPU executable instructions.

comment: Source code (also referred to as source or code) is the version of software as it is originally written (i.e., typed into a computer) by a human in plain text (i.e., human readable alphanumeric characters).

prefLabel: SourceCode

Subclass of:

- is_a Software
- is_a ProgrammingLanguage

Java

IRI: http://emmo:info/emmo#EMMO_09007bc0_b5f2_4fb9_af01_caf948cf2044

prefLabel: Java

Subclass of:

- is_a CompiledLanguage

CPlusPlus

IRI: http://emmo:info/emmo#EMMO_64aba1e5_24b7_4140_8eb4_676c35698e79

elucidation: A language object respecting the syntactic rules of C++.

altLabel: C++

prefLabel: CPlusPlus

Subclass of:

- is_a CompiledLanguage

CompiledLanguage

IRI: http://emmo:info/emmo#EMMO_1461e904_a2bf_4558_ad74_2706f5706b34

prefLabel: CompiledLanguage

Subclass of:

- is_a ProgrammingLanguage

CSharp

IRI: http://emmo:info/emmo#EMMO_268a8a97_3a6f_4022_93da_962a66827cdc

altLabel: C#

prefLabel: CSharp

Subclass of:

- is_a CompiledLanguage

Python

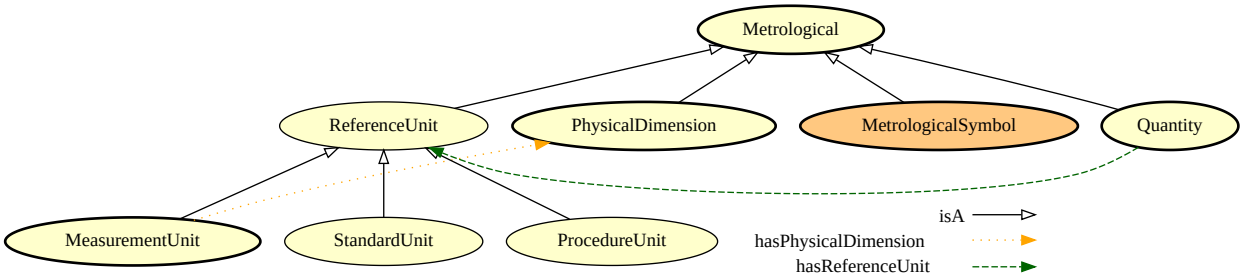
IRI: http://emmo:info/emmo#EMMO_add2e29d_6d87_4b78_9706_588e25557093

prefLabel: Python

Subclass of:

- is_a ScriptingLanguage

METROLOGICAL BRANCH



Metrological branch.

ReferenceUnit

IRI: http://emmo:info/emmo#EMMO_18ce5200_00f5_45bb_8c6f_6fb128cd41ae

elucidation: A reference can be a measurement unit, a measurement procedure, a reference material, or a combination of such. International vocabulary of metrology (VIM)

prefLabel: ReferenceUnit

Subclass of:

- is_a Metrological

Metrological

IRI: http://emmo:info/emmo#EMMO_985bec21_989f_4b9e_a4b3_735d88099c3c

elucidation: A language object used in metrology.

prefLabel: Metrological

Subclass of:

- is_a Language

StandardUnit

IRI: http://emmo:info/emmo#EMMO_acd1a504_ca32_4f30_86ad_0b62cea5bc02

elucidation: A reference unit provided by a reference material. International vocabulary of metrology (VIM)

example: Arbitrary amount-of-substance concentration of lutropin in a given sample of plasma (WHO international standard 80/552): 5.0 International Unit/l

prefLabel: StandardUnit

Subclass of:

- is_a ReferenceUnit

ProcedureUnit

IRI: http://emmo:info/emmo#EMMO_c9c8f824_9127_4f93_bc21_69fe78a7f6f2

elucidation: A reference unit provided by a measurement procedure.

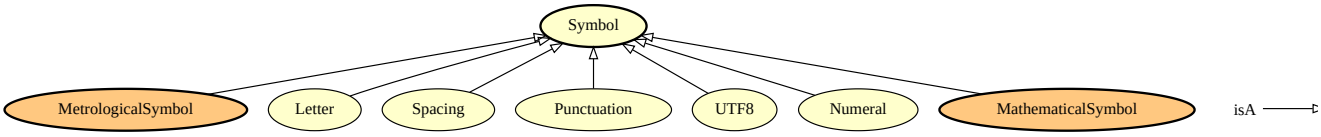
example: Rockwell C hardness of a given sample (150 kg load): 43.5HRC(150 kg)

prefLabel: ProcedureUnit

Subclass of:

- is_a ReferenceUnit

SYMBOL BRANCH



Symbol branch.

Spacing

IRI: http://emmo:info/emmo#EMMO_432192c4_111f_4e80_b7cd_c6ce1c1129ea

prefLabel: Spacing

Subclass of:

- is_a Symbol

Punctuation

IRI: http://emmo:info/emmo#EMMO_a817035a_3e3c_4709_8ede_3205df3031a3

prefLabel: Punctuation

Subclass of:

- is_a Symbol

UTF8

IRI: http://emmo:info/emmo#EMMO_e13b2173_1dec_4b97_9ac1_1dc4b418612a

prefLabel: UTF8

Subclass of:

- is_a Symbol

Symbol

IRI: http://emmo:info/emmo#EMMO_a1083d0a_c1fb_471f_8e20_a98f881ad527

elucidation: The class of individuals that stand for an elementary mark of a specific symbolic code (alphabet).

example: The class of letter “A” is the symbol as idea and the letter A that you see on the screen is the mark that can be represented by an individual belonging to “A”.

comment: Subclasses of ‘Symbol’ are alphabets, in formal languages terminology. A ‘Symbol’ is atomic for that alphabet, i.e. it has no parts that are symbols for the same alphabet. e.g. a math symbol is not made of other math symbols

A Symbol may be a String in another language. e.g. “Bq” is the symbol for Becquerel units when dealing with metrology, or a string of “B” and “q” symbols when dealing with characters.

comment: Symbols of a formal language need not be symbols of anything. For instance there are logical constants which do not refer to any idea, but rather serve as a form of punctuation in the language (e.g. parentheses).

Symbols of a formal language must be capable of being specified without any reference to any interpretation of them. (Wikipedia)

comment: The class is the idea of the symbol, while the individual of that class stands for a specific mark (or token) of that idea.

prefLabel: Symbol

Subclass of:

- is_a Symbolic

Numeral

IRI: http://emmo:info/emmo#EMMO_74b05aed_66bf_43c8_aa2c_752a9ca8be03

prefLabel: Numeral

Subclass of:

- is_a Symbol

Letter

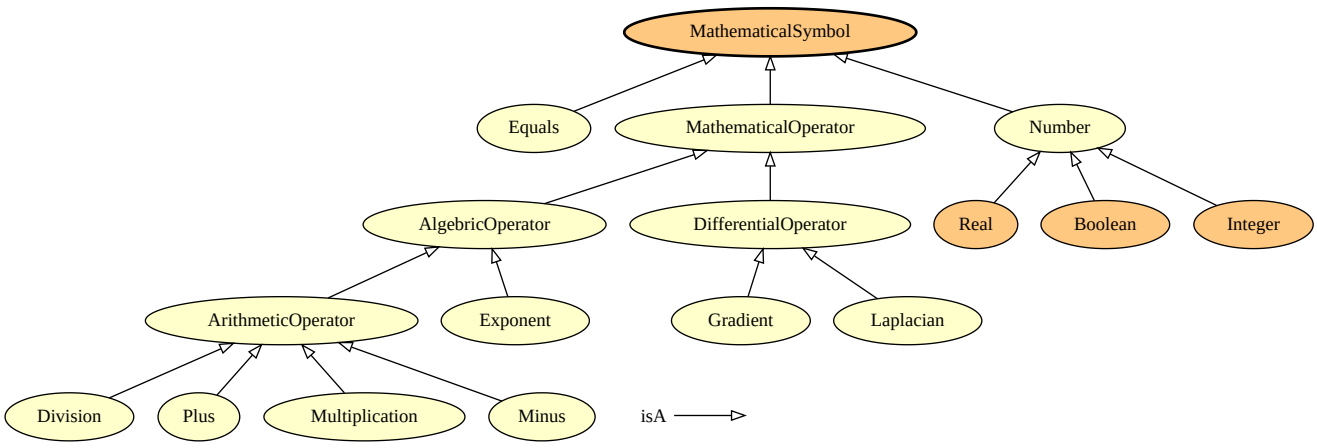
IRI: http://emmo:info/emmo#EMMO_bed2fe4c_dc7e_43a8_8200_6aac44030bff

prefLabel: Letter

Subclass of:

- is_a Symbol

Mathematical Symbol branch



Mathematical Symbol branch.

Number

IRI: http://emmo:info/emmo#EMMO_21f56795_ee72_4858_b571_11cfaa59c1a8

elucidation: A numerical data value.

altLabel: Numeral

prefLabel: Number

Subclass of:

- is_a Numerical

- is_a MathematicalSymbol

ArithmeticOperator

IRI: http://emmo:info/emmo#EMMO_707f0cd1_941c_4b57_9f20_d0ba30cd6ff3

prefLabel: ArithmeticOperator

Subclass of:

- is_a AlgebricOperator

Gradient

IRI: http://emmo:info/emmo#EMMO_b5c58790_fb2d_42eb_b184_2a3f6ca60acb

prefLabel: Gradient

Subclass of:

- is_a DifferentialOperator
- hasSymbolData value '∇'

AlgebricOperator

IRI: http://emmo:info/emmo#EMMO_3c424d37_cf62_41b1_ac9d_a316f8d113d6

prefLabel: AlgebricOperator

Subclass of:

- is_a MathematicalOperator

Real

IRI: http://emmo:info/emmo#EMMO_18d180e4_5e3e_42f7_820c_e08951223486

elucidation: A real number.

prefLabel: Real

Subclass of:

- is_a Number
- hasNumericalData only type
- hasNumericalData exactly 1 type
- equivalent_to hasNumericalData some type

Division

IRI: http://emmo:info/emmo#EMMO_a365b3c1_7bde_41d7_a15b_2820762e85f4

prefLabel: Division

Subclass of:

- is_a ArithmeticOperator
- hasSymbolData value '/'

Equals

IRI: http://emmo:info/emmo#EMMO_535d75a4_1972_40bc_88c6_ca566386934f

elucidation: The equals symbol.

prefLabel: Equals

Subclass of:

- hasSymbolData value '='
- is_a MathematicalSymbol

Exponent

IRI: http://emmo:info/emmo#EMMO_223d9523_4169_4ecd_b8af_acad1215e1ff

prefLabel: Exponent

Subclass of:

- is_a AlgebricOperator

Boolean

IRI: http://emmo:info/emmo#EMMO_54dc83cb_06e1_4739_9e45_bc09cead7f48

elucidation: A boolean number.

prefLabel: Boolean

Subclass of:

- is_a Number
- hasNumericalData only type
- hasNumericalData exactly 1 type
- equivalent_to hasNumericalData some type

Laplacian

IRI: http://emmo:info/emmo#EMMO_048a14e3_65fb_457d_8695_948965c89492

prefLabel: Laplacian

Subclass of:

- is_a DifferentialOperator
- hasSymbolData value ‘Δ’

Plus

IRI: http://emmo:info/emmo#EMMO_8de14a59_660b_454f_aff8_76a07ce185f4

prefLabel: Plus

Subclass of:

- is_a ArithmeticOperator
- hasSymbolData value ‘+’

DifferentialOperator

IRI: http://emmo:info/emmo#EMMO_f8a2fe9f_458b_4771_9aba_a50e76afc52d

prefLabel: DifferentialOperator

Subclass of:

- is_a MathematicalOperator

Multiplication

IRI: http://emmo:info/emmo#EMMO_2b1303e8_d4c3_453b_9918_76f1d009543f

prefLabel: Multiplication

Subclass of:

- is_a ArithmeticOperator
- hasSymbolData value ‘*’

MathematicalOperator

IRI: http://emmo:info/emmo#EMMO_f6d0c26a_98b6_4cf8_8632_aa259131faaa

elucidation: A mapping that acts on elements of one space and produces elements of another space.

example: The algebraic operator ‘+’ that acts on two real numbers and produces one real number.

example: The differential operator that acts on a C1 real function and produces another real function.

prefLabel: MathematicalOperator

Subclass of:

- is_a MathematicalSymbol

Minus

IRI: http://emmo:info/emmo#EMMO_46d5643b_9706_4b67_8bea_ed77d6026539

prefLabel: Minus

Subclass of:

- is_a ArithmeticOperator
- hasSymbolData value '-'

Integer

IRI: http://emmo:info/emmo#EMMO_f8bd64d5_5d3e_4ad4_a46e_c30714fecb7f

elucidation: An integer number.

prefLabel: Integer

Subclass of:

- is_a Number
- hasNumericalData only type
- hasNumericalData exactly 1 type
- equivalent_to hasNumericalData some type

MathematicalSymbol

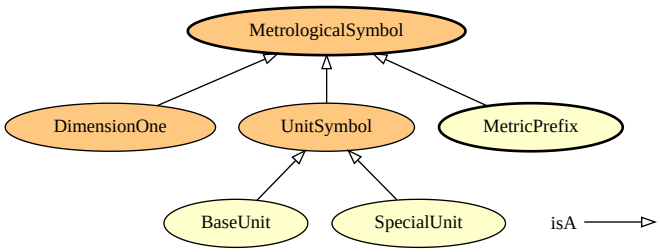
IRI: http://emmo:info/emmo#EMMO_5be83f9c_a4ba_4b9a_be1a_5bfc6e891231

prefLabel: MathematicalSymbol

Subclass of:

- hasProperPart only not Mathematical
- is_a Symbol
- is_a Mathematical
- equivalent_to Mathematical and Symbol

METROLOGICAL SYMBOL BRANCH



Metrological Symbol branch.

DimensionOne

IRI: http://emmo:info/emmo#EMMO_3227b821_26a5_4c7c_9c01_5c24483e0bd0

elucidation: "The unit one is the neutral element of any system of units – necessary and present automatically." SI Brochure

prefLabel: DimensionOne

Subclass of:

- is_a PhysicalDimension
- is_a MetrologicalSymbol
- equivalent_to hasSymbolData value 'T0 L0 M0 I0 Θ0 N0 J0'

UnitSymbol

IRI: http://emmo:info/emmo#EMMO_216f448e_cdbc_4aeb_a529_7a5fe7fc38bb

elucidation: A symbol that stands for a single unit.

example: Some examples are "Pa", "m" and "J".

prefLabel: UnitSymbol

Subclass of:

- is_a MetrologicalSymbol
- is_a NonPrefixedUnit
- equivalent_to Symbol and MeasurementUnit
- disjoint_union_of SpecialUnit, BaseUnit

BaseUnit

IRI: http://emmo:info/emmo#EMMO_db716151_6b73_45ff_910c_d182fdcbb4f5

elucidation: A set of units that correspond to the base quantities in a system of units.

VIMTerm: base unit

prefLabel: BaseUnit

Subclass of:

- is_a UnitSymbol

MetrologicalSymbol

IRI: http://emmo:info/emmo#EMMO_50a3552e_859a_4ff7_946d_76d537cabce6

elucidation: A symbol that stands for a concept in the language of the meterological domain of ISO 80000.

prefLabel: MetrologicalSymbol

Subclass of:

- hasProperPart only not Metrological
- is_a Symbol
- is_a Metrological
- equivalent_to Metrological and Symbol

SpecialUnit

IRI: http://emmo:info/emmo#EMMO_3ee80521_3c23_4dd1_935d_9d522614a3e2

elucidation: A unit symbol that stands for a derived unit.

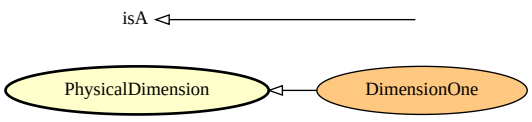
example: Pa stands for N/m2 J stands for N m

prefLabel: SpecialUnit

Subclass of:

- is_a DerivedUnit
- Inverse(hasSign) some DerivedUnit
- is_a Information
- is_a UnitSymbol

PHYSICAL DIMENSION BRANCH



Physical Dimension branch.

DimensionOne

IRI: http://emmo:info/emmo#EMMO_3227b821_26a5_4c7c_9c01_5c24483e0bd0

elucidation: “The unit one is the neutral element of any system of units – necessary and present automatically.” SI Brochure

prefLabel: DimensionOne

Subclass of:

- is_a PhysicalDimension
- is_a MetrologicalSymbol
- equivalent_to hasSymbolData value ‘T0 L0 M0 I0 Θ0 N0 J0’

PhysicalDimension

IRI: http://emmo:info/emmo#EMMO_9895a1b4_f0a5_4167_ac5e_97db40b8bfcc

elucidation: A symbol that, following SI specifications, describe the physical dimensionality of a physical quantity and the exponents of the base units in a measurement unit.

VIMTerm: quantity dimension

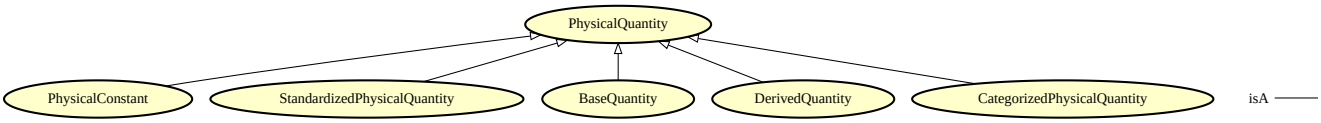
altLabel: QuantityDimension

prefLabel: PhysicalDimension

Subclass of:

- is_a Metrological

Physical Quantity branch



Physical Quantity branch.

PhysicalQuantity

IRI: http://emmo:info/emmo#EMMO_02c0621e_a527_4790_8a0f_2bb51973c819

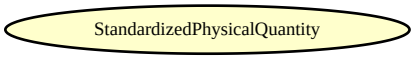
elucidation: A ‘Mathematical’ entity that is made of a ‘Numeral’ and a ‘MeasurementUnit’ defined by a physical law, connected to a physical entity through a model perspective. Measurement is done according to the same model.

prefLabel: PhysicalQuantity

Subclass of:

- hasReferenceUnit only MeasurementUnit
- is_a Quantity
- disjoint_union_of DerivedQuantity, BaseQuantity

Standardized Physical Quantity branch



Standardized Physical Quantity branch.

StandardizedPhysicalQuantity

IRI: http://emmo:info/emmo#EMMO_9c407ac0_fd4c_4178_8763_95fad9fe29ec

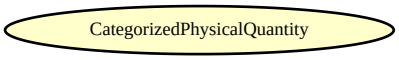
elucidation: The superclass for all physical quantities classes that are categorized according to a standard (e.g. ISQ).

prefLabel: StandardizedPhysicalQuantity

Subclass of:

- is_a PhysicalQuantity

Categorized Physical Quantity branch



Categorized Physical Quantity branch.

CategorizedPhysicalQuantity

IRI: http://emmo:info/emmo#EMMO_79751276_b2d0_4e2f_bbd4_99d412f43d55

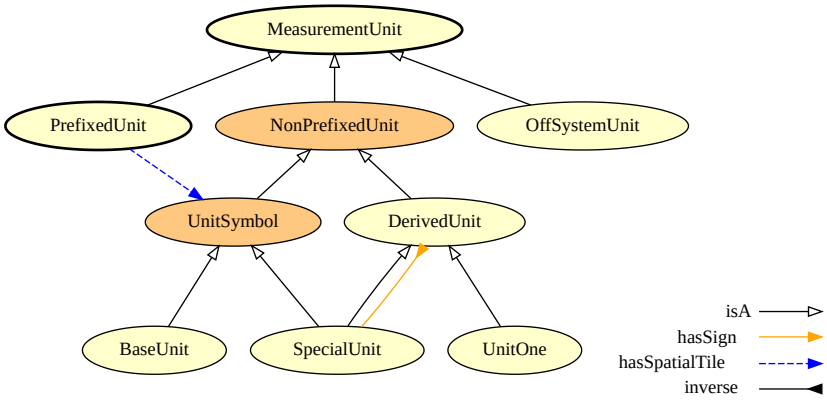
elucidation: The superclass for all physical quantities classes that are categorized according to some domain of interests (e.g. metallurgy, chemistry), property (intensive/extensive) or application.

prefLabel: CategorizedPhysicalQuantity

Subclass of:

- is_a PhysicalQuantity

Measurement Unit branch



Measurement Unit branch.

BaseUnit

IRI: http://emmo:info/emmo#EMMO_db716151_6b73_45ff_910c_d182fdcbb4f5

elucidation: A set of units that correspond to the base quantities in a system of units.

VIMTerm: base unit

prefLabel: BaseUnit

Subclass of:

- is_a UnitSymbol

OffSystemUnit

IRI: http://emmo:info/emmo#EMMO_591e02fd_8d37_45a6_9d11_bb21cef391a0

elucidation: A measurement unit that does not belong to any system of units.

example: eV barn

VIMTerm: off-system measurement unit

VIMTerm: off-system unit

prefLabel: OffSystemUnit

Subclass of:

- is_a MeasurementUnit

UnitOne

IRI: http://emmo:info/emmo#EMMO_5ebd5e01_0ed3_49a2_a30d_cd05cbe72978

elucidation: Represents the number 1, used as an explicit unit to say something has no units.

example: Refractive index or volume fraction.

example: Typically used for ratios of two units whos dimensions cancels out.

prefLabel: UnitOne

qudtReference: http://qudt:org/vocab/unit/UNITLESS

Subclass of:

- is_a DerivedUnit
- hasPhysicalDimension some DimensionOne

MeasurementUnit

IRI: http://emmo:info/emmo#EMMO_b081b346_7279_46ef_9a3d_2c088fcd79f4

elucidation: A ‘Quantity’ that stands for the standard reference magnitude of a specific class of measurement processes, defined and adopted by convention or by law.

The numerical quantity value of the ‘MeasurementUnit’ is conventionally 1 and does not appear.

Quantitative measurement results are expressed as a multiple of the ‘MeasurementUnit’.

VIMTerm: measurement unit

prefLabel: MeasurementUnit

Subclass of:

- is_a ReferenceUnit
- hasPhysicalDimension exactly 1 PhysicalDimension
- is_a Declared
- disjoint_union_of NonPrefixedUnit, PrefixedUnit

DerivedUnit

IRI: http://emmo:info/emmo#EMMO_08b308d4_31cd_4779_a784_aa92fc730f39

elucidation: Derived units are defined as products of powers of the base units corresponding to the relations defining the derived quantities in terms of the base quantities.

VIMTerm: derived unit

comment: A measurement unit for a derived quantity. – VIM

prefLabel: DerivedUnit

Subclass of:

- is_a NonPrefixedUnit

NonPrefixedUnit

IRI: http://emmo:info/emmo#EMMO_868ae137_4d25_493e_b270_21ea3d94849e

elucidation: A measurement unit symbol that do not have a metric prefix as a direct spatial part.

prefLabel: NonPrefixedUnit

Subclass of:

- hasSpatialTile only not MetricPrefix
- is_a MeasurementUnit
- equivalent_to DerivedUnit or UnitSymbol

UnitSymbol

IRI: http://emmo:info/emmo#EMMO_216f448e_cdbc_4aeb_a529_7a5fe7fc38bb

elucidation: A symbol that stands for a single unit.

example: Some examples are “Pa”, “m” and “J”.

prefLabel: UnitSymbol

Subclass of:

- is_a MetrologicalSymbol
- is_a NonPrefixedUnit
- equivalent_to Symbol and MeasurementUnit
- disjoint_union_of SpecialUnit, BaseUnit

SpecialUnit

IRI: http://emmo:info/emmo#EMMO_3ee80521_3c23_4dd1_935d_9d522614a3e2

elucidation: A unit symbol that stands for a derived unit.

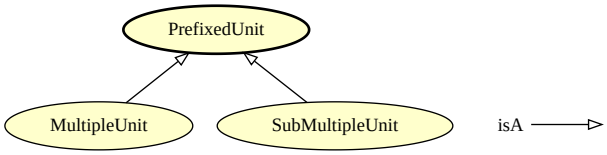
example: Pa stands for N/m2 J stands for N m

prefLabel: SpecialUnit

Subclass of:

- is_a DerivedUnit
- Inverse(hasSign) some DerivedUnit
- is_a Information
- is_a UnitSymbol

Prefixed Unit branch



Prefixed Unit branch.

PrefixedUnit

IRI: http://emmo:info/emmo#EMMO_c6d4a5e0_7e95_44df_a6db_84ee0a8bbc8e

elucidation: A measurement unit that is made of a metric prefix and a unit symbol.

prefLabel: PrefixedUnit

Subclass of:

- hasSpatialTile only (UnitSymbol or MetricPrefix)
- hasSpatialTile exactly 1 UnitSymbol
- hasSpatialTile exactly 1 MetricPrefix
- is_a MeasurementUnit
- is_a Tessellation
- is_a SymbolicConstruct
- disjoint_union_of MultipleUnit, SubMultipleUnit

MultipleUnit

IRI: http://emmo:info/emmo#EMMO_62f0d847_3603_45b4_bfc4_dd4511355ff2

elucidation: Measurement unit obtained by multiplying a given measurement unit by an integer greater than one.

VIMTerm: multiple of a unit

prefLabel: MultipleUnit

Subclass of:

- is_a PrefixedUnit

SubMultipleUnit

IRI: http://emmo:info/emmo#EMMO_a2f94f33_71fa_443c_a1fb_d1685fc537ec

elucidation: Measurement unit obtained by dividing a given measurement unit by an integer greater than one.

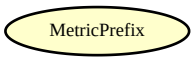
VIMTerm: submultiple of a unit

prefLabel: SubMultipleUnit

Subclass of:

- is_a PrefixedUnit

Metric Prefix branch



Metric Prefix branch.

MetricPrefix

IRI: http://emmo:info/emmo#EMMO_7d2afa66_ae9e_4095_a9bf_421d0be401b6

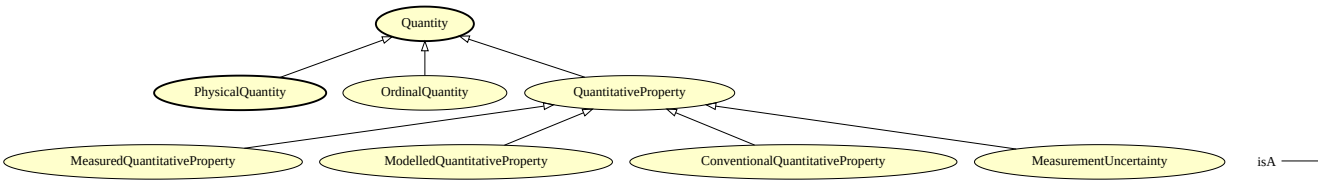
elucidation: Dimensionless multiplicative unit prefix.

prefLabel: MetricPrefix

Subclass of:

- is_a MetrologicalSymbol

QUANTITY BRANCH



Quantity branch.

Quantity

IRI: http://emmo:info/emmo#EMMO_f658c301_ce93_46cf_9639_4eace2c5d1d5

elucidation: A symbolic that has parts a reference unit and a numerical object separated by a space expressing the value of a quantitative property (expressed as the product of the numerical and the unit).

example: 6.8 m 0.9 km 8 K 6 MeV 43.5 HRC(150 kg)

VIMTerm: quantity value

prefLabel: Quantity

Subclass of:

- is_a Metrological
- hasReferenceUnit exactly 1 ReferenceUnit
- hasQuantityValue exactly 1 Numerical
- is_a SymbolicConstruct
- is_a Tessellation
- disjoint_union_of PhysicalQuantity, OrdinalQuantity

MeasuredQuantitativeProperty

IRI: http://emmo:info/emmo#EMMO_873b0ab3_88e6_4054_b901_5531e01f14a4

elucidation: Quantitative property intended to be measured.

– VIM

VIMTerm: measurand

altLabel: Measurand

prefLabel: MeasuredQuantitativeProperty

Subclass of:

- is_a QuantitativeProperty

QuantitativeProperty

IRI: http://emmo:info/emmo#EMMO_dd4a7f3e_ef56_466c_ac1a_d2716b5f87ec

definition: A property of a phenomenon, body, or substance, where the property has a magnitude that can be expressed by means of a number and a reference. – ISO 80000-1

A reference can be a measurement unit, a measurement procedure, a reference material, or a combination of such. – International vocabulary of metrology (VIM)

elucidation: A quantity that can be quantified with respect to a standardized reference physical instance (e.g. the prototype meter bar, the kg prototype) or method (e.g. resilience) through a measurement process.

VIMTerm: quantity

prefLabel: QuantitativeProperty

Subclass of:

- is_a Objective
- is_a Quantity
- is_a Information

ModelledQuantitativeProperty

IRI: http://emmo:info/emmo#EMMO_d0200cf1_e4f4_45ae_873f_b9359daea3cd

prefLabel: ModelledQuantitativeProperty

Subclass of:

- is_a QuantitativeProperty

ConventionalQuantitativeProperty

IRI: http://emmo:info/emmo#EMMO_d8aa8e1f_b650_416d_88a0_5118de945456

elucidation: A quantitative property attributed by agreement to a quantity for a given purpose.

example: The thermal conductivity of a copper sample in my laboratory can be assumed to be the conductivity that appears in the vendor specification. This value has been obtained by measurement of a sample which is not the one I have in my laboratory. This conductivity value is then a conventional quantitiative property assigned to my sample through a semiotic process in which no actual measurement is done by my laboratory.

If I don't believe the vendor, then I can measure the actual thermal conductivity. I then perform a measurement process that semiotically assign another value for the conductivity, which is a measured property, since is part of a measurement process.

Then I have two different physical quantities that are properties thanks to two different semiotic processes.

prefLabel: ConventionalQuantitativeProperty

Subclass of:

- is_a QuantitativeProperty

OrdinalQuantity

IRI: http://emmo:info/emmo#EMMO_c46f091c_0420_4c1a_af30_0a2c8ebcf7d7

elucidation: "Quantity, defined by a conventional measurement procedure, for which a total ordering relation can be established, according to magnitude, with other quantities of the same kind, but for which no algebraic operations among those quantities exist" International vocabulary of metrology (VIM)

example: Hardness Resilience

VIMTerm: ordinal quantity

prefLabel: OrdinalQuantity

Subclass of:

- is_a Quantity

MeasurementUncertainty

IRI: http://emmo:info/emmo#EMMO_847724b7_acef_490e_9f0d_67da967f2812

elucidation: A non-negative parameter characterising the dispersion of the quantity being measured.

example: - Standard deviation

- Half-width of an interval with a stated coverage probability

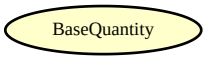
VIMTerm: measurement uncertainty

prefLabel: MeasurementUncertainty

Subclass of:

- is_a QuantitativeProperty

Base Quantity branch



Base Quantity branch.

BaseQuantity

IRI: http://emmo:info/emmo#EMMO_acaaa124_3dde_48b6_86e6_6ec6f364f408

elucidation: “Quantity in a conventionally chosen subset of a given system of quantities, where no quantity in the subset can be expressed in terms of the other quantities within that subset” ISO 80000-1

VIMTerm: base quantity

prefLabel: BaseQuantity

Subclass of:

- is_a PhysicalQuantity

Derived Quantity branch

Derived Quantity branch.

DerivedQuantity

IRI: http://emmo:info/emmo#EMMO_71f6ab56_342c_484b_bbe0_de86b7367cb3

elucidation: “Quantity, in a system of quantities, defined in terms of the base quantities of that system”.

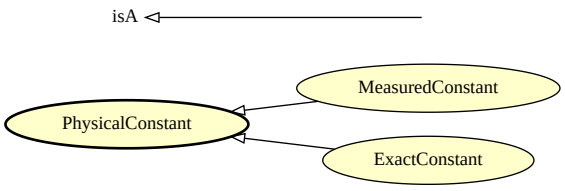
VIMTerm: derived quantity

prefLabel: DerivedQuantity

Subclass of:

- is_a PhysicalQuantity

Physical Constant branch



Physical Constant branch.

PhysicalConstant

IRI: http://emmo:info/emmo#EMMO_b953f2b1_c8d1_4dd9_b630_d3ef6580c2bb

elucidation: Physical constants are categorised into “exact” and measured constants.

With “exact” constants, we refer to physical constants that have an exact numerical value after the revision of the SI system that was enforsed May 2019.

prefLabel: PhysicalConstant

wikipediaReference: https://en:wikipedia:org/wiki/List_of_physical_constants

Subclass of:

- is_a PhysicalQuantity
- disjoint_union_of MeasuredConstant, ExactConstant

MeasuredConstant

IRI: http://emmo:info/emmo#EMMO_3f15d200_c97b_42c8_8ac0_d81d150361e2

elucidation: For a given unit system, measured constants are physical constants that are not used to define the unit system. Hence, these constants have to be measured and will therefore be associated with an uncertainty.

prefLabel: MeasuredConstant

Subclass of:

- is_a PhysicalConstant

ExactConstant

IRI: http://emmo:info/emmo#EMMO_89762966_8076_4f7c_b745_f718d653e8e2

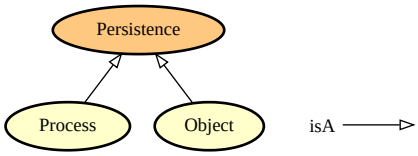
elucidation: Physical constant used to define a unit system. Hence, when expressed in that unit system they have an exact value with no associated uncertainty.

prefLabel: ExactConstant

Subclass of:

- is_a PhysicalConstant

PERSISTENCE BRANCH



Persistence branch.

Persistence

IRI: http://emmo:info/emmo#EMMO_e04884d9_eda6_487e_93d5_7722d7eda96b

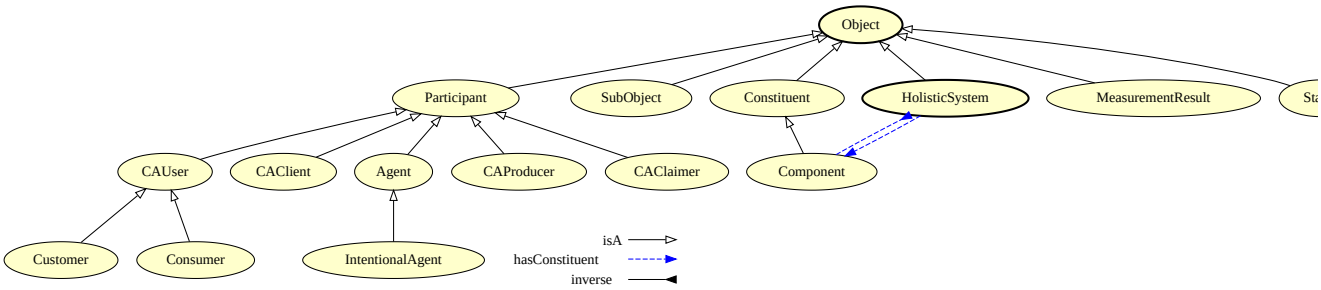
elucidation: The union of the object or process classes.

prefLabel: Persistence

Subclass of:

- is_a Perspective
- equivalent_to Process or Object

OBJECT BRANCH



Object branch.

MeasurementResult

IRI: http://emmo:info/emmo#EMMO_0f6f0120_c079_4d95_bb11_4ddee05e530e

elucidation: Result of a measurement.

A set of quantites being attributed to a measurand (measured quantitative property) together with any other available relevant information, like measurement uncertainty.

– VIM

VIMTerm: measurement result

comment: A measurement result has the measured quantity, measurement uncertainty and other relevant attributes as holistic parts.

prefLabel: MeasurementResult

Subclass of:

- is_a Objective
- hasQuantity some Quantity
- is_a Whole
- is_a Object

Component

IRI: http://emmo:info/emmo#EMMO_f76884f7_964e_488e_9bb7_1b2453e9e817

elucidation: A constituent of a system.

prefLabel: Component

Subclass of:

- Inverse(hasConstituent) some HolisticSystem
- is_a Constituent

Customer

IRI: http://emmo:info/emmo#EMMO_a1e306e9_cabf_4fcb_84bb_21fc95c8df2c

comment: organization or person that receives a product Note 1 to entry: The customer may be the user or a distributor.

prefLabel: Customer

Subclass of:

- is_a CAUser

CAUser

IRI: http://emmo:info/emmo#EMMO_972a6b9c_6dbc_4e60_8953_1dd54946005c

comment: user is organization or person that purchases or otherwise acquires fasteners and installs them for purposes of assembly or overhaul and maintenance

prefLabel: CAUser

Subclass of:

- Inverse(hasParticipant) some ConformityAssessment
- is_a Participant

SubObject

IRI: http://emmo:info/emmo#EMMO_2553c342_fc28_47d8_8e19_7a98fa08f150

elucidation: An object which is an holistic temporal part of another object.

example: If an inhabited house is considered as an house that is occupied by some people in its majority of time, then an interval of inhabited house in which occasionally nobody is in there is no more an inhabited house, but an unhinabited house, since this temporal part does not satisfy the criteria of the whole.

prefLabel: SubObject

Subclass of:

- is_a TemporalRole
- is_a Object

Agent

IRI: http://emmo:info/emmo#EMMO_2480b72b_db8d_460f_9a5f_c2912f979046

elucidation: A participant that is the driver of the process.

example: A catalyst. A bus driver. A substance that is initiating a reaction that would not occur without its presence.

comment: An agent is not necessarily human. An agent plays an active role within the process. An agent is a participant of a process that would not occur without it.

prefLabel: Agent

Subclass of:

- is_a Participant

Participant

IRI: http://emmo:info/emmo#EMMO_13191289_6c2b_4741_93e1_82d53bd0e703

elucidation: An object which is an holistic spatial part of a process.

example: A student during an examination.

prefLabel: Participant

Subclass of:

- is_a Object
- is_a NonTemporalRole

Object

IRI: http://emmo:info/emmo#EMMO_90ae56e4_d197_49b6_be1a_0049e4756606

elucidation: A whole that is identified according to a criteria based on its spatial configuration that is satisfied throughout its time extension.

altLabel: Continuant

altLabel: Endurant

prefLabel: Object

Subclass of:

- is_a Persistence

Status

IRI: http://emmo:info/emmo#EMMO_d9589ed2_5304_48b3_9795_11bf44e64e9b

elucidation: An object which is an holistic temporal part of a process.

example: A semi-naked man is a status in the process of a man’s dressing.

altLabel: State

prefLabel: Status

Subclass of:

- is_a TemporalRole
- is_a Object

CAClient

IRI: http://emmo:info/emmo#EMMO_8d954278_8789_4e8f_84a1_a35a04af4e0c

elucidation: Client is individual, organization, department or division, internal or external, that requests or commissions an objective to be realised, that is called claim

comment: individual, organization, department or division, internal or external, that requests or commissions a research project

prefLabel: CAClient

Subclass of:

- Inverse(hasParticipant) some ConformityAssessment
- is_a Participant

Constituent

IRI: http://emmo:info/emmo#EMMO_ceaaf9f7_fd11_424b_8fda_9afa186af186

elucidation: An object which is an holistic spatial part of a object.

example: A tire is a constituent of a car.

altLabel: ObjectPart

prefLabel: Constituent

Subclass of:

- is_a Object
- is_a NonTemporalRole

CAProducer

IRI: http://emmo:info/emmo#EMMO_354e79ba_13d8_44d4_a2b8_e113370275ad

comment: organization or individual that carries out an experiment or measurement, funded by a payer (3.11), and producing a data set Note 1 to entry: In the research domain producer is typically a researcher, in the commercial domain the producer can be a contract laboratory.

comment: producer creator or provider of a tool (3.17), including anyone who modifies or customises a tool Note 1 to entry: The person(s) or organization(s) responsible for the creation or maintenance of a tool or customisation of a tool is the producer. Note 2 to entry: Providing scripts to automate common functions modifies or customises a tool.

prefLabel: CAProducer

Subclass of:

- Inverse(hasParticipant) some ConformityAssessment
- is_a Participant

IntentionalAgent

IRI: http://emmo:info/emmo#EMMO_c130614a_2985_476d_a7ed_8a137847703c

elucidation: An agent that is driven by the intention to reach a defined objective in driving a process.

comment: Intentionality is not limited to human agents, but in general to all agents that have the capacity to decide to act in driving a process according to a motivation.

prefLabel: IntentionalAgent

Subclass of:

- is_a Agent

CAClaimer

IRI: http://emmo:info/emmo#EMMO_63f95f1f_8b6f_433c_88b9_a14b63b43f2f

elucidation: The CAClaimer, in a Conformity Assessment, is the one who commissions the target to be achieved and against which the comparison with the test item is made, prior to awarding the Test Result.

example: Stakeholder, Company, Market

altLabel: ConformityAssessmentBody

comment: individual, organization, department or division, internal or external, that requests or commissions a research project

prefLabel: CAClaimer

Subclass of:

- Inverse(hasParticipant) some ConformityAssessment
- is_a Participant

Consumer

IRI: http://emmo:info/emmo#EMMO_55700226_edfa_44f3_960b_eae91e498aab

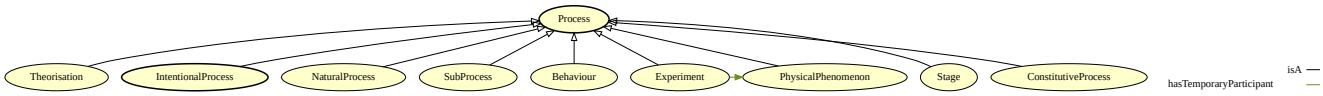
comment: consumer individual member of the general public purchasing or using goods, property or services for private purposes

prefLabel: Consumer

Subclass of:

- is_a CAUser

PROCESS BRANCH



Process branch.

Theorisation

IRI: http://emmo:info/emmo#EMMO_6c739b1a_a774_4416_bb31_1961486fa9ed

elucidation: The ‘semiosis’ process of interpreting a ‘physical’ and provide a complec sign, ‘theory’ that stands for it and explain it to another interpreter.

altLabel: Theorization

prefLabel: Theorisation

Subclass of:

- is_a Determination
- hasTemporaryParticipant some Theory
- is_a Whole
- is_a Process

Process

IRI: http://emmo:info/emmo#EMMO_43e9a05d_98af_41b4_92f6_00f79a09bfce

elucidation: A whole that is identified according to a criteria based on its temporal evolution that is satisfied throughout its time extension.

altLabel: Occurrent

altLabel: Perdurant

comment: A process can be defined only according to an entity type. The minimum process is an entity made of two entities of the same type that are temporally related.

prefLabel: Process

Subclass of:

- is_a Persistence

NaturalProcess

IRI: http://emmo:info/emmo#EMMO_135ab8ea_e028_439e_be64_3e0f9734ea2b

elucidation: A process occurring by natural (non-intentional) laws.

altLabel: NonIntentionalProcess

prefLabel: NaturalProcess

Subclass of:

- is_a Process

SubProcess

IRI: http://emmo:info/emmo#EMMO_49804605_c0fe_4538_abda_f70ba1dc8a5d

elucidation: A process which is an holistic spatial part of a process.

example: Breathing is a subprocess of living for a human being.

comment: In the EMMO the relation of participation to a process falls under mereotopology.

Since topological connection means causality, then the only way for a real world object to participate to a process is to be a part of it.

prefLabel: SubProcess

Subclass of:

- is_a Process
- is_a NonTemporalRole

Behaviour

IRI: http://emmo:info/emmo#EMMO_210e7e99_c1cf_44cc_87c7_310a10ff068b

elucidation: A process which is an holistic temporal part of an object.

example: Accelerating is a behaviour of a car.

prefLabel: Behaviour

Subclass of:

- is_a TemporalRole
- is_a Process

Experiment

IRI: http://emmo:info/emmo#EMMO_22522299_4091_4d1f_82a2_3890492df6db

elucidation: An experiment is a process that is intended to replicate a physical phenomenon in a controlled environment.

prefLabel: Experiment

Subclass of:

- is_a Observation
- hasTemporaryParticipant some PhysicalPhenomenon
- is_a Whole
- is_a Process

Stage

IRI: http://emmo:info/emmo#EMMO_a633c6f8_4269_4870_9b28_f5ca1783fd54

elucidation: A process which is an holistic temporal part of a process.

example: Moving a leg is a stage of the process of running.

prefLabel: Stage

Subclass of:

- is_a TemporalRole
- is_a Process

PhysicalPhenomenon

IRI: http://emmo:info/emmo#EMMO_314d0bd5_67ed_437e_a609_36d46147cea7

elucidation: A ‘process’ that is recognized by physical sciences and is categorized accordingly.

prefLabel: PhysicalPhenomenon

Subclass of:

- is_a Process

ConstitutiveProcess

IRI: http://emmo:info/emmo#EMMO_f68858dd_64f4_4877_b7fb_70d04fbe5bab

elucidation: A process which is an holistic spatial part of an object.

example: Blood circulation in a human body.

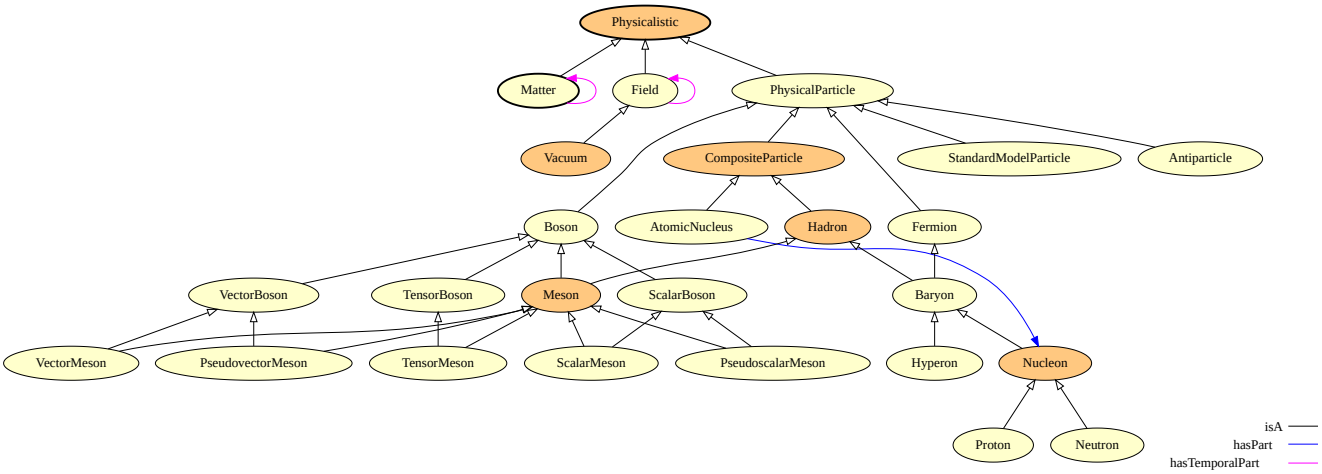
comment: A constitutive process is a process that is holistically relevant for the definition of the whole.

prefLabel: ConstitutiveProcess

Subclass of:

- is_a Process
- is_a NonTemporalRole

PHYSICALISTIC BRANCH



Physicalistic branch.

CharmQuark

IRI: http://emmo:info/emmo#EMMO_1ea2f3fc_da94_4685_99b4_352922fbc461

prefLabel: CharmQuark

wikipediaReference: https://en:wikipedia:org/wiki/Charm_quark

Subclass of:

- is_a Quark

WBoson

IRI: http://emmo:info/emmo#EMMO_21a13e48_e4e2_450b_ad03_d9a112daee87

elucidation: A charged vector boson that mediate the weak interaction.

prefLabel: WBoson

wikipediaReference: https://en:wikipedia:org/wiki/W_and_Z_bosons

Subclass of:

- is_a GaugeBoson
- is_a MassiveElementary

Homonuclear

IRI: http://emmo:info/emmo#EMMO_e024544d_e374_45b7_9340_1982040bc6b7

elucidation: A molecule with only one nucleus.

example: A helium molecule in a gas.

altLabel: ElementalMolecule

prefLabel: Homonuclear

Subclass of:

- is_a Molecule

Fermion

IRI: http://emmo:info/emmo#EMMO_53dced52_34f6_4cf0_8a99_ddf451861543

elucidation: A particle with half odd integer spin (1/2, 3/2, etc…) that follows Fermi-Dirac statistics.

prefLabel: Fermion

wikipediaReference: https://en:wikipedia:org/wiki/Fermion

Subclass of:

- is_a PhysicalParticle

Muon

IRI: http://emmo:info/emmo#EMMO_2531fe94_1cdf_4f36_9abc_7ab7574310db

elucidation: The class of individuals that stand for muon elementary particles belonging to the second generation of leptons.

prefLabel: Muon

wikipediaReference: https://en:wikipedia:org/wiki/Muon

Subclass of:

- is_a Lepton

MuonNeutrino

IRI: http://emmo:info/emmo#EMMO_83550665_c68c_4015_86a7_308c9dd2fb4b

elucidation: A neutrino belonging to the second generation of leptons.

prefLabel: MuonNeutrino

wikipediaReference: https://en:wikipedia:org/wiki/Muon_neutrino

Subclass of:

- is_a Neutrino

ZBoson

IRI: http://emmo:info/emmo#EMMO_f8e436fb_61ed_4512_a5a5_bee90f0cec2f

elucidation: An uncharged vector boson that mediate the weak interaction.

prefLabel: ZBoson

wikipediaReference: https://en:wikipedia:org/wiki/W_and_Z_bosons

Subclass of:

- is_a GaugeBoson
- is_a MassiveElementary

Molecule

IRI: http://emmo:info/emmo#EMMO_3397f270_dfc1_4500_8f6f_4d0d85ac5f71

elucidation: An atom_based state defined by an exact number of e-bonded atomic species and an electron cloud made of the shared electrons.

example: H20, C6H12O6, CH4

prefLabel: Molecule

Subclass of:

- is_a MolecularEntity
- hasSpatialPart some Electron
- hasSpatialPart some AtomicNucleus
- is_a CompositeParticle
- is_a CausalSystem
- disjoint_union_of Heteronuclear, Homonuclear

GaugeBoson

IRI: http://emmo:info/emmo#EMMO_fd6559e8_ef94_460c_9dfc_bad5c68d63b4

elucidation: A bosonic elementary particle that mediates interactions among elementary fermions, and thus acts as a force carrier.

prefLabel: GaugeBoson

wikipediaReference: https://en:wikipedia:org/wiki/Gauge_boson

Subclass of:

- is_a VectorBoson
- is_a ElementaryBoson
- equivalent_to WBoson or Photon or Gluon or ZBoson

VectorMeson

IRI: http://emmo:info/emmo#EMMO_1b32a555_978b_4e56_933f_e158e165023e

elucidation: A meson with total spin 1 and odd parit.

prefLabel: VectorMeson

wikipediaReference: https://en:wikipedia:org/wiki/Vector_meson

Subclass of:

- is_a VectorBoson
- is_a Meson

ElectronNeutrino

IRI: http://emmo:info/emmo#EMMO_1d5305d7_5690_4e5a_92de_4611e8c356ef

elucidation: A neutrino belonging to the first generation of leptons.

prefLabel: ElectronNeutrino

wikipediaReference: https://en:wikipedia:org/wiki/Electron_neutrino

Subclass of:

- is_a Neutrino

DownQuark

IRI: http://emmo:info/emmo#EMMO_a4edc1d4_bb38_4897_ba1e_f87e7aa31c5b

prefLabel: DownQuark

wikipediaReference: https://en:wikipedia:org/wiki/Down_quark

Subclass of:

- is_a Quark

MasslessElementary

IRI: http://emmo:info/emmo#EMMO_e5488299_8dab_4ebb_900a_26d2abed8396

definition: The union of classes of elementary particles that do not possess mass.

elucidation: An elementary particle that does not pocess mass.

prefLabel: MasslessElementary

Subclass of:

- is_a ElementaryBoson
- equivalent_to Photon or Gluon or Graviton

Antiparticle

IRI: http://emmo:info/emmo#EMMO_6c228d96_ed6c_4029_8acb_b88c93594f1a

prefLabel: Antiparticle

wikipediaReference: https://en:wikipedia:org/wiki/Antiparticle

Subclass of:

- is_a PhysicalParticle

TensorMeson

IRI: http://emmo:info/emmo#EMMO_f895cb83_2280_42e9_9f4c_047273e70d3c

elucidation: A meson with spin two.

prefLabel: TensorMeson

Subclass of:

- is_a TensorBoson
- is_a Meson

VectorBoson

IRI: http://emmo:info/emmo#EMMO_530ebacb_8bb7_4c69_88fb_253e5a9dd112

elucidation: A boson whose spin equals one.

prefLabel: VectorBoson

wikipediaReference: https://en:wikipedia:org/wiki/Vector_boson

Subclass of:

- is_a Boson

TensorBoson

IRI: http://emmo:info/emmo#EMMO_6a40a5ac_f5dd_40c9_a2b1_69d50a89914e

elucidation: A boson whos spin equals two.

comment: The only known tensor boson is the hypothetical graviton.

prefLabel: TensorBoson

Subclass of:

- is_a Boson

Proton

IRI: http://emmo:info/emmo#EMMO_8f87e700_99a8_4427_8ffb_e493de05c217

elucidation: A positive charged subatomic particle found in the atomic nucleus.

prefLabel: Proton

wikipediaReference: https://en:wikipedia:org/wiki/Proton

Subclass of:

- is_a Nucleon

ElementaryBoson

IRI: http://emmo:info/emmo#EMMO_fa3c9d4d_9fc9_4e8a_82c1_28c84e34133a

elucidation: A boson that is a single elementary particle.

prefLabel: ElementaryBoson

wikipediaReference: https://en:wikipedia:org/wiki/Boson#Elementary_bosons

Subclass of:

- is_a StandardModelParticle
- is_a Boson
- equivalent_to WBoson or Photon or HiggsBoson or Gluon or Graviton or ZBoson

Field

IRI: http://emmo:info/emmo#EMMO_70dac51e_bddd_48c2_8a98_7d8395e91fc2

elucidation: A ‘Physical’ with ‘Massless’ parts that are mediators of interactions.

example: The electric field generated by an electric charge.

comment: A field can include matter-like particles besides bosonic ones. In the case of electromagnetic field in matter the entity is made of photons and other matter particles (e.g. gas molecules).

prefLabel: Field

Subclass of:

- hasPart some ElementaryBoson
- hasTemporalPart only Field
- is_a Physicalistic

Photon

IRI: http://emmo:info/emmo#EMMO_25f8b804_9a0b_4387_a3e7_b35bce5365ee

elucidation: The class of individuals that stand for photons elementary particles.

prefLabel: Photon

wikipediaReference: https://en:wikipedia:org/wiki/Photon

Subclass of:

- is_a GaugeBoson

- is_a MasslessElementary

ScalarMeson

IRI: http://emmo:info/emmo#EMMO_3275b6e9_05f1_4912_954f_7d64ac12b2d2

elucidation: A meson with spin zero and even parity.

prefLabel: ScalarMeson

wikipediaReference: https://en:wikipedia:org/wiki/Scalar_meson

Subclass of:

- is_a ScalarBoson
- is_a Meson

BottomQuark

IRI: http://emmo:info/emmo#EMMO_d37eeb84_895f_4c30_bf60_387b3314a1a6

prefLabel: BottomQuark

wikipediaReference: https://en:wikipedia:org/wiki/Bottom_quark

Subclass of:

- is_a Quark

Hyperon

IRI: http://emmo:info/emmo#EMMO_f87e79eb_f549_4a06_9c27_a3d1412444c6

elucidation: A baryon containing one or more strange quarks, but no charm, bottom, or top quark.

comment: This form of matter may exist in a stable form within the core of some neutron stars.

prefLabel: Hyperon

wikipediaReference: https://en:wikipedia:org/wiki/Hyperon

Subclass of:

- is_a Baryon
- hasProperPart some StrangeQuark
- hasProperPart only (UpQuark or StrangeQuark or DownQuark)

PhysicalParticle

IRI: http://emmo:info/emmo#EMMO_a15cea10_9946_4d2b_95c5_cfc333fd2abb

definition: The union of hadron and lepton, or fermion and bosons.

elucidation: A well defined physical entity, elementary or composite, usually treated as a singular unit, that is found at scales spanning from the elementary particles to molecules, as fundamental constituents of larger scale substances (as the etymology of “particle” suggests).

altLabel: Particle

prefLabel: PhysicalParticle

wikipediaReference: https://en:wikipedia:org/wiki/Vector_boson

Subclass of:

- is_a Physicalistic
- disjoint_union_of Fermion, Boson
- disjoint_union_of CompositeParticle, StandardModelParticle

Lepton

IRI: http://emmo:info/emmo#EMMO_d324ae63_7574_4d73_b25b_96479e2626f2

elucidation: An elementary particle of half-integer spin (spin 1⁄2) that does not undergo strong interactions.

prefLabel: Lepton

wikipediaReference: https://en:wikipedia:org/wiki/Lepton

Subclass of:

- is_a Fermion
- is_a MassiveElementary

- equivalent_to ElectronNeutrino or Muon or Tau or Electron or MuonNeutrino or TauNeutrino

Hadron

IRI: http://emmo:info/emmo#EMMO_7b42954f_0b91_4b3a_a65e_2470202cf548

elucidation: Particles composed of two or more quarks.

prefLabel: Hadron

wikipediaReference: https://en:wikipedia:org/wiki/Hadron

Subclass of:

- is_a CompositeParticle
- equivalent_to Baryon or Meson

Quark

IRI: http://emmo:info/emmo#EMMO_72d53756_7fb1_46ed_980f_83f47efbe105

elucidation: The class of individuals that stand for quarks elementary particles.

prefLabel: Quark

wikipediaReference: https://en:wikipedia:org/wiki/Quark

Subclass of:

- is_a Fermion
- is_a MassiveElementary
- equivalent_to UpQuark or CharmQuark or StrangeQuark or DownQuark or TopQuark or BottomQuark

TauNeutrino

IRI: http://emmo:info/emmo#EMMO_eb95a619_ca07_4678_a809_10021b25a13f

elucidation: A neutrino belonging to the third generation of leptons.

prefLabel: TauNeutrino

wikipediaReference: https://en:wikipedia:org/wiki/Tau_neutrino

Subclass of:

- is_a Neutrino

HiggsBoson

IRI: http://emmo:info/emmo#EMMO_676a29e6_d4e1_4b54_8961_25947bd20861

elucidation: An elementary bosonic particle with zero spin produced by the quantum excitation of the Higgs field.

prefLabel: HiggsBoson

wikipediaReference: https://en:wikipedia:org/wiki/Higgs_boson

Subclass of:

- is_a ScalarBoson
- is_a MassiveElementary
- is_a ElementaryBoson

AtomicNucleus

IRI: http://emmo:info/emmo#EMMO_f835f4d4_c665_403d_ab25_dca5cc74be52

elucidation: The small, dense region at the centre of an atom consisting of protons and neutrons.

prefLabel: AtomicNucleus

Subclass of:

- hasPart some Nucleon
- is_a CompositeParticle

PseudovectorMeson

IRI: http://emmo:info/emmo#EMMO_38d00e5f_d759_4dcc_8551_ab95865cf799

elucidation: A meson with total spin 1 and even parit.

prefLabel: PseudovectorMeson

wikipediaReference: https://en:wikipedia:org/wiki/Pseudovector_meson

Subclass of:

- is_a VectorBoson
- is_a Meson

ScalarBoson

IRI: http://emmo:info/emmo#EMMO_cc1b6be1_3102_4376_b33b_d8dd13f9be2f

elucidation: A Boson whos spin equals zero.

prefLabel: ScalarBoson

wikipediaReference: https://en:wikipedia:org/wiki/Scalar_boson

Subclass of:

- is_a Boson

Meson

IRI: http://emmo:info/emmo#EMMO_be0a7278_b4e6_4bca_88ba_de3f67a478e2

elucidation: Hadronic subatomic particles composed of an equal number of quarks and antiquarks bound together by strong interactions.

prefLabel: Meson

wikipediaReference: https://en:wikipedia:org/wiki/Meson

Subclass of:

- is_a Boson
- hasProperPart some Quark
- is_a Hadron
- equivalent_to PseudoscalarMeson or VectorMeson or ScalarMeson or PseudovectorMeson or TensorMeson

Baryon

IRI: http://emmo:info/emmo#EMMO_24dda193_ada8_433b_bb74_6ca4a0b89a20

elucidation: Subatomic particle which contains an odd number of valence quarks, at least 3.

prefLabel: Baryon

wikipediaReference: https://en:wikipedia:org/wiki/Baryon

Subclass of:

- is_a Fermion
- hasProperPart some Quark
- is_a Hadron

Graviton

IRI: http://emmo:info/emmo#EMMO_eb3c61f0_3983_4346_a0c6_e7f6b90a67a8

elucidation: The class of individuals that stand for gravitons elementary particles.

prefLabel: Graviton

wikipediaReference: https://en:wikipedia:org/wiki/Graviton

Subclass of:

- is_a TensorBoson
- is_a MasslessElementary

Gluon

IRI: http://emmo:info/emmo#EMMO_7db59e56_f68b_48b7_ae99_891c35ae5c3b

elucidation: The class of individuals that stand for gluons elementary particles.

prefLabel: Gluon

wikipediaReference: https://en:wikipedia:org/wiki/Gluon

Subclass of:

- is_a GaugeBoson
- is_a MasslessElementary

Neutrino

IRI: http://emmo:info/emmo#EMMO_dbb2ae7f_9f47_41b3_bf68_d9bece864e2c

elucidation: An elementary particle with spin 1/2 that interacts only via the weak interaction and gravity.

prefLabel: Neutrino

wikipediaReference: https://en:wikipedia:org/wiki/Neutrino

Subclass of:

- is_a Lepton
- equivalent_to ElectronNeutrino or MuonNeutrino or TauNeutrino

Heteronuclear

IRI: http://emmo:info/emmo#EMMO_50967f46_51f9_462a_b1e4_e63365b4a184

elucidation: A molecule with more than one nucleus.

example: Hydrogen molecule (H2).

prefLabel: Heteronuclear

Subclass of:

- is_a Molecule

Vacuum

IRI: http://emmo:info/emmo#EMMO_3c218fbe_60c9_4597_8bcf_41eb1773af1f

elucidation: A ‘Physical’ with no ‘Massive’ parts.

comment: Vacuum in the EMMO is not the absence of particles: vacuum is the absence of matter particles in an entity. In the EMMO there is no such a thing as void, i.e. spatiotemporal regions without entities. In other words there are no entities without particles.

This assumption negates the existence of a spacetime fabric independent by particles. What we call spacetime is the outcome of particle interactions. Without particles there are no interactions and then no spacetime.

etymology: From Latin vacuus, “empty”.

prefLabel: Vacuum

Subclass of:

- is_a Field
- equivalent_to Field and not Matter

Tau

IRI: http://emmo:info/emmo#EMMO_3a948fa6_033a_4bb2_a319_36a45741d832

elucidation: The class of individuals that stand for tau elementary particles belonging to the third generation of leptons.

prefLabel: Tau

wikipediaReference: https://en:wikipedia:org/wiki/Tau_(particle)

Subclass of:

- is_a Lepton

Boson

IRI: http://emmo:info/emmo#EMMO_b5a5494c_83bf_44aa_a9a6_49b948e68939

elucidation: A particle with integer spin that follows Bose–Einstein statistics.

prefLabel: Boson

wikipediaReference: https://en:wikipedia:org/wiki/Boson

Subclass of:

- is_a PhysicalParticle
- disjoint_union_of VectorBoson, TensorBoson, ScalarBoson

Nucleon

IRI: http://emmo:info/emmo#EMMO_50781fd9_a9e4_46ad_b7be_4500371d188d

elucidation: Either a proton or a neutron.

prefLabel: Nucleon

wikipediaReference: https://en:wikipedia:org/wiki/Nucleon

Subclass of:

- is_a Baryon
- equivalent_to Proton or Neutron

Atom

IRI: http://emmo:info/emmo#EMMO_eb77076b_a104_42ac_a065_798b2d2809ad

elucidation: A standalone atom has direct part one ‘nucleus’ and one ‘electron_cloud’.

An O ‘atom’ within an O2 ‘molecule’ is an ‘e-bonded_atom’.

In this material branch, H atom is a particular case, with respect to higher atomic number atoms, since as soon as it shares its electron it has no nucleus entangled electron cloud.

We cannot say that H2 molecule has direct part two H atoms, but has direct part two H nucleus.

altLabel: ChemicalElement

prefLabel: Atom

Subclass of:

- is_a MolecularEntity
- hasSpatialPart some Electron
- hasSpatialSlice some AtomicNucleus
- is_a CompositeParticle
- is_a CausalSystem

Neutron

IRI: http://emmo:info/emmo#EMMO_df808271_df91_4f27_ba59_fa423c51896c

elucidation: An uncharged subatomic particle found in the atomic nucleus.

prefLabel: Neutron

wikipediaReference: https://en:wikipedia:org/wiki/Neutron

Subclass of:

- is_a Nucleon

Physicalistic

IRI: http://emmo:info/emmo#EMMO_98ada9d8_f1c8_4f13_99b5_d890f5354152

elucidation: The perspective for which physical objects are categorized only by concepts coming from applied physical sciences.

altLabel: OrdinaryMatter

prefLabel: Physicalistic

Subclass of:

- is_a Perspective
- equivalent_to Matter or Field

PseudoscalarMeson

IRI: http://emmo:info/emmo#EMMO_12aae025_a226_4762_9d51_81200a8ce54c

elucidation: A meson with spin zero and odd parity.

prefLabel: PseudoscalarMeson

wikipediaReference: https://en:wikipedia:org/wiki/Pseudoscalar_meson

Subclass of:

- is_a ScalarBoson
- is_a Meson

TopQuark

IRI: http://emmo:info/emmo#EMMO_a589e6b8_2f5b_4118_8522_cdc4c89578dc

prefLabel: TopQuark

wikipediaReference: https://en:wikipedia:org/wiki/Top_quark

Subclass of:

- is_a Quark

CompositeParticle

IRI: http://emmo:info/emmo#EMMO_8b1367d6_0133_4b56_acc1_fa8b058169e3

prefLabel: CompositeParticle

Subclass of:

- is_a PhysicalParticle
- equivalent_to Molecule or Hadron or Atom or AtomicNucleus

StrangeQuark

IRI: http://emmo:info/emmo#EMMO_22a6f189_7ad7_424d_af15_5efe002c1365

prefLabel: StrangeQuark

wikipediaReference: https://en:wikipedia:org/wiki/Strange_quark

Subclass of:

- is_a Quark

Electron

IRI: http://emmo:info/emmo#EMMO_8043d3c6_a4c1_4089_ba34_9744e28e5b3d

elucidation: The class of individuals that stand for electrons elementary particles belonging to the first generation of leptons.

prefLabel: Electron

wikipediaReference: https://en:wikipedia:org/wiki/Electron

Subclass of:

- is_a Lepton

UpQuark

IRI: http://emmo:info/emmo#EMMO_0a3f04a6_ba3a_49d9_99da_08b0e26f51f0

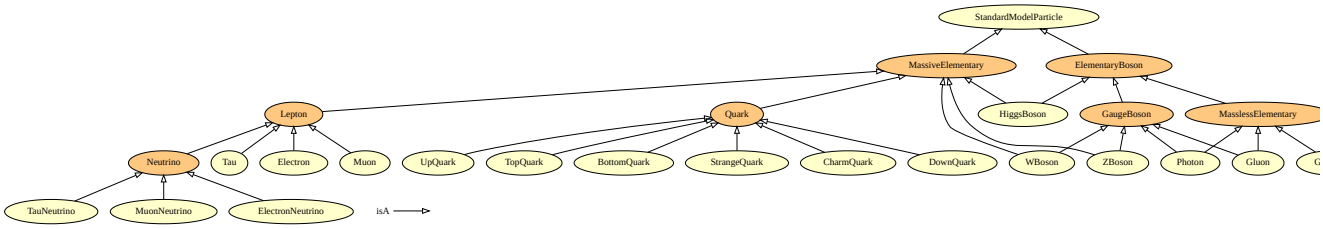
prefLabel: UpQuark

wikipediaReference: https://en:wikipedia:org/wiki/Up_quark

Subclass of:

- is_a Quark

Elementary Particle branch



Elementary Particle branch.

CharmQuark

IRI: http://emmo:info/emmo#EMMO_1ea2f3fc_da94_4685_99b4_352922fbc461

prefLabel: CharmQuark

wikipediaReference: https://en:wikipedia:org/wiki/Charm_quark

Subclass of:

- is_a Quark

WBoson

IRI: http://emmo:info/emmo#EMMO_21a13e48_e4e2_450b_ad03_d9a112daee87

elucidation: A charged vector boson that mediate the weak interaction.

prefLabel: WBoson

wikipediaReference: https://en:wikipedia:org/wiki/W_and_Z_bosons

Subclass of:

- is_a GaugeBoson
- is_a MassiveElementary

Quark

IRI: http://emmo:info/emmo#EMMO_72d53756_7fb1_46ed_980f_83f47efbe105

elucidation: The class of individuals that stand for quarks elementary particles.

prefLabel: Quark

wikipediaReference: https://en:wikipedia:org/wiki/Quark

Subclass of:

- is_a Fermion
- is_a MassiveElementary
- equivalent_to UpQuark or CharmQuark or StrangeQuark or DownQuark or TopQuark or BottomQuark

HiggsBoson

IRI: http://emmo:info/emmo#EMMO_676a29e6_d4e1_4b54_8961_25947bd20861

elucidation: An elementary bosonic particle with zero spin produced by the quantum excitation of the Higgs field.

prefLabel: HiggsBoson

wikipediaReference: https://en:wikipedia:org/wiki/Higgs_boson

Subclass of:

- is_a ScalarBoson
- is_a MassiveElementary
- is_a ElementaryBoson

TauNeutrino

IRI: http://emmo:info/emmo#EMMO_eb95a619_ca07_4678_a809_10021b25a13f

elucidation: A neutrino belonging to the third generation of leptons.

prefLabel: TauNeutrino

wikipediaReference: https://en:wikipedia:org/wiki/Tau_neutrino

Subclass of:

- is_a Neutrino

Muon

IRI: http://emmo:info/emmo#EMMO_2531fe94_1cdf_4f36_9abc_7ab7574310db

elucidation: The class of individuals that stand for muon elementary particles belonging to the second generation of leptons.

prefLabel: Muon

wikipediaReference: https://en:wikipedia:org/wiki/Muon

Subclass of:

- is_a Lepton

StandardModelParticle

IRI: http://emmo:info/emmo#EMMO_c26a0340_d619_4928_b1a1_1a04e88bb89d

elucidation: The union of all classes categorising elementary particles according to the Standard Model.

altLabel: ElementaryParticle

comment: Disjointness comes from the fact that standard model elementary particles are entities that possess objectively distinct and singular characters.

comment: Graviton is included, even if it is an hypothetical particle, to enable causality for gravitational interactions.

prefLabel: StandardModelParticle

Subclass of:

- is_a CausalChain
- is_a PhysicalParticle
- disjoint_union_of UpQuark, ElectronNeutrino, CharmQuark, WBoson, StrangeQuark, Muon, Photon, Tau, HiggsBoson, Gluon, Electron, MuonNeutrino, DownQuark, TopQuark, BottomQuark, Graviton, TauNeutrino, ZBoson

MassiveElementary

IRI: http://emmo:info/emmo#EMMO_385b8f6e_43ac_4596_ad76_ac322c68b7ca

definition: The union of classes of elementary particles that possess mass.

elucidation: An elementary particle that pocess mass.

prefLabel: MassiveElementary

Subclass of:

- is_a StandardModelParticle
- equivalent_to WBoson or HiggsBoson or Quark or Lepton or ZBoson

MuonNeutrino

IRI: http://emmo:info/emmo#EMMO_83550665_c68c_4015_86a7_308c9dd2fb4b

elucidation: A neutrino belonging to the second generation of leptons.

prefLabel: MuonNeutrino

wikipediaReference: https://en:wikipedia:org/wiki/Muon_neutrino

Subclass of:

- is_a Neutrino

ZBoson

IRI: http://emmo:info/emmo#EMMO_f8e436fb_61ed_4512_a5a5_bee90f0cec2f

elucidation: An uncharged vector boson that mediate the weak interaction.

prefLabel: ZBoson

wikipediaReference: https://en:wikipedia:org/wiki/W_and_Z_bosons

Subclass of:

- is_a GaugeBoson
- is_a MassiveElementary

GaugeBoson

IRI: http://emmo:info/emmo#EMMO_fd6559e8_ef94_460c_9dfc_bad5c68d63b4

elucidation: A bosonic elementary particle that mediates interactions among elementary fermions, and thus acts as a force carrier.

prefLabel: GaugeBoson

wikipediaReference: https://en:wikipedia:org/wiki/Gauge_boson

Subclass of:

- is_a VectorBoson
- is_a ElementaryBoson
- equivalent_to WBoson or Photon or Gluon or ZBoson

Graviton

IRI: http://emmo:info/emmo#EMMO_eb3c61f0_3983_4346_a0c6_e7f6b90a67a8

elucidation: The class of individuals that stand for gravitons elementary particles.

prefLabel: Graviton

wikipediaReference: https://en:wikipedia:org/wiki/Graviton

Subclass of:

- is_a TensorBoson
- is_a MasslessElementary

Gluon

IRI: http://emmo:info/emmo#EMMO_7db59e56_f68b_48b7_ae99_891c35ae5c3b

elucidation: The class of individuals that stand for gluons elementary particles.

prefLabel: Gluon

wikipediaReference: https://en:wikipedia:org/wiki/Gluon

Subclass of:

- is_a GaugeBoson
- is_a MasslessElementary

Neutrino

IRI: http://emmo:info/emmo#EMMO_dbb2ae7f_9f47_41b3_bf68_d9bece864e2c

elucidation: An elementary particle with spin 1/2 that interacts only via the weak interaction and gravity.

prefLabel: Neutrino

wikipediaReference: https://en:wikipedia:org/wiki/Neutrino

Subclass of:

- is_a Lepton
- equivalent_to ElectronNeutrino or MuonNeutrino or TauNeutrino

ElectronNeutrino

IRI: http://emmo:info/emmo#EMMO_1d5305d7_5690_4e5a_92de_4611e8c356ef

elucidation: A neutrino belonging to the first generation of leptons.

prefLabel: ElectronNeutrino

wikipediaReference: https://en:wikipedia:org/wiki/Electron_neutrino

Subclass of:

- is_a Neutrino

MasslessElementary

IRI: http://emmo:info/emmo#EMMO_e5488299_8dab_4ebb_900a_26d2abed8396

definition: The union of classes of elementary particles that do not possess mass.

elucidation: An elementary particle that does not pocess mass.

prefLabel: MasslessElementary

Subclass of:

- is_a ElementaryBoson
- equivalent_to Photon or Gluon or Graviton

DownQuark

IRI: http://emmo:info/emmo#EMMO_a4edc1d4_bb38_4897_ba1e_f87e7aa31c5b

prefLabel: DownQuark

wikipediaReference: https://en:wikipedia:org/wiki/Down_quark

Subclass of:

- is_a Quark

Tau

IRI: http://emmo:info/emmo#EMMO_3a948fa6_033a_4bb2_a319_36a45741d832

elucidation: The class of individuals that stand for tau elementary particles belonging to the third generation of leptons.

prefLabel: Tau

wikipediaReference: https://en:wikipedia:org/wiki/Tau_(particle)

Subclass of:

- is_a Lepton

UpQuark

IRI: http://emmo:info/emmo#EMMO_0a3f04a6_ba3a_49d9_99da_08b0e26f51f0

prefLabel: UpQuark

wikipediaReference: https://en:wikipedia:org/wiki/Up_quark

Subclass of:

- is_a Quark

ElementaryBoson

IRI: http://emmo:info/emmo#EMMO_fa3c9d4d_9fc9_4e8a_82c1_28c84e34133a

elucidation: A boson that is a single elementary particle.

prefLabel: ElementaryBoson

wikipediaReference: https://en:wikipedia:org/wiki/Boson#Elementary_bosons

Subclass of:

- is_a StandardModelParticle
- is_a Boson
- equivalent_to WBoson or Photon or HiggsBoson or Gluon or Graviton or ZBoson

Photon

IRI: http://emmo:info/emmo#EMMO_25f8b804_9a0b_4387_a3e7_b35bce5365ee

elucidation: The class of individuals that stand for photons elementary particles.

prefLabel: Photon

wikipediaReference: https://en:wikipedia:org/wiki/Photon

Subclass of:

- is_a GaugeBoson
- is_a MasslessElementary

TopQuark

IRI: http://emmo:info/emmo#EMMO_a589e6b8_2f5b_4118_8522_cdc4c89578dc

prefLabel: TopQuark

wikipediaReference: https://en:wikipedia:org/wiki/Top_quark

Subclass of:

- is_a Quark

BottomQuark

IRI: http://emmo:info/emmo#EMMO_d37eeb84_895f_4c30_bf60_387b3314a1a6

prefLabel: BottomQuark

wikipediaReference: https://en:wikipedia:org/wiki/Bottom_quark

Subclass of:

- is_a Quark

StrangeQuark

IRI: http://emmo:info/emmo#EMMO_22a6f189_7ad7_424d_af15_5efe002c1365

prefLabel: StrangeQuark

wikipediaReference: https://en:wikipedia:org/wiki/Strange_quark

Subclass of:

- is_a Quark

Electron

IRI: http://emmo:info/emmo#EMMO_8043d3c6_a4c1_4089_ba34_9744e28e5b3d

elucidation: The class of individuals that stand for electrons elementary particles belonging to the first generation of leptons.

prefLabel: Electron

wikipediaReference: https://en:wikipedia:org/wiki/Electron

Subclass of:

- is_a Lepton

Lepton

IRI: http://emmo:info/emmo#EMMO_d324ae63_7574_4d73_b25b_96479e2626f2

elucidation: An elementary particle of half-integer spin (spin 1⁄2) that does not undergo strong interactions.

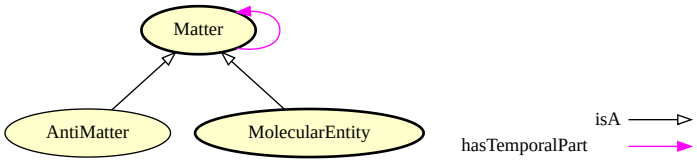
prefLabel: Lepton

wikipediaReference: https://en:wikipedia:org/wiki/Lepton

Subclass of:

- is_a Fermion
- is_a MassiveElementary
- equivalent_to ElectronNeutrino or Muon or Tau or Electron or MuonNeutrino or TauNeutrino

MATTER BRANCH



Matter branch.

AntiMatter

IRI: http://emmo:info/emmo#EMMO_f13672a3_59cc_40ed_8def_65009a8f74e6

elucidation: Antimatter is matter that is composed of the antiparticles of those that constitute ordinary matter.

prefLabel: AntiMatter

Subclass of:

- is_a Matter

Matter

IRI: http://emmo:info/emmo#EMMO_5b2222df_4da6_442f_8244_96e9e45887d1

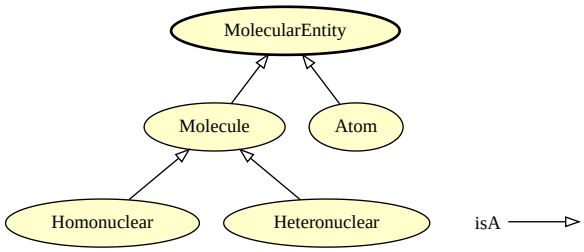
elucidation: A ‘Physical’ that possesses some ‘Lepton’ or ‘Quark’ parts in each of its temporal parts.

prefLabel: Matter

Subclass of:

- hasPart some (Quark or Lepton)
- hasTemporalPart only Matter
- is_a Physicalistic

Molecular Entity branch



Molecular Entity branch.

Homonuclear

IRI: http://emmo:info/emmo#EMMO_e024544d_e374_45b7_9340_1982040bc6b7

elucidation: A molecule with only one nucleus.

example: A helium molecule in a gas.

altLabel: ElementalMolecule

prefLabel: Homonuclear

Subclass of:

- is_a Molecule

Molecule

IRI: http://emmo:info/emmo#EMMO_3397f270_dfc1_4500_8f6f_4d0d85ac5f71

elucidation: An atom_based state defined by an exact number of e-bonded atomic species and an electron cloud made of the shared electrons.

example: H20, C6H12O6, CH4

prefLabel: Molecule

Subclass of:

- is_a MolecularEntity
- hasSpatialPart some Electron
- hasSpatialPart some AtomicNucleus
- is_a CompositeParticle
- is_a CausalSystem
- disjoint_union_of Heteronuclear, Homonuclear

Heteronuclear

IRI: http://emmo:info/emmo#EMMO_50967f46_51f9_462a_b1e4_e63365b4a184

elucidation: A molecule with more than one nucleus.

example: Hydrogen molecule (H2).

prefLabel: Heteronuclear

Subclass of:

- is_a Molecule

Atom

IRI: http://emmo:info/emmo#EMMO_eb77076b_a104_42ac_a065_798b2d2809ad

elucidation: A standalone atom has direct part one ‘nucleus’ and one ‘electron_cloud’.

An O ‘atom’ within an O2 ‘molecule’ is an ‘e-bonded_atom’.

In this material branch, H atom is a particular case, with respect to higher atomic number atoms, since as soon as it shares its electron it has no nucleus entangled electron cloud.

We cannot say that H2 molecule has direct part two H atoms, but has direct part two H nucleus.

altLabel: ChemicalElement

prefLabel: Atom

Subclass of:

- is_a MolecularEntity
- hasSpatialPart some Electron
- hasSpatialSlice some AtomicNucleus
- is_a CompositeParticle
- is_a CausalSystem

MolecularEntity

IRI: http://emmo:info/emmo#EMMO_21205421_5783_4d3e_81e5_10c5d894a88a

elucidation: Any constitutionally or isotopically distinct atom, molecule, ion, ion pair, radical, radical ion, complex, conformer etc., identifiable as a separately distinguishable entity.

example: Hydrogen molecule is an adequate definition of a certain molecular entity for some purposes, whereas for others it is necessary to distinguish the electronic state and/or vibrational state and/or nuclear spin, etc. of the hydrogen molecule.

example: Methane, may mean a single molecule of CH4 (molecular entity) or a molar amount, specified or not (chemical species), participating in a reaction. The degree of precision necessary to describe a molecular entity depends on the context.

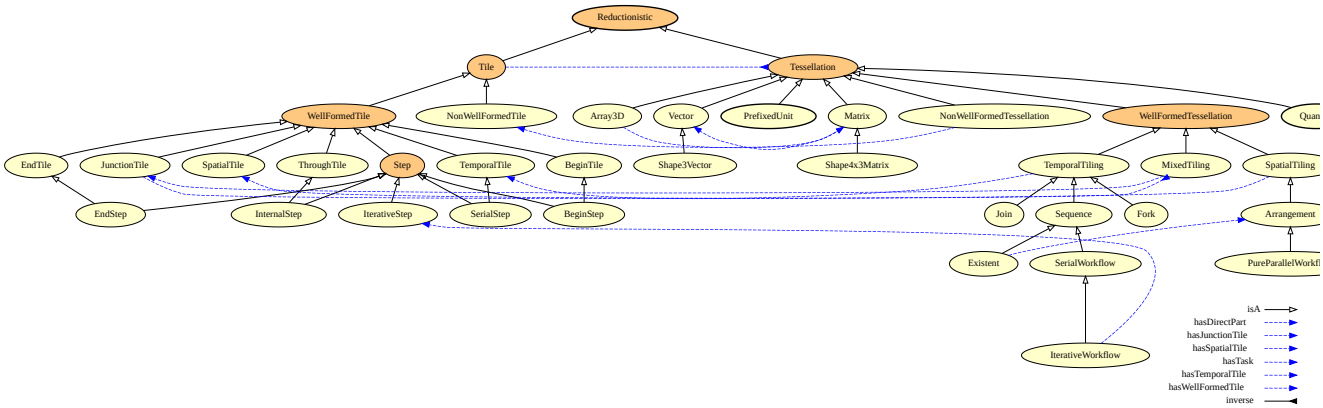
altLabel: ChemicalEntity

prefLabel: MolecularEntity

Subclass of:

- is_a Matter

Reductionistic branch



Reductionistic branch.

Shape4x3Matrix

IRI: http://emmo:info/emmo#EMMO_24b30ba4_90f4_423d_93d2_fd0fde349087

elucidation: A real matrix with shape 4x3.

prefLabel: Shape4x3Matrix

Subclass of:

- is_a Matrix

Arrangement

IRI: http://emmo:info/emmo#EMMO_36c79456_e29c_400d_8bd3_0eedddb82652

elucidation: A causal object which is tessellated with only spatial direct parts.

example: e.g. the existent in my glass is declared at t = t_start as made of two direct parts: the ice and the water. It will continue to exists as state as long as the ice is completely melt at t = t_end. The new state will be completely made of water. Between t_start and t_end there is an exchange of molecules between the ice and the water, but this does not affect the existence of the two states.

If we partition the existent in my glass as ice surrounded by several molecules (we do not use the object water as direct part) then the appearance of a molecule coming from the ice will cause a state to end and another state to begin.

altLabel: MereologicalState

prefLabel: Arrangement

Subclass of:

- is_a SpatialTiling

SerialStep

IRI: http://emmo:info/emmo#EMMO_2666a7e3_2ad4_49a0_899e_329607231f4b

prefLabel: SerialStep

Subclass of:

- is_a TemporalTile
- is_a Step

Tessellation

IRI: http://emmo:info/emmo#EMMO_ee0466e4_780d_4236_8281_ace7ad3fc5d2

elucidation: A causal object that is tessellated in direct parts.

altLabel: Tiling

conceptualisation: A tessellation (or tiling) is the covering of a surface, often a plane, using one or more geometric shapes, called tiles, with no overlaps and no gaps.

prefLabel: Tessellation

Subclass of:

- hasDirectPart some Item
- is_a Reductionistic
- equivalent_to NonWellFormedTessellation or WellFormedTessellation

IterativeWorkflow

IRI: http://emmo:info/emmo#EMMO_ddecfff6_d3a1_4972_b9e9_3d0ca11a3a0b

elucidation: A workflow whose steps (iterative steps) are the repetition of the same workflow type.

prefLabel: IterativeWorkflow

Subclass of:

- is_a SerialWorkflow
- hasTask some IterativeStep

ThroughTile

IRI: http://emmo:info/emmo#EMMO_caa63d00_80b1_4408_ac1b_cd0d23b0ec50

elucidation: A tile that has next and is next of other tiles within the same tessellation.

prefLabel: ThroughTile

Subclass of:

- is_a WellFormedTile

Shape3Vector

IRI: http://emmo:info/emmo#EMMO_2ff07b07_c447_490f_903a_f6a72a12d7bf

elucidation: A real vector with 3 elements.

example: The quantity value of physical quantities if real space is a Shape3Vector.

prefLabel: Shape3Vector

Subclass of:

- is_a Vector

Existent

IRI: http://emmo:info/emmo#EMMO_52211e5e_d767_4812_845e_eb6b402c476a

elucidation: A ‘Physical’ which is a tessellation of ‘State’ temporal direct parts.

prefLabel: Existent

Subclass of:

- is_a Sequence
- hasTemporalTile only Arrangement

SerialWorkflow

IRI: http://emmo:info/emmo#EMMO_57ba1bf0_4314_432c_a9bb_6a6720c8dab5

elucidation: A workflow whose tasks are tiles of a sequence.

prefLabel: SerialWorkflow

Subclass of:

- is_a Workflow
- is_a Sequence

MixedTiling

IRI: http://emmo:info/emmo#EMMO_2b1fb71c_0eb0_445c_9be7_fb5d30ae79fd

elucidation: A well formed tessellation with at least a junction tile.

prefLabel: MixedTiling

Subclass of:

- hasDirectPart some JunctionTile
- is_a WellFormedTessellation

EndTile

IRI: http://emmo:info/emmo#EMMO_edf72228_e040_4edc_8b46_78b2a47c72d7

elucidation: emmo.hasEndTile

prefLabel: EndTile

Subclass of:

- is_a WellFormedTile

Matrix

IRI: http://emmo:info/emmo#EMMO_1cba0b27_15d0_4326_933f_379d0b3565b6

elucidation: 2-dimensional array who’s spatial direct parts are vectors.

altLabel: 2DArray

prefLabel: Matrix

Subclass of:

- is_a Array
- hasSpatialTile some Vector
- is_a MathematicalConstruct
- is_a Tessellation

BeginStep

IRI: http://emmo:info/emmo#EMMO_b941e455_2cb1_4c11_93e3_17caa06086b4

elucidation: An initial step of a workflow.

comment: There may be more than one begin task, if they run in parallel.

prefLabel: BeginStep

Subclass of:

- is_a Step
- is_a BeginTile

Fork

IRI: http://emmo:info/emmo#EMMO_1ce18268_dc63_42af_9113_6589331b5562

elucidation: A tessellation in wich a tile has next two or more non spatially connected tiles.

prefLabel: Fork

Subclass of:

- is_a TemporalTiling

Array3D

IRI: http://emmo:info/emmo#EMMO_20ff3b34_c864_4936_8955_9345fc0a3b3c

elucidation: 3-dimensional array who's spatial direct parts are matrices.

altLabel: 3DArray

prefLabel: Array3D

Subclass of:

- is_a Array
- hasSpatialTile some Matrix
- is_a MathematicalConstruct
- is_a Tessellation

Tile

IRI: http://emmo:info/emmo#EMMO_9953c19f_ee33_4af8_be5e_dbf6d1e33581

elucidation: A causal object that is direct part of a tessellation.

prefLabel: Tile

Subclass of:

- Inverse(hasDirectPart) some Tessellation
- is_a Reductionistic
- equivalent_to WellFormedTile or NonWellFormedTile

PureParallelWorkflow

IRI: http://emmo:info/emmo#EMMO_83a460aa_5826_4fbb_93e8_d73d0df25757

elucidation: A workflow that is the concurrent evolution of two or more tasks, not communicacting between themselves.

altLabel: EmbarassinglyParallelWorkflow

prefLabel: PureParallelWorkflow

Subclass of:

- is_a Arrangement
- is_a ParallelWorkflow

TemporalTiling

IRI: http://emmo:info/emmo#EMMO_f7f41d20-eabb-4bcb-9a16-0436851fcd5c

elucidation: A well formed tessellation with tiles that are all temporal.

prefLabel: TemporalTiling

Subclass of:

- hasWellFormedTile only TemporalTile
- is_a WellFormedTessellation

NonWellFormedTile

IRI: http://emmo:info/emmo#EMMO_d5ba4872-a576-44bf-86c0-eefb3fbbbe7f

elucidation: emmo.hasNonWellFormedPart

prefLabel: NonWellFormedTile

Subclass of:

- is_a Tile

Join

IRI: http://emmo:info/emmo#EMMO_c7ee175d_4c25_45cb_b74e_71435b11b77d

elucidation: A tessellation in wich a tile is next for two or more non spatially connected tiles.

prefLabel: Join

Subclass of:

- is_a TemporalTiling

IterativeStep

IRI: http://emmo:info/emmo#EMMO_9ac10a20_63d0_4bbd_a5d3_f00a0ad4682c

elucidation: A workflow whose output ca be used as input for another workflow of the same type, iteratively, within the framework of a larger workflow.

example: Jacobi method numerical step, involving the multiplication between a matrix A and a vector x, whose result is used to update the vector x.

prefLabel: IterativeStep

Subclass of:

- is_a Workflow
- is_a Step

EndStep

IRI: http://emmo:info/emmo#EMMO_8a2a1cbc_dfc3_4e6c_b337_00ee56fd438a

elucidation: The final step of a workflow.

comment: There may be more than one end task, if they run in parallel leading to more than one output.

prefLabel: EndStep

Subclass of:

- is_a Step
- is_a EndTile

WellFormedTile

IRI: http://emmo:info/emmo#EMMO_2e46d966-9f14-4673-821e-7c7cf2957926

elucidation: emmo.hasWellFormedPart

prefLabel: WellFormedTile

Subclass of:

- is_a Tile
- equivalent_to SpatialTile or TemporalTile or JunctionTile
- equivalent_to ThroughTile or EndTile or BeginTile

Vector

IRI: http://emmo:info/emmo#EMMO_06658d8d_dcde_4fc9_aae1_17f71c0bcdec

elucidation: 1-dimensional array who’s spatial direct parts are numbers.

altLabel: 1DArray

altLabel: LinearArray

prefLabel: Vector

Subclass of:

- is_a Array
- hasSpatialTile some Number
- is_a MathematicalConstruct
- is_a Tessellation

JunctionTile

IRI: http://emmo:info/emmo#EMMO_d4c95fa1_5bda_4063_a22d_62c81fcea284

elucidation: A direct part that is obtained by partitioning a whole hybridly in spatial, temporal and spatiotemporal parts.

prefLabel: JunctionTile

Subclass of:

- Inverse(hasJunctionTile) some MixedTiling
- is_a WellFormedTile

Reductionistic

IRI: http://emmo:info/emmo#EMMO_15db234d_ecaf_4715_9838_4b4ec424fb13

elucidation: A class devoted to categorize causal objects by specifying their granularity levels.

comment: A granularity level is specified by a tiling decomposition of the whole y. A tiling is identified as a set of items {x1, x2, … xn} called tiles that: - are proper parts of y - covers the entire whole (y = x1 +x2 + … + xn) - do not overlap - are part of one, and one only, whole (inverse functional)

comment: Direct parthood is the antitransitive parthood relation used to build the class hierarchy (and the granularity hierarchy) for this perspective.

prefLabel: Reductionistic

Subclass of:

- is_a Perspective
- equivalent_to Tile or Tessellation

BeginTile

IRI: http://emmo:info/emmo#EMMO_fa595892_070d_455e_9459_06c97179c080

elucidation: emmo.hasBeginTile

prefLabel: BeginTile

Subclass of:

- is_a WellFormedTile

WellFormedTessellation

IRI: http://emmo:info/emmo#EMMO_e12dcfa4-c9f1-4546-9a12-8457c052e6ba

elucidation: A tessellation in which all tiles are well formed.

prefLabel: WellFormedTessellation

Subclass of:

- hasWellFormedTile some Item
- is_a Tessellation
- equivalent_to MixedTiling or SpatialTiling or TemporalTiling

InternalStep

IRI: http://emmo:info/emmo#EMMO_322ce14e_9ede_4841_ad70_302b4d6c5f28

elucidation: A generic step in a workflow, that is not the begin or the end.

prefLabel: InternalStep

Subclass of:

- is_a Step
- is_a ThroughTile

NonWellFormedTessellation

IRI: http://emmo:info/emmo#EMMO_4f786965-5b4b-4441-8776-e8cd7435d816

elucidation: A tessellation in which some tiles are non well formed.

prefLabel: NonWellFormedTessellation

Subclass of:

- hasDirectPart some NonWellFormedTile

- is_a Tessellation

SpatialTiling

IRI: http://emmo:info/emmo#EMMO_8944581c-64da-46a9-be29-7074f7cc8098

elucidation: A well formed tessellation with tiles that all spatial.

prefLabel: SpatialTiling

Subclass of:

- hasWellFormedTile only SpatialTile
- is_a WellFormedTessellation

Step

IRI: http://emmo:info/emmo#EMMO_9f6ec830_c59f_46aa_8a22_945ba20b6ea3

elucidation: A task that is a well formed tile of a workflow, according to a reductionistic description.

comment: A step is part of a specific granularity level for the workflow description, as composition of tasks.

prefLabel: Step

Subclass of:

- is_a Task
- is_a WellFormedTile
- equivalent_to InternalStep or EndStep or BeginStep

SpatialTile

IRI: http://emmo:info/emmo#EMMO_4cf484af_082a_40f5_9f11_930bf4634482

elucidation: A direct part that is obtained by partitioning a whole purely in spatial parts.

prefLabel: SpatialTile

Subclass of:

- is_a WellFormedTile

Sequence

IRI: http://emmo:info/emmo#EMMO_92829beb_6ed4_4c88_bbd5_3bc7403e2895

elucidation: A tessellation of temporal slices.

prefLabel: Sequence

Subclass of:

- is_a TemporalTiling

TemporalTile

IRI: http://emmo:info/emmo#EMMO_504ad89e_dd4a_4fa6_aeb6_15c8ce0cde9b

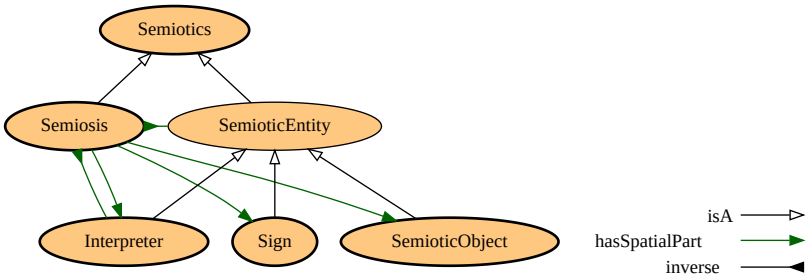
elucidation: A direct part that is obtained by partitioning a whole purely in temporal parts.

prefLabel: TemporalTile

Subclass of:

- is_a WellFormedTile

SEMIOTICS BRANCH



Semiotics branch.

SemioticEntity

IRI: http://emmo:info/emmo#EMMO_b803f122_4acb_4064_9d71_c1e5fd091fc9

elucidation: The class of individuals that stands for semiotic objects, i.e. objects that take part on a semiotic process.

prefLabel: SemioticEntity

Subclass of:

- Inverse(hasSpatialPart) some Semiosis
- is_a Semiotics
- equivalent_to Interpreter or SemioticObject or Sign

Semiotics

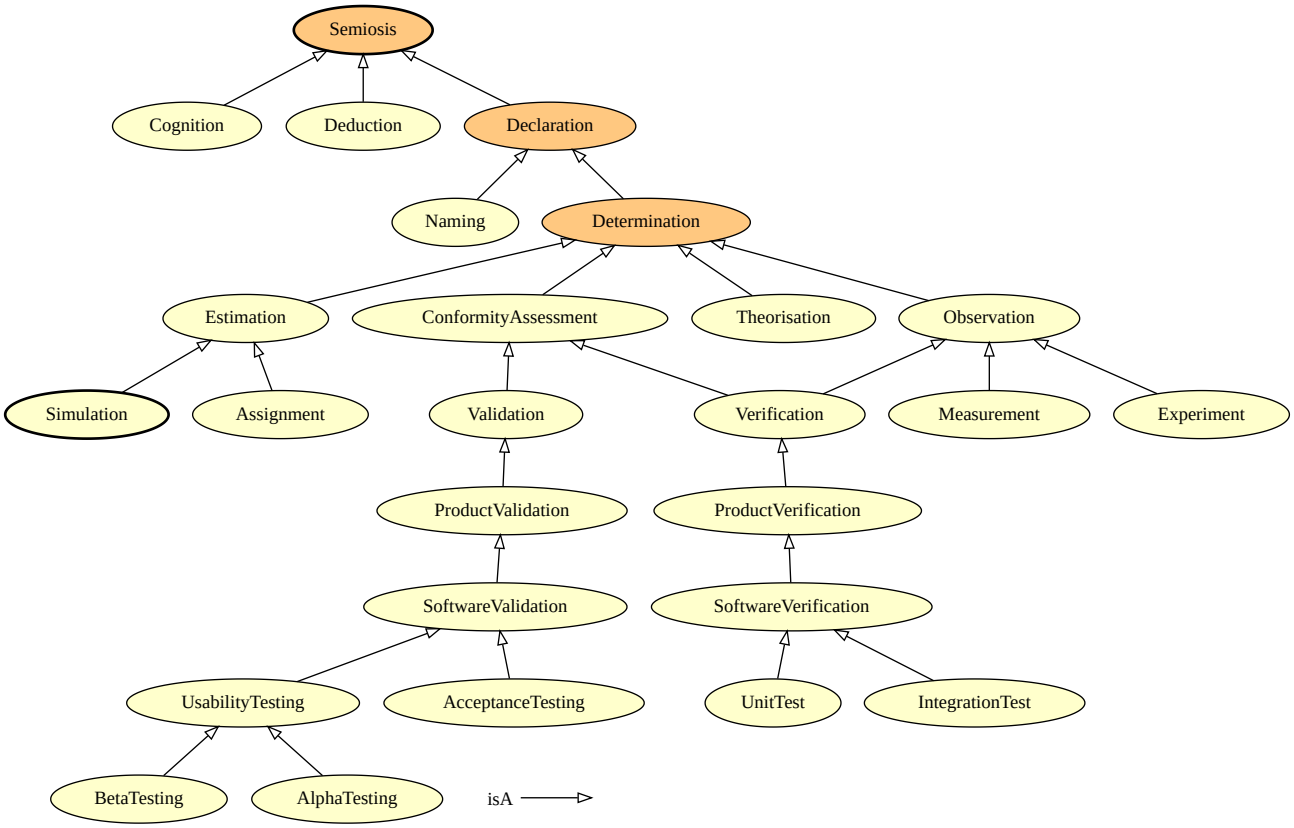
IRI: http://emmo:info/emmo#EMMO_8bb6b688_812a_4cb9_b76c_d5a058928719

prefLabel: Semiotics

Subclass of:

- is_a Perspective
- equivalent_to Semiosis or SemioticEntity

SEMIOSIS BRANCH



Semiosis branch.

BetaTesting

IRI: http://emmo:info/emmo#EMMO_321eb37b_e9d7_4319_bf43_8981ee2d2e43

prefLabel: BetaTesting

Subclass of:

- is_a UsabilityTesting

Semiosis

IRI: http://emmo:info/emmo#EMMO_008fd3b2_4013_451f_8827_52bceab11841

elucidation: A ‘Process’, that has participant an ‘Interpreter’, that is aimed to produce a ‘Sign’ representing another participant, the ‘Object’.

example: Me looking a cat and saying loud: “Cat!” -> the semiosis process

me -> interpreter cat -> object (in Peirce semiotics) the cat perceived by my mind -> interpretant “Cat!” -> sign, the produced sign

prefLabel: Semiosis

Subclass of:

- hasSpatialPart some Interpreter
- hasSpatialPart some Interpretant
- hasSpatialPart some SemioticObject
- hasSpatialPart some Sign
- is_a Semiotics
- is_a CausalSystem
- equivalent_to Deduction or Declaration or Cognition

UsabilityTesting

IRI: http://emmo:info/emmo#EMMO_551f93c7_7e76_4994_8293_fe2c8ebda450

prefLabel: UsabilityTesting

Subclass of:

- is_a SoftwareValidation

Verification

IRI: http://emmo:info/emmo#EMMO_433eac85_e5ae_4a88_8fd5_27299d76c8c7

elucidation: A Verification is a process where the interpreter attributes a sign, specifically a property, to the way the product is made following test procedures, depending on the fulfillment of specified requirements. The interpreter is the producer. The Verification can be executed either on the entire process or on parts of it.(e in qualsiasi momento) The Verification can be executed during the initial stages of the product realisation, or during the final stages of that.

comment: Confirmation, through the provision of objective evidence (3.8.3), that specified requirements (3.6.4) have been fulfilled. NOTE 1 : The objective evidence needed for a verification can be the result of an inspection (3.11.7) or of other forms of determination (3.11.1) such as performing alternative calculations or reviewing documents (3.8.5). Note 2 to entry: The activities carried out for verification are sometimes called a qualification process (3.4.1). Note 3 to entry: The word “verified” is used to designate the corresponding status.

comment: The process of evaluating a system or component to determine whether the products of a given development phase satisfy the conditions imposed at the start of that phase.

comment: The process of evaluating a system or component to determine whether the products of a given development phase satisfy the conditions imposed at the start of that phase. (B) The process of providing objective evidence that the system, software, or hardware and its associated products conform to requirements (e.g., for correctness, completeness, consistency, and accuracy) for all life cycle activities during each life cycle process (acquisition, supply, development, operation, and maintenance); satisfy standards, practices, and conventions during life cycle processes; and successfully complete each life cycle activity and satisfy all the criteria for initiating succeeding life cycle activities. Verification of interim work products is essential for proper understanding and assessment of the life cycle phase product(s).

comment: Verification is a strictly paper-based exercise. It begins by acquiring all design inputs: characteristics, government and industry standards, knowledge gained from previous projects, and any other information required for proper operation. Once you have these requirements, you compare them with the outputs of your design: schematics, assembly instructions, test instructions and electronic design files.

comment: it answers to the question “Am I doing the thing right?”

prefLabel: Verification

Subclass of:

- is_a Observation
- is_a ConformityAssessment

Cognition

IRI: http://emmo:info/emmo#EMMO_7cdc375d_d371_4d78_acd5_d51732f52126

altLabel: IconSemiosis

prefLabel: Cognition

Subclass of:

- hasSpatialPart some Cogniser
- hasSpatialPart some Cognised
- hasSpatialPart some Icon
- is_a Semiosis

Measurement

IRI: http://emmo:info/emmo#EMMO_463bcfda_867b_41d9_a967_211d4d437cfb

elucidation: An ‘observation’ that results in a quantitative comparison of a ‘property’ of an ‘object’ with a standard reference based on a well defined mesurement procedure.

VIMTerm: measurement

prefLabel: Measurement

Subclass of:

- is_a Observation
- is_a Procedure
- hasTemporaryParticipant some MeasurementResult
- hasTemporaryParticipant some MeasuringSystem
- hasOutput some MeasurementResult

Validation

IRI: http://emmo:info/emmo#EMMO_3ecefbaf_f06b_4ea3_9e50_a798cf25a879

elucidation: A Validation is a process where the interpreter attributes a sign, specifically a property, to the end product or to a product in its final stages of realisation, following test procedures, or on the basis of certain criteria. It can been done on a first end unit produced, but also on a prototype of the product. The interpreter can be either producer or the customer.(If the interpreters are the producers, they conduct the process simulating the use conditions of the end product so they are estimators, if the use conditions are real they are observers). If the interpreters are the customers, they are observers. The validaton process can be executed both on products and data. The Validation may require the cooperation of the two interpreter, making a comparison between the two processes of determination done by the customer and by the producer.

comment: Answer to the question “Am I doing the right thing?”

comment: The process of evaluating a system or component during or at the end of the development process to determine whether it satisfies specified requirements

comment: The process of evaluating a system or component during or at the end of the development process to determine whether it satisfies specified requirements. (B) The process of providing evidence that the system, software, or hardware and its associated products satisfy requirements allocated to it at the end of each life cycle activity, solve the right problem (e.g., correctly model physical laws, implement business rules, and use the proper system assumptions), and satisfy intended use and user needs.

comment: confirmation, through the provision of objective evidence (3.8.3), that the requirements (3.6.4) for a specific intended use or application have been fulfilled Note 1 to entry: The objective evidence needed for a validation is the result of a test (3.11.8) or other form of determination (3.11.1) such as performing alternative calculations or reviewing documents (3.8.5). Note 2 to entry: The word “validated” is used to designate the corresponding status. Note 3 to entry: The use conditions for validation can be real or simulated.

prefLabel: Validation

Subclass of:

- is_a ConformityAssessment

Deduction

IRI: http://emmo:info/emmo#EMMO_39a4e2a4_d835_426d_b497_182d06e1caff

altLabel: IndexSemiosis

prefLabel: Deduction

Subclass of:

- hasSpatialPart some Index
- hasSpatialPart some Deducer
- hasSpatialPart some Deduced
- is_a Semiosis

Estimation

IRI: http://emmo:info/emmo#EMMO_1c0b22a2_be82_4fa8_9e2b_a569a625d442

elucidation: A determination of an object without any actual interaction.

prefLabel: Estimation

Subclass of:

- Inverse(hasSpatialPart) some Estimator
- is_a Determination

Experiment

IRI: http://emmo:info/emmo#EMMO_22522299_4091_4d1f_82a2_3890492df6db

elucidation: An experiment is a process that is intended to replicate a physical phenomenon in a controlled environment.

prefLabel: Experiment

Subclass of:

- is_a Observation
- hasTemporaryParticipant some PhysicalPhenomenon
- is_a Whole
- is_a Process

ConformityAssessment

IRI: http://emmo:info/emmo#EMMO_508f7b78_b67a_4cbf_bab0_a5afd5eb0134

elucidation: A Conformity assessment is a process where the interpreter attributes a sign, specifically a property, to a process or a product, considering the fullfillment or not fullfillment of requiremnts estimated or defined.

altLabel: AssertionTesting

comment: any activity concerned with determining directly or indirectly that relevant requirements are fulfilled

comment: confirmation through the provision of objective evidence (3.4.32), that specified requirements (3.1.15) have been fulfilled

comment: demonstration that specified requirements relating to a product, process, system, person or body are fulfilled

prefLabel: ConformityAssessment

Subclass of:

- is_a Determination
- is_a Procedure

Naming

IRI: http://emmo:info/emmo#EMMO_e999f9e0_7d63_4564_9028_07246580a267

elucidation: A declaration that provides a sign for an object that is independent from any assignment rule.

example: A unique id attached to an entity.

prefLabel: Naming

Subclass of:

- is_a Declaration

AlphaTesting

IRI: http://emmo:info/emmo#EMMO_1d4d1a1a_1366_4d2f_82b1_55fd27de14e1

prefLabel: AlphaTesting

Subclass of:

- is_a UsabilityTesting

Declaration

IRI: http://emmo:info/emmo#EMMO_47bf3513_4ae6_4858_9c45_76e23230d68d

altLabel: ConventionalSemiosis

prefLabel: Declaration

Subclass of:

- hasSpatialPart some Declarer
- hasSpatialPart some Conventional
- hasSpatialPart some Declared
- is_a Semiosis
- equivalent_to Determination or Naming

UnitTest

IRI: http://emmo:info/emmo#EMMO_886b5675_5339_45b4_bcf3_7be7f70d93fe

elucidation: In software engineering, unit testing, unit test[1] or unit testing refers to the activity of testing individual units of a piece of software. A unit is normally understood to be the smallest component of a programme with autonomous operation; depending on the programming paradigm or programming language, this may correspond, for example, to a single function in procedural programming, or a single class or method in object-oriented programming.

altLabel: UnitTesting

comment: test of individual programs or modules in order to ensure that there are no analysis or programming errors Note 1 to entry: unit test: term and definition standardized by ISO/IEC [ISO/IEC 2382-20:1990]. Note 2 to entry: 20.05.05 (2382)

prefLabel: UnitTest

Subclass of:

- is_a SoftwareVerification

Theorisation

IRI: http://emmo:info/emmo#EMMO_6c739b1a_a774_4416_bb31_1961486fa9ed

elucidation: The ‘semiosis’ process of interpreting a ‘physical’ and provide a complec sign, ‘theory’ that stands for it and explain it to another interpreter.

altLabel: Theorization

prefLabel: Theorisation

Subclass of:

- is_a Determination
- hasTemporaryParticipant some Theory
- is_a Whole
- is_a Process

Assignment

IRI: http://emmo:info/emmo#EMMO_d5adc819_d4b2_4661_b429_1705b75d5053

elucidation: A estimation of a property by a criteria based on the pre-existing knowledge of the estimator.

example: The Argon gas in my bottle has ionisation energy of 15.7596 eV. This is not measured but assigned to this material by previous knowledge.

prefLabel: Assignment

Subclass of:

- is_a Estimation

Determination

IRI: http://emmo:info/emmo#EMMO_10a5fd39_06aa_4648_9e70_f962a9cb2069

elucidation: A ‘Semiosis’ that involves an ‘Observer’ that perceives another ‘Physical’ (the ‘Object’) through a specific perception mechanism and produces a ‘Property’ (the ‘Sign’) that stands for the result of that particular perception according to a well defined conventional procedure.

example: Assigning the word “red” as sign for an object provides an information to all other interpreters about the outcome of a specific observation procedure according to the determiner.

altLabel: Characterisation

prefLabel: Determination

Subclass of:

- is_a Declaration
- hasSpatialPart some Determiner
- hasSpatialPart some Property
- equivalent_to Estimation or Observation

IntegrationTest

IRI: http://emmo:info/emmo#EMMO_3ec60cca_870d_4e47_8efd_7c2f3a995d4c

elucidation: progressive linking and testing of programs or modules in order to ensure their proper functioning in the complete system

prefLabel: IntegrationTest

Subclass of:

- is_a SoftwareVerification

AcceptanceTesting

IRI: http://emmo:info/emmo#EMMO_b5215e42_33fb_4bdd_917b_6f6f36b14755

prefLabel: AcceptanceTesting

Subclass of:

- is_a SoftwareValidation

SoftwareValidation

IRI: http://emmo:info/emmo#EMMO_78807d14_82c4_44e6_867c_142b338c27d1

elucidation: The software Validation is a validation process where the interprer can be the program or a human.

prefLabel: SoftwareValidation

Subclass of:

- is_a ProductValidation

ProductValidation

IRI: http://emmo:info/emmo#EMMO_e4ece4ad_41fc_4af5_9014_1afdbf722436

elucidation: The Product Validation is a validation process that can be realise by a human interpreter.

prefLabel: ProductValidation

Subclass of:

- is_a Validation

SoftwareVerification

IRI: http://emmo:info/emmo#EMMO_87d19dcd_9fdb_4d89_b168_894e2490b46d

elucidation: testing that takes into account the internal mechanism of a system or component cf. functional testing (1), structure-based testing Note 1 to entry: Types include branch testing, path testing, statement testing.

example: WhiteBoxTesting

altLabel: StructureTesting

prefLabel: SoftwareVerification

Subclass of:

- is_a ProductVerification

Observation

IRI: http://emmo:info/emmo#EMMO_3b19eab4_79be_4b02_bdaf_ecf1f0067a68

elucidation: A characterisation of an object with an actual interaction.

prefLabel: Observation

Subclass of:

- Inverse(hasSpatialPart) some Observer
- is_a Determination

ProductVerification

IRI: http://emmo:info/emmo#EMMO_5f2f0d99_c958_489c_a373_522eb07c5f40

elucidation: inspection, test or examination to ensure that materials, products or services conform to specified requirements

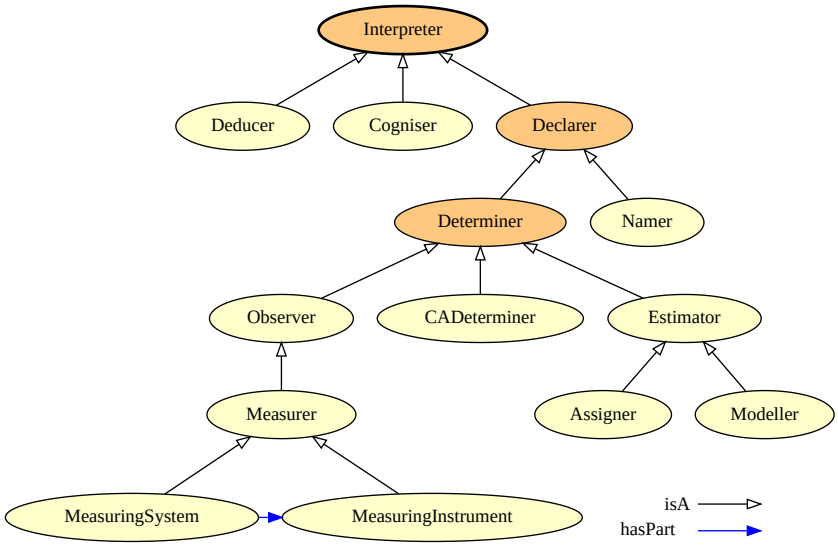
altLabel: QualityControl

prefLabel: ProductVerification

Subclass of:

- is_a Verification

INTERPRETER BRANCH



Interpreter branch.

Declarer

IRI: http://emmo:info/emmo#EMMO_2d72e38c_d587_437f_98f6_f2718fb130eb

elucidation: An interpreter who establish the connection between an conventional sign and an object according to a specific convention.

example: A scientist that assigns a quantity to a physical objects without actually measuring it but taking it for granted due to its previous experience (e.g. considering an electron charge as 1.6027663e-19 C, assigning a molecular mass to a gas only by the fact of a name on the bottle).

example: Someone who assigns a name to an object.

prefLabel: Declarer

Subclass of:

- Inverse(hasSpatialPart) some Declaration
- is_a Interpreter
- equivalent_to Determiner or Namer

Interpreter

IRI: http://emmo:info/emmo#EMMO_0527413c_b286_4e9c_b2d0_03fb2a038dee

elucidation: The entity (or agent, or observer, or cognitive entity) who connects ‘Sign’, ‘Interpretant’ and ‘Object’.

example: For example, the ontologist may be interest in cataloguing in the EMMO how the same object (e.g. a cat) is addressed using different signs (e.g. cat, gatto, chat) by different interpreters (e.g. english, italian or french people).

The same applies for the results of measurements: the ontologist may be interest to represent in the EMMO how different measurement processes (i.e. semiosis) lead to different quantitative results (i.e. signs) according to different measurement devices (i.e. interpreters).

prefLabel: Interpreter

Subclass of:

- is_a SemioticEntity
- hasSpatialSlice some Interpretant
- Inverse(hasSpatialPart) some Semiosis
- is_a CausalSystem
- equivalent_to Cogniser or Declarer or Deducer

MeasuringSystem

IRI: http://emmo:info/emmo#EMMO_7dea2572_ab42_45bd_9fd7_92448cec762a

elucidation: A set of one or more ‘MeasuringInstruments’ and often other devices, including any reagent and supply, assembled and adapted to give information used to generate ‘MeasuredQuantityProperty’ within specified intervals for quantities of specified kinds.

– VIM

VIMTerm: measuring system

prefLabel: MeasuringSystem

Subclass of:

- is_a Measurer
- hasPart some MeasuringInstrument

Observer

IRI: http://emmo:info/emmo#EMMO_ea67caa5_2609_4e91_98ae_81103f2d5c25

elucidation: A characteriser that declares a property for an object through the specific interaction required by the property definition.

prefLabel: Observer

Subclass of:

- is_a Determiner

CADeterminer

IRI: http://emmo:info/emmo#EMMO_57301187_137f_4103_a875_79a97e566ba7

elucidation: A CADeterminer is who performs the Conformity assessment, determining if the TestItem fulfilles the requirements claimed.

example: Customer, Consumer, Producer, Experts, Agent

altLabel: ConformityAssessmentBody

comment: body that performs conformity assessment activities and that can be the object of accreditation (3.1) Note 1 to entry: Whenever the term “conformity assessment body” is used in the text, it applies to both the applicant and accredited conformity assessment bodies, unless otherwise specified. [SOURCE: ISO/IEC 17000:2004, 2.5, modified — The words “and that can be the object of accreditation” have been added to the definition and the Note to entry has been added.]

prefLabel: CADeterminer

Subclass of:

- is_a Determiner

Deducer

IRI: http://emmo:info/emmo#EMMO_36a4c1ca_5085_49ca_9e13_4c70d00c50a5

elucidation: An interpreter who establish the connection between an index sign and an object according to a causal contiguity.

example: Someone who deduces an emotional status of a persona according to facial expression.

example: Someone who deduces the occurring of a physical phenomenon through other phenomena.

prefLabel: Deducer

Subclass of:

- Inverse(hasSpatialPart) some Deduction
- is_a Interpreter

Determiner

IRI: http://emmo:info/emmo#EMMO_1b52ee70_121e_4d8d_8419_3f97cd0bd89c

elucidation: An ‘interpreter’ that perceives another ‘entity’ (the ‘object’) through a specific perception mechanism and produces a ‘property’ (the ‘sign’) that stands for the result of that particular perception.

prefLabel: Determiner

Subclass of:

- Inverse(hasSpatialPart) some Determination
- is_a Declarer
- equivalent_to Estimator or Observer

Estimator

IRI: http://emmo:info/emmo#EMMO_4a1c73f1_b6f5_4d10_a3a6_5de90bac7cd0

elucidation: A characteriser that declares a property for an object without actually interact with it with the specific interaction required by the property definition (i.e. infer a property from other properties).

prefLabel: Estimator

Subclass of:

- is_a Determiner

MeasuringInstrument

IRI: http://emmo:info/emmo#EMMO_f2d5d3ad_2e00_417f_8849_686f3988d929

elucidation: Device used for making measurements, alone or in conjunction with one or more supplementary devices.

– VIM

VIMTerm: measuring instrument

prefLabel: MeasuringInstrument

Subclass of:

- is_a Measurer

Assigner

IRI: http://emmo:info/emmo#EMMO_f273529f_9f2c_4877_a94b_5b47590353fc

elucidation: A estimator that uses its predefined knowledge to declare a property of an object.

example: I estimate the molecular mass of the gas in my bottle as 1.00784 u because it is tagged as H.

prefLabel: Assigner

Subclass of:

- is_a Estimator

Modeller

IRI: http://emmo:info/emmo#EMMO_f94e509a_be29_4365_a4cd_70165e47e232

elucidation: A estimator that uses modelling to declare a property of an object (i.e. infer a property from other properties).

prefLabel: Modeller

Subclass of:

- is_a Estimator

Cogniser

IRI: http://emmo:info/emmo#EMMO_19608340_178c_4bfd_bd4d_0d3b935c6fec

elucidation: An interpreter who establish the connection between an icon an an object recognizing their resemblance (e.g. logical, pictorial)

example: The scientist that connects an equation to a physical phenomenon.

prefLabel: Cogniser

Subclass of:

- Inverse(hasSpatialPart) some Cognition
- is_a Interpreter

Measurer

IRI: http://emmo:info/emmo#EMMO_9be5fcc4_0d8b_481d_b984_6338d4b55588

elucidation: An observer that makes use of a measurement tool and provides a quantitative property.

prefLabel: Measurer

Subclass of:

- is_a Observer

Namer

IRI: http://emmo:info/emmo#EMMO_421167c0_1ea5_405f_970f_a41e9cb308f9

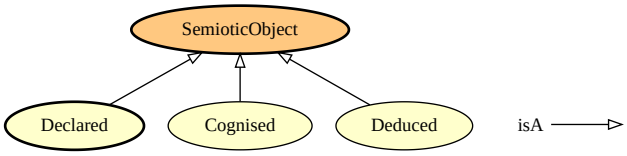
elucidation: An interpreter who assigns a name to an object without any motivations related to the object characters.

prefLabel: Namer

Subclass of:

- is_a Declarer

Semiotic Object branch



Semiotic Object branch.

Cognised

IRI: http://emmo:info/emmo#EMMO_881606d0_6f2f_4947_bc8b_75c5b7b2b688

prefLabel: Cognised

Subclass of:

- is_a SemioticObject

SemioticObject

IRI: http://emmo:info/emmo#EMMO_6f5af708_f825_4feb_a0d1_a8d813d3022b

elucidation: The object, in Peirce semiotics, as participant to a semiotic process.

altLabel: Object

prefLabel: SemioticObject

Subclass of:

- is_a SemioticEntity
- equivalent_to Deduced or Cognised or Declared

Deduced

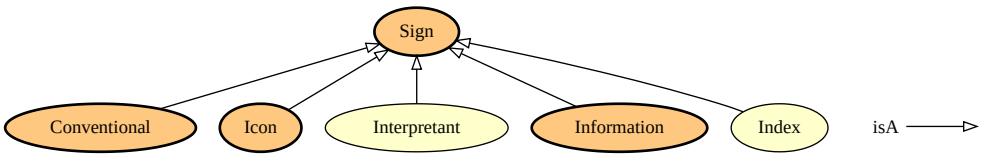
IRI: http://emmo:info/emmo#EMMO_669d2749_bece_460a_b26a_9a909fd8ca4d

prefLabel: Deduced

Subclass of:

- is_a SemioticObject

Sign branch



Sign branch.

Sign

IRI: http://emmo:info/emmo#EMMO_b21a56ed_f969_4612_a6ec_cb7766f7f31d

elucidation: An ‘Physical’ that is used as sign (“semeion” in greek) that stands for another ‘Physical’ through an semiotic process.

example: A novel is made of chapters, paragraphs, sentences, words and characters (in a direct parthood mereological hierarchy).

Each of them are ‘sign’-s.

A character can be the a-tomistic ‘sign’ for the class of texts.

The horizontal segment in the character “A” is direct part of “A” but it is not a ‘sign’ itself.

For plain text we can propose the ASCII symbols, for math the fundamental math symbols.

prefLabel: Sign

Subclass of:

- is_a SemioticEntity
- equivalent_to Index or Conventional or Icon

Interpretant

IRI: http://emmo:info/emmo#EMMO_054af807_85cd_4a13_8eba_119dfdaaf38b

elucidation: The interpreter's internal representation of the object in a semiosis process.

prefLabel: Interpretant

Subclass of:

- is_a Sign

Index

IRI: http://emmo:info/emmo#EMMO_0cd58641_824c_4851_907f_f4c3be76630c

elucidation: A 'Sign' that stands for an 'Object' due to causal continguity.

example: Smoke stands for a combustion process (a fire). My facial expression stands for my emotional status.

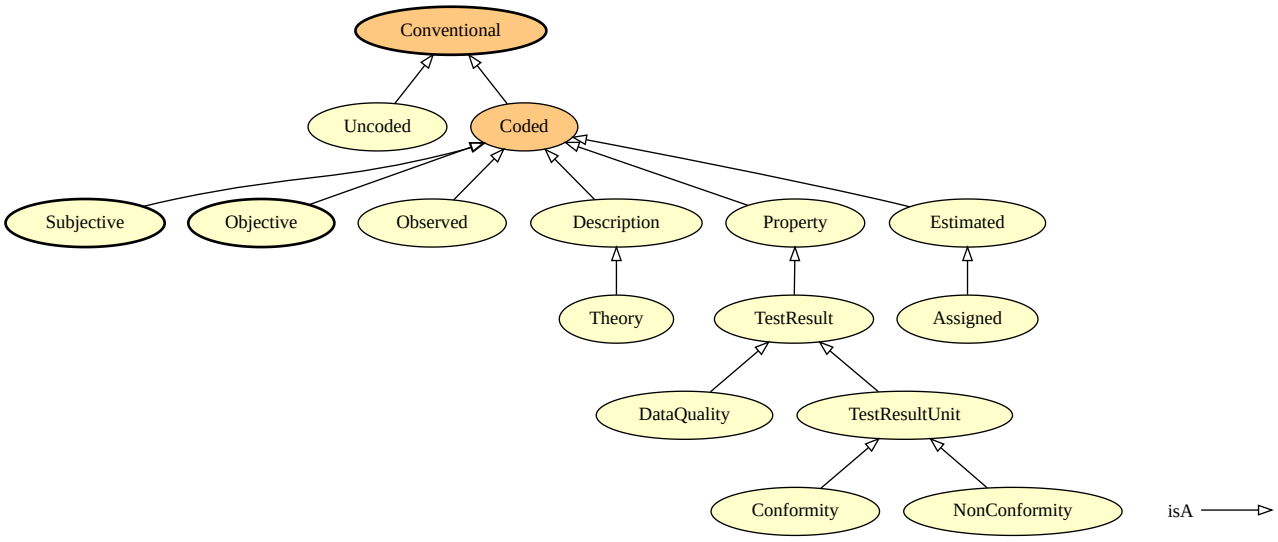
altLabel: Signal

prefLabel: Index

Subclass of:

- Inverse(hasSpatialPart) some Deduction
- is_a Sign

CONVENTIONAL BRANCH



Conventional branch.

Conventional

IRI: http://emmo:info/emmo#EMMO_35d2e130_6e01_41ed_94f7_00b333d46cf9

elucidation: A 'Sign' that stands for an 'Object' through convention, norm or habit, without any resemblance to it.

prefLabel: Conventional

Subclass of:

- Inverse(hasSpatialPart) some Declaration
- is_a Sign
- equivalent_to Uncoded or Coded

DataQuality

IRI: http://emmo:info/emmo#EMMO_bc5adc6b_2dce_4735_8306_e121b83d5027

elucidation: Data Quality is a degree assigned to the Data on the base of how much they satisfy the requirements of user needs.

prefLabel: DataQuality

Subclass of:

- is_a TestResult

Guess

IRI: http://emmo:info/emmo#EMMO_57b9fd6c_84d6_43f2_8c4f_de6a1ab50aea

elucidation: A guess is a theory, estimated and subjective, since its premises are subjective.

prefLabel: Guess

Subclass of:

- is_a Subjective
- is_a Theory
- is_a Estimated

ScientificTheory

IRI: http://emmo:info/emmo#EMMO_937757d3_ed79_4ae3_9513_3b135e58a6a1

elucidation: A scientific theory is a description, objective and observed, produced with scientific methodology.

prefLabel: ScientificTheory

Subclass of:

- is_a Observed
- is_a Objective
- is_a Theory

Assigned

IRI: http://emmo:info/emmo#EMMO_dabe353b_8bfc_4da7_8ac7_8f52786d16f8

prefLabel: Assigned

Subclass of:

- is_a Estimated

Conformity

IRI: http://emmo:info/emmo#EMMO_eeebe42f_981f_4d84_83f8_72723b86036b

altLabel: AssertionResult

prefLabel: Conformity

Subclass of:

- is_a TestResultUnit

Hypothesis

IRI: http://emmo:info/emmo#EMMO_e7cbc129_0d05_41a2_851a_10b198cd7ca2

elucidation: A hypothesis is a theory, estimated and objective, since its estimated premises are objective.

prefLabel: Hypothesis

Subclass of:

- is_a Objective
- is_a Theory
- is_a Estimated

PhysicalLaw

IRI: http://emmo:info/emmo#EMMO_9c32fd69_f480_4130_83b3_fb25d9face14

elucidation: A law that provides a connection between a property of the object and other properties, capturing a fundamental physical phenomena.

prefLabel: PhysicalLaw

Subclass of:

- is_a NaturalLaw

Observed

IRI: http://emmo:info/emmo#EMMO_1b6a95fb_3df7_44c9_ad3d_419c9c5fe7cb

example: The biography of a person met by the author.

prefLabel: Observed

Subclass of:

- is_a Coded

Theory

IRI: http://emmo:info/emmo#EMMO_8d2d9374_ef3a_47e6_8595_6bc208e07519

elucidation: A ‘conventional’ that stand for a ‘physical’.

prefLabel: Theory

Subclass of:

- is_a Description

TestResult

IRI: http://emmo:info/emmo#EMMO_54c79761_da7d_4afe_8412_01128daa9f4d

elucidation: conclusion on the base of all conformities and non-conformities of the test item during an activity of testing. It can be qualitative or quantitative.

altLabel: ConclusiveTestResult

prefLabel: TestResult

Subclass of:

- is_a Property

MaterialLaw

IRI: http://emmo:info/emmo#EMMO_f19ff3b4_6bfe_4c41_a2b2_9affd39c140b

elucidation: A law that provides a connection between a material property and other properties of the object.

prefLabel: MaterialLaw

Subclass of:

- is_a NaturalLaw

Description

IRI: http://emmo:info/emmo#EMMO_35d4c439_fcb6_4399_a855_a89a207b41e9

elucidation: A coded that is not atomic with respect to a code of description.

example: A biography.

example: A sentence about some object, depticting its properties.

comment: A description is a collection of properties that depicts an object. It is not atomic since it is made of several properties collected together.

prefLabel: Description

Subclass of:

- is_a Coded

Uncoded

IRI: http://emmo:info/emmo#EMMO_6e78433a_dbb9_409a_a7c0_4037f79d4ed8

elucidation: A conventional that provides no possibility to infer the characteristics of the object to which it refers.

example: A random generated id for a product.

prefLabel: Uncoded

Subclass of:

- is_a Conventional
- Inverse(hasSpatialPart) some Naming

Property

IRI: http://emmo:info/emmo#EMMO_b7bcff25_ffc3_474e_9ab5_01b1664bd4ba

elucidation: A coded that makes use of an atomic symbol with respect to the code used to refer to the interaction.

example: Hardness is a subclass of properties. Vickers hardness is a subclass of hardness that involves the procedures and instruments defined by the standard hardness test.

example: The name “red” which is atomic in the code made of the list of colors.

comment: A property is atomic in the sense that is aimed to deliver one and one only aspect of the object according to one code, such as the color with one sign (e.g., black) or a quantitiative property (e.g., 1.4 kg).

prefLabel: Property

Subclass of:

- Inverse(hasSpatialPart) some Determination
- is_a Coded

Coded

IRI: http://emmo:info/emmo#EMMO_7286b164_df4c_4c14_a4b5_d41ad9c121f3

elucidation: A conventional that stands for an object according to a code of interpretation to which the interpreter refers.

example: A biography that makes use of a code that is provided by the meaning of the element of the language used by the author.

example: The name “red” that stands for the color of an object.

prefLabel: Coded

Subclass of:

- is_a Conventional
- Inverse(hasSpatialPart) some Determination
- equivalent_to Observed or Estimated
- equivalent_to Subjective or Objective
- equivalent_to Description or Property

Estimated

IRI: http://emmo:info/emmo#EMMO_9b87d718_9dcc_4f7d_ad20_12c2aa4c76be

example: The biography of a person that the author have not met.

prefLabel: Estimated

Subclass of:

- is_a Coded

NaturalLaw

IRI: http://emmo:info/emmo#EMMO_db9a009e_f097_43f5_9520_6cbc07e7610b

elucidation: A scientific theory that focuses on a specific phenomena, for which a single statement (not necessariliy in mathematical form) can be expressed.

prefLabel: NaturalLaw

Subclass of:

- is_a ScientificTheory

NonConformity

IRI: http://emmo:info/emmo#EMMO_08fb109f_95df_4daa_845d_9884b1700c0a

prefLabel: NonConformity

Subclass of:

- is_a TestResultUnit

TestResultUnit

IRI: http://emmo:info/emmo#EMMO_0718ca88_f15d_4f69_85e2_28fb5f43c9af

elucidation: The Test Result Unit is the simplest output of the semiotic process of testing. It can present itself in two opposing forms that can be numeric value or charcacter.

example: PASS, FAILED

example: YES,NOT

altLabel: AssertionResult

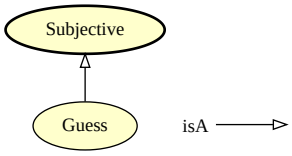
comment: Result of an asserion Test

prefLabel: TestResultUnit

Subclass of:

- is_a TestResult

Subjective branch



Subjective branch.

Subjective

IRI: http://emmo:info/emmo#EMMO_251cfb4f_5c75_4778_91ed_6c8395212fd8

elucidation: A coded conventional that cannot be univocally determined and depends on an agent (e.g. a human individual, a community) acting as black-box.

example: The beauty of that girl. The style of your clothing.

prefLabel: Subjective

Subclass of:

- is_a Coded

Guess

IRI: http://emmo:info/emmo#EMMO_57b9fd6c_84d6_43f2_8c4f_de6a1ab50aea

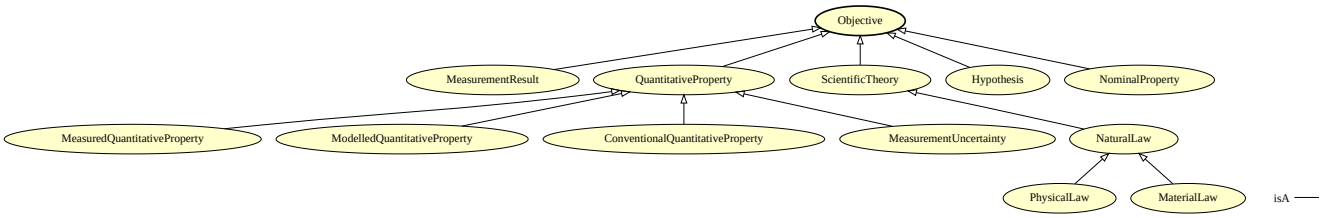
elucidation: A guess is a theory, estimated and subjective, since its premises are subjective.

prefLabel: Guess

Subclass of:

- is_a Subjective
- is_a Theory
- is_a Estimated

Objective branch



Objective branch.

MeasurementResult

IRI: http://emmo:info/emmo#EMMO_0f6f0120_c079_4d95_bb11_4ddee05e530e

elucidation: Result of a measurement.

A set of quantites being attributed to a measurand (measured quantitative property) together with any other available relevant information, like measurement uncertainty.

– VIM

VIMTerm: measurement result

comment: A measurement result has the measured quantity, measurement uncertainty and other relevant attributes as holistic parts.

prefLabel: MeasurementResult

Subclass of:

- is_a Objective
- hasQuantity some Quantity
- is_a Whole
- is_a Object

QuantitativeProperty

IRI: http://emmo:info/emmo#EMMO_dd4a7f3e_ef56_466c_ac1a_d2716b5f87ec

definition: A property of a phenomenon, body, or substance, where the property has a magnitude that can be expressed by means of a number and a reference. – ISO 80000-1

A reference can be a measurement unit, a measurement procedure, a reference material, or a combination of such. – International vocabulary of metrology (VIM)

elucidation: A quantity that can be quantified with respect to a standardized reference physical instance (e.g. the prototype meter bar, the kg prototype) or method (e.g. resilience) through a measurement process.

VIMTerm: quantity

prefLabel: QuantitativeProperty

Subclass of:

- is_a Objective
- is_a Quantity
- is_a Information

ScientificTheory

IRI: http://emmo:info/emmo#EMMO_937757d3_ed79_4ae3_9513_3b135e58a6a1

elucidation: A scientific theory is a description, objective and observed, produced with scientific methodology.

prefLabel: ScientificTheory

Subclass of:

- is_a Observed
- is_a Objective
- is_a Theory

NaturalLaw

IRI: http://emmo:info/emmo#EMMO_db9a009e_f097_43f5_9520_6cbc07e7610b

elucidation: A scientific theory that focuses on a specific phenomena, for which a single statement (not necessariliy in mathematical form) can be expressed.

prefLabel: NaturalLaw

Subclass of:

- is_a ScientificTheory

Hypothesis

IRI: http://emmo:info/emmo#EMMO_e7cbc129_0d05_41a2_851a_10b198cd7ca2

elucidation: A hypothesis is a theory, estimated and objective, since its estimated premises are objective.

prefLabel: Hypothesis

Subclass of:

- is_a Objective
- is_a Theory
- is_a Estimated

MeasuredQuantitativeProperty

IRI: http://emmo:info/emmo#EMMO_873b0ab3_88e6_4054_b901_5531e01f14a4

elucidation: Quantitative property intended to be measured.

– VIM

VIMTerm: measurand

altLabel: Measurand

prefLabel: MeasuredQuantitativeProperty

Subclass of:

- is_a QuantitativeProperty

Objective

IRI: http://emmo:info/emmo#EMMO_2a888cdf_ec4a_4ec5_af1c_0343372fc978

elucidation: A coded conventional that is determined by each interpeter following a well defined determination procedure through a specific perception channel.

prefLabel: Objective

Subclass of:

- is_a Coded

PhysicalLaw

IRI: http://emmo:info/emmo#EMMO_9c32fd69_f480_4130_83b3_fb25d9face14

elucidation: A law that provides a connection between a property of the object and other properties, capturing a fundamental physical phenomena.

prefLabel: PhysicalLaw

Subclass of:

- is_a NaturalLaw

ModelledQuantitativeProperty

IRI: http://emmo:info/emmo#EMMO_d0200cf1_e4f4_45ae_873f_b9359daea3cd

prefLabel: ModelledQuantitativeProperty

Subclass of:

- is_a QuantitativeProperty

NominalProperty

IRI: http://emmo:info/emmo#EMMO_909415d1_7c43_4d5e_bbeb_7e1910159f66

elucidation: An ‘ObjectiveProperty’ that cannot be quantified.

example: CFC is a ‘sign’ that stands for the fact that the morphology of atoms composing the microstructure of an entity is predominantly Cubic Face Centered

A color is a nominal property.

Sex of a human being.

VIMTerm: nominal property

prefLabel: NominalProperty

Subclass of:

- is_a Objective

ConventionalQuantitativeProperty

IRI: http://emmo:info/emmo#EMMO_d8aa8e1f_b650_416d_88a0_5118de945456

elucidation: A quantitative property attributed by agreement to a quantity for a given purpose.

example: The thermal conductivity of a copper sample in my laboratory can be assumed to be the conductivity that appears in the vendor specification. This value has been obtained by measurement of a sample which is not the one I have in my laboratory. This conductivity value is then a conventional quantitiative property assigned to my sample through a semiotic process in which no actual measurement is done by my laboratory.

If I don’t believe the vendor, then I can measure the actual thermal conductivity. I then perform a measurement process that semiotically assign another value for the conductivity, which is a measured property, since is part of a measurement process.

Then I have two different physical quantities that are properties thanks to two different semiotic processes.

prefLabel: ConventionalQuantitativeProperty

Subclass of:

- is_a QuantitativeProperty

MeasurementUncertainty

IRI: http://emmo:info/emmo#EMMO_847724b7_acef_490e_9f0d_67da967f2812

elucidation: A non-negative parameter characterising the dispersion of the quantity being measured.

example: - Standard deviation

- Half-width of an interval with a stated coverage probability

VIMTerm: measurement uncertainty

prefLabel: MeasurementUncertainty

Subclass of:

- is_a QuantitativeProperty

MaterialLaw

IRI: http://emmo:info/emmo#EMMO_f19ff3b4_6bfe_4c41_a2b2_9affd39c140b

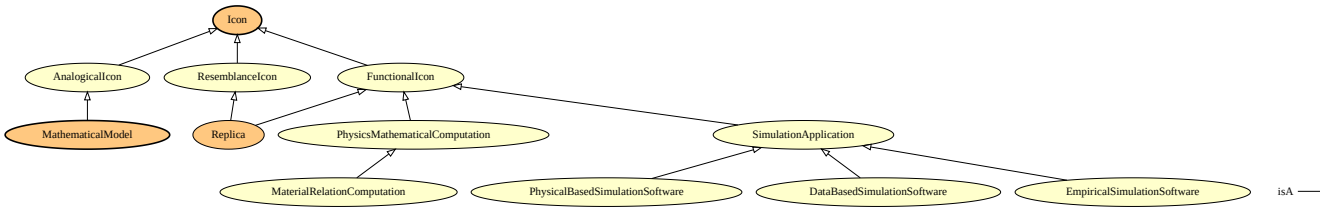
elucidation: A law that provides a connection between a material property and other properties of the object.

prefLabel: MaterialLaw

Subclass of:

- is_a NaturalLaw

ICON BRANCH



Icon branch.

SimulationApplication

IRI: http://emmo:info/emmo#EMMO_8b66ada5_510c_44bd_a8d8_3c64d301a5e9

elucidation: An application aimed to functionally reproduce an object.

example: An application that predicts the pressure drop of a fluid in a pipe segment is aimed to functionally reproduce the outcome of a measurement of pressure before and after the segment.

prefLabel: SimulationApplication

Subclass of:

- is_a ApplicationProgram
- is_a FunctionalIcon
- is_a Information

PhysicalBasedSimulationSoftware

IRI: http://emmo:info/emmo#EMMO_8d4962d7_9608_44f7_a2f1_82a4bb173f4a

elucidation: A computational application that uses a physical model to predict the behaviour of a system, providing a identifiable analogy with the original object.

prefLabel: PhysicalBasedSimulationSoftware

Subclass of:

- is_a SimulationApplication

AnalogicalIcon

IRI: http://emmo:info/emmo#EMMO_4f2d1fcc_e20c_4479_9ad7_7a0480dd3e44

elucidation: An icon that represents the internal logical structure of the object.

example: A physics equation is replicating the mechanisms internal to the object.

example: Electrical diagram is diagrammatic and resemblance

example: MODA and CHADA are diagrammatic representation of a simulation or a characterisation workflow.

comment: An icon that focus on HOW the object works.

comment: The subclass of icon inspired by Peirceian category (b) the diagram, whose internal relations, mainly dyadic or so taken, represent by analogy (with the same logic) the relations in something (e.g. math formula, geometric flowchart).

prefLabel: AnalogicalIcon

Subclass of:

- is_a Icon

ResemblanceIcon

IRI: http://emmo:info/emmo#EMMO_8c537c06_8e1d_4a3b_a251_1c89bb2c4790

elucidation: An icon that mimics the spatial or temporal shape of the object.

example: A geographical map that imitates the shape of the landscape and its properties at a specific historical time.

comment: An icon that focus on WHERE/WHEN the object is, in the sense of spatial or temporal shape.

prefLabel: ResemblanceIcon

Subclass of:

- is_a Icon

DataBasedSimulationSoftware

IRI: http://emmo:info/emmo#EMMO_a4b14b83_9392_4a5f_a2e8_b2b58793f59b

elucidation: A computational application that uses existing data to predict the behaviour of a system without providing a identifiable analogy with the original object.

prefLabel: DataBasedSimulationSoftware

Subclass of:

- is_a SimulationApplication

Replica

IRI: http://emmo:info/emmo#EMMO_8533871a_01e4_4935_8c7b_cedf8fcc3fa3

elucidation: An icon that not only resembles the object, but also can express some of the object's functions.

example: A small scale replica of a plane tested in a wind gallery shares the same functionality in terms of aerodynamic behaviour of the bigger one.

example: Pinocchio is a functional icon of a boy since it imitates the external behaviour without having the internal biological structure of a human being (it is made of magic wood…).

prefLabel: Replica

Subclass of:

- is_a ResemblanceIcon
- is_a FunctionalIcon
- equivalent_to ResemblanceIcon and FunctionalIcon

EmpiricalSimulationSoftware

IRI: http://emmo:info/emmo#EMMO_67c70dcd_2adf_4e6c_b3f8_f33dd1512487

elucidation: A computational application that uses an empiric equation to predict the behaviour of a system without relying on the knowledge of the actual physical phenomena occurring in the object.

prefLabel: EmpiricalSimulationSoftware

Subclass of:

- is_a SimulationApplication

Icon

IRI: http://emmo:info/emmo#EMMO_d7788d1a_020d_4c78_85a1_13563fcec168

elucidation: A sign that stands for an object by resembling or imitating it, in shape, function or by sharing a similar logical structure.

example: A picture that reproduces the aspect of a person.

example: An equation that reproduces the logical connection of the properties of a physical entity.

altLabel: Model

altLabel: Simulacrum

prefLabel: Icon

Subclass of:

- Inverse(hasSpatialPart) some Cognition
- is_a Sign
- equivalent_to AnalogicalIcon or ResemblanceIcon or FunctionalIcon

MaterialRelationComputation

IRI: http://emmo:info/emmo#EMMO_084b4f77_6df7_4c6a_b705_2528aba5cdda

prefLabel: MaterialRelationComputation

Subclass of:

- is_a PhysicsMathematicalComputation

FunctionalIcon

IRI: http://emmo:info/emmo#EMMO_c7013b53_3071_410b_a5e4_a8d266dcdfb5

elucidation: An icon that imitates one representative character of the object. It share external similarities with the object, but not necessarily the same internal logical structure.

example: A data based model is only a functional icon, since it provide the same relations between the properties of the object (e.g., it can predict some properties as function of others) but is not considering the internal mechanisms (i.e., it can ignore the physics).

example: A guinea pig.

comment: An icon that focusing WHAT the object does.

prefLabel: FunctionalIcon

Subclass of:

- is_a Icon

PhysicsMathematicalComputation

IRI: http://emmo:info/emmo#EMMO_5dd63d84_57f5_4b79_b760_fe940c06680d

elucidation: A functional icon that imitates the behaviour of the object through mathematical evaluations of some mathematical construct.

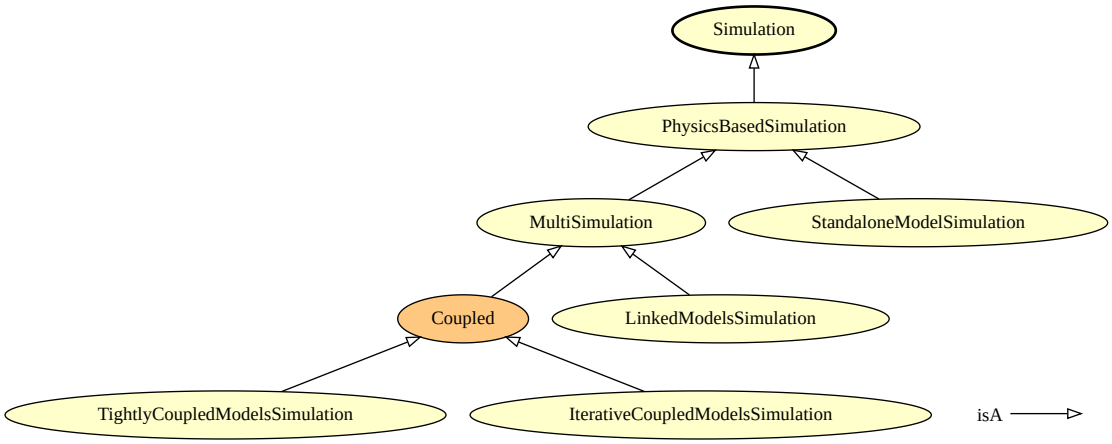
comment: The equation that describes the velocity of a uniform accelerated body v = v0 + at *is a functional icon. In general every analitical solution of a mathematical model can be considered an icon. A functional icon expresses its similarity with the object when is part of a process the makes it imitate the behavior of the object. In the case of v = v0 + a*t, plotting the velocity over time or listing their values at certain instants is when the icon expresses it functionality.

prefLabel: PhysicsMathematicalComputation

Subclass of:

- is_a FunctionalIcon
- is_a Computation

SIMULATION BRANCH



Simulation branch.

TightlyCoupledModelsSimulation

IRI: http://emmo:info/emmo#EMMO_fbcc3aad_c58a_4185_bcc9_859db779b226

elucidation: A simulation in which more than one model are solved together with a coupled method.

example: Solving within the same linear system the discretised form of the pressure and momentum equation for a fluid, using the ideal gas law as material relation for connecting pressure to density.

prefLabel: TightlyCoupledModelsSimulation

Subclass of:

- is_a Coupled

MultiSimulation

IRI: http://emmo:info/emmo#EMMO_7d56ec24_499d_487a_af7d_a91aaa787bfe

elucidation: A physics based simulation with multiple physics based models.

prefLabel: MultiSimulation

Subclass of:

- is_a PhysicsBasedSimulation

Simulation

IRI: http://emmo:info/emmo#EMMO_9335cf09_431f_4613_9dab_ce4ceaca965b

elucidation: A estimation of a property using a functional icon.

example: I calculate the electrical conductivity of an Ar-He plasma with the Chapman-Enskog method and use the value as property for it.

altLabel: Modelling

prefLabel: Simulation

Subclass of:

- is_a Estimation
- is_a Computation

PhysicsBasedSimulation

IRI: http://emmo:info/emmo#EMMO_e97af6ec_4371_4bbc_8936_34b76e33302f

elucidation: A simulation that relies on physics based models, according to the Review of Materials Modelling and CWA 17284:2018.

prefLabel: PhysicsBasedSimulation

Subclass of:

- is_a Simulation

StandaloneModelSimulation

IRI: http://emmo:info/emmo#EMMO_d0bcf2ca_cd55_4f34_8fc2_2decc4c6087a

elucidation: A standalone simulation, where a single physics equation is solved.

prefLabel: StandaloneModelSimulation

Subclass of:

- is_a PhysicsBasedSimulation

LinkedModelsSimulation

IRI: http://emmo:info/emmo#EMMO_ec502e30_b9ec_4216_90c6_f67d2df75627

elucidation: A chain of linked physics based model simulations, where equations are solved sequentially.

prefLabel: LinkedModelsSimulation

Subclass of:

- is_a MultiSimulation

Coupled

IRI: http://emmo:info/emmo#EMMO_02c4890b_aef3_4173_9669_94d1f6baf611

prefLabel: Coupled

Subclass of:

- is_a MultiSimulation
- equivalent_to IterativeCoupledModelsSimulation or TightlyCoupledModelsSimulation

IterativeCoupledModelsSimulation

IRI: http://emmo:info/emmo#EMMO_01354ac2_cce1_4b7d_8b4a_7322d6cb10bc

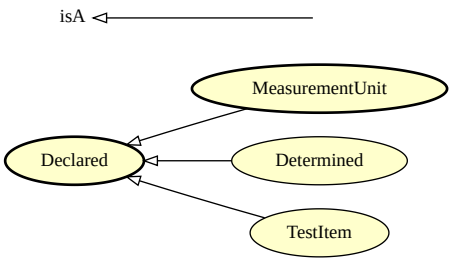
elucidation: A chain of linked physics based model simulations solved iteratively, where equations are segregated.

prefLabel: IterativeCoupledModelsSimulation

Subclass of:

- is_a Coupled

Declared branch



Declared branch.

Declared

IRI: http://emmo:info/emmo#EMMO_c9805ac9_a943_4be4_ac4b_6da64ba36c73

prefLabel: Declared

Subclass of:

- is_a SemioticObject

Determined

IRI: http://emmo:info/emmo#EMMO_dc5dee4e_4305_4a21_8dd5_4e8311c98c73

prefLabel: Determined

Subclass of:

- is_a Declared

TestItem

IRI: http://emmo:info/emmo#EMMO_7aa150c8_a726_4494_bbef_2232ab58549b

elucidation: The Test Item is an object whose conformity with the required objectives is assessed.

prefLabel: TestItem

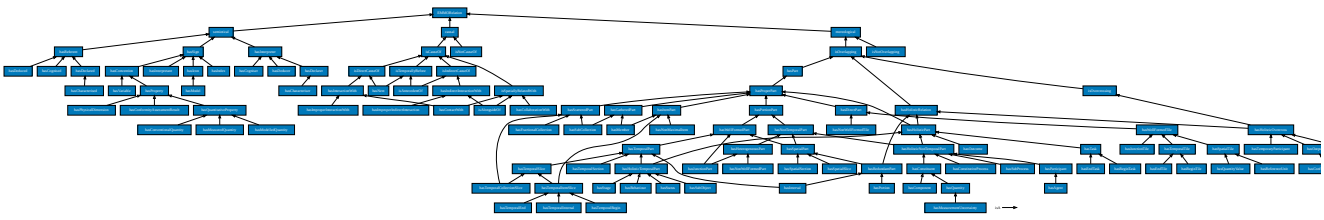
Subclass of:

- is_a Declared

Individuals

Appendix

The complete taxonomy of EMMO relations



The complete taxonomy of EMMO relations.